Indira Gandhi Delhi Technical University For Women
(Established by Govt. of Delhi vide Act 09 of 2012)
Kashmere Gate, Delhi-110006
ISO 9001:2015 Certified University

Revised Syllabus of ASH Courses
B. Tech (CSE, ECE, IT, MAE, DMAM)
w.e.f
Academic Year 2022-2023 Onwards

First Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BAS-101	Applied Mathematics-I	3-1-0	4	**BAS**
2.	BAS-103	Applied Physics-I	2-1-2	4	**BAS**
3.	BAS-105	Applied Chemistry	2-1-2	4	**BAS**
4.	HMC-110	Communication Skills	3-1-0	4	**BAS**

Second Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BAS-102	Applied Mathematics-II	3-1-0	4	**BAS**
2.	BAS-104	Applied Physics-II	2-1-2	4	**BAS**
3.	BAS-106	Environmental Science	2-1-2	4	**BAS**
4.	HMC-110	Communication Skills	3-1-0	4	**BAS**

APPLIED MATHEMATICS – I	
Course Code: BAS-101 Contact Hours: L-3 T-1 P-0 Course Category: BAS	Credits: 4 Semester: 1

Introduction: Mathematics is used in almost every field of engineering be it computer science and information technology wherein it may be used in modeling, machine learning, image processing etc., or by electrical engineers for signal processing, control engineering or by mechanical engineers for design, modeling, manufacturing etc. But the problem faced by engineers is to how to apply the basic mathematical concepts in engineering problem which they would be dealing in coming years. The course covers the various topics of engineering mathematics such as matrices, sequences and series, calculus of functions of more than one variable.

Course Objective:

- The students will be made familiar with the concepts of matrices, sequences and series.
- To provide students with skills and knowledge of calculus of functions of several variables which would enable them to devise solutions for given situations they may encounter in day to day engineering problems.

Prerequisite: Fundamentals of matrices, calculus of functions of single variable.

Course Outcomes (CO)

Having successfully completed this course, the student will be able to

C0 1. Recall the concepts of matrices. Evaluate rank, inverse, eigen values and eigen vectors of a matrix and apply them in engineering problems.

C0 2. Determine the convergence/divergence of an infinite series.

C0 3. Apply the knowledge of calculus to trace simple Cartesian and polar curves for evaluating multiple integrals.

C0 4. Find the partial derivatives and evaluate maxima/minima for functions of two or more variables and apply them in real world problems.

C0 5. Evaluate multiple integrals and discuss their applications in determining surface area and volumes.

PO / CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	1	-	-	-	-	-	-	-
CO 2	3	3	1	1	1	-	-	-	-	-	-	-
CO 3	3	3	2	1	1	-	-	-	-	-	-	-
CO 4	3	3	2	1	1	-	-	-	-	-	-	-
CO 5	3	3	2	1	1	-	-	-	-	-	-	-

Pedagogy: Apart from class room teaching, main focus is to enhance problem solving ability supported by weekly assignments and discussing individual's doubts.

Contents

UNIT-I	08 Hours
Matrix Algebra: Rank of a matrix, Inverse of a matrix using elementary transformations, consistency of system of linear equations, eigenvalues and eigenvectors of a matrix, some special matrices and their properties, Cayley Hamilton theorem, Diagonalization of a matrix.	
UNIT-II	12 Hours
Sequences and series: Introduction to sequences and infinite series, various tests for convergence/divergence of infinite series-limit comparison test, ratio test, root test, Raabe's test, log test, integral test. Alternating series, absolute and conditional convergence. **Differential Calculus:** Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's Series (in one variable).	
UNIT-III	12 Hours
Differential Calculus (continued): Tracing of some standard curves (cartesian, polar, parametric coordinates), Introductions to functions of several variables, Partial differentiation, Euler's theorem for homogenous equations, Jacobian, Taylor's and Maclaurin's Series (in two variables), maxima and minima, Lagrange's method of undetermined multiplier.	
UNIT-IV	10 Hours
Integral Calculus: Evaluation of double integral (in cartesian and polar co-ordinates), change of order of integration, change of variables, triple integral (in cartesian),applications of definite integrals in determination of area, arc length, surface area and volumes.	

1.	D. G. Zill and W. S. Wright, "Advanced Engineering Mathematics", 6th Edition, The Jones and Bartlett Learning Publishers, 2016.
2.	Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing House Pvt. Ltd.2016.
3.	Grewal, B. S. , "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017
Reference Books	
1.	George B. Thomas Jr., Ross L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010
2.	Greenberg M., "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 1998.
3.	KreyszigE. , "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2010.

APPLIED PHYSICS - I	
Course Code: BAS-103 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 1

Introduction: Applied physics introduces the basic concepts of physics to undergraduate students, with the application of scientific principles in various technological applications, devices, and systems. The course covers wide-ranging topics of physics which cover the underlying principles of classical mechanics, quantum mechanics, optics and its applications like lasers and fiber optics communication. The syllabus is a perfect blend of classical laws with allied modern devices and will serve to enhance the ability of students toapply fundamental principles to various modern-age applications.

Course Objectives:

- To introduce the students with the wide-ranging topics of physics which cover the underlying principles of classical mechanics, quantum mechanics, optics, and its applications.
- To develop their ability of solving real world problems, going one step ahead of what they have already learnt in school.
- To impart them with an in-depth knowledge of everyday systems and phenomena surrounding them and explain the underlying physics behind those phenomena.
- To enhance the ability of students to apply physics fundamentals to various modern applications.

Pre-requisites: None

Course Outcomes:

Having successfully completed this course, the student will be able to

CO1: Gain knowledge of different concepts in optics and optical devices.

CO2: Understand the principles of Classical Mechanics and study the motion of harmonic Oscillators and body under a Central force.

CO3: Explain the basic principles and laws of Quantum Mechanics and examine the quantum mechanical behavior of a particle in a 1-D box.

CO4: Describe the principles of LASER and optical fibers and study their modern-day applications.

CO-PO Mapping:-

S.No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	---	---	1	1	1	---	---
CO2	3	2	---	2	2	---	---	1	1	2	---	---
CO3	3	2	---	2	---	---	---	---	---	---	---	---
CO4	3	2	2	2	2	2	1	1	1	1	---	---

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, supplemented with periodic tutorial classes to enhance the problem-solving ability. The students would perform experiments to develop a deeper insight into the underlying principles of Physics.

Contents

UNIT-1	8 Hours

OPTICS

Coherent Sources, Temporal and Spatial Coherence, Interference due to Division of wave- front and Division of Amplitude, Interference in Parallel Thin Films, Fresnel Diffraction at Straight Edge, Fraunhofer Diffraction due to Single Slit, N Slits, Diffraction Grating (absent spectra, maxima, resolving and dispersive power of grating (Formula only without derivation)
Polarization, Malus Law, Brewster Law, Double Refraction, Nicol Prism, Production of Plane, Elliptically and Circularly Polarized Light.

UNIT-2	6 Hours

CLASSICAL MECHANICS

Simple Harmonic Oscillator, Damped Harmonic Oscillator, Forced Harmonic Oscillator, small oscillations, Central and Non-Central Forces (conservative, planar, boundtrajectories)

UNIT-3	8 Hours

QUANTUM MECHANICS

Origin of Quantum Mechanics, De Broglie Hypothesis, Heisenberg Uncertainty Principle, Postulates of Quantum Mechanics, Wave Function and Properties, Group and Phase velocity, Time Independent Schrodinger Wave Equation, Particle in 1-D Box.

UNIT-4	6 Hours

LASER AND OPTICAL FIBER COMMUNICATION

Stimulated and Spontaneous Emission, Principle of LASER, Einstein's A and B Coefficients, Components of LASER, He-Ne LASER.
Optical Fibers, Step Index and Graded Index Fibers, Numerical Aperture, Acceptance angle, Pulse Dispersion in Optical Fibers, Schematic of optical fiber communication

Textbooks

1	H. K. Malik and A. K. Singh, "Engineering Physics", 2nd Edition, Mc Graw Hill Ed, 2017.
2	M. C. Jain, "Textbook of Engineering Physics", 1st Edition, Vol. I and II, Phi Learning Pvt Limited, 2009.
3	G. Aruldhas, "Engineering Physics", Phi Learning Pvt Limited 2010.
4	Abhijit Nayak, "Engineering Physics", S K Kataria and sons, 2011
5	M N Avadhanulu, P G Kshirsagarand TVS Arun Murthy, "A Textbook of Engineering Physics", S Chand Publishing, 11th Edition, 2018.

Reference Books	
1	Daniel Kleppner and Robert Kolenkow, “An Introduction to Mechanics”, 2nd Edition, Cambridge University Press, 2021.
2	C. Kittle, “Mechanics”, Berkeley Physics Course, Vol-I, 2nd Edition, McGraw Hill Education 2017.
3	Wilson and J.F.B Hawkes, “Optoelectronics”, 3rd Edition, Prentice Hall Europe, 1998.
4	F. K. Richtmyer, E. H. Kennard, and J. N. Cooper, “Introduction to Modern Physics” 6th Edition, Tata Mc Graw Hill, 1997.
5	Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, “Concepts of Modern Physics”, 7th Edition, Mc Graw Hill,2015
6	Eugene Hecht and A.R. Ganesan, “Optics”,5th Edition, Pearson Education, 2019.
7	David J Griffiths and Darrell F. Schroeter, “Introduction to Quantum Mechanics”, 3rd Edition, Cambridge University Press India Pvt Ltd, 2019.
8	Ajoy K. Ghatak, “Optics”, 7th Edition, McGraw Hill Education India Private Limited, 2020

PRACTICAL CONTENT (BAS-103, BAS-104)

Introduction: Applied Physics lab acquaints the students with fundamental laboratory equipment and their usage. The students gain hands on experience of conducting various experiments.

Course Objectives:

- To make the students learn the usage of basic instruments in sciences like CRO, multimeter, Vernier Calipers, breadboard etc.
- To perform various experiments related to mechanics and optics.

Pre-requisites: None

Course Outcomes:

Having successfully completed this course, the student will be able to

- Learn to work on a variety of instruments to be used later.
- Understand and correlate mechanics, optics, solid state physics and electromagnetic theory with experiments.

Pedagogy: Hands on experience on laboratory equipment with self-explanatory lab manuals.

Evaluation Scheme:

Continuous Assessment Practical (CAP)	10marks
End Term Internal Practical (ETIP)	15marks

Preliminary study

1. Working and connection of a bread board.
2. To study the working of a digital multimeter and measurement of resistance, dc voltages, capacitance.
3. To study the working of a CRO and measurement of voltage and frequency of signals coming from a function generator.
4. AC bridges for measurement of capacitance, inductance etc.

List of Experiments (Any 8-10 Experiments to be done in each Semester)

1. To determine the refractive index of a prism using spectrometer.
2. To determine the wavelength of sodium vapour lamp by Newton's Ring.
3. To determine the wavelength of sodium light using diffraction grating.
4. To determine the specific rotation of cane sugar solution with the help of polarimeter.
5. To find the wavelength of He-Ne Laser using transmission diffraction grating.
6. To determine the numerical aperture of an optical fiber.

7. Measurement of transmission wavelength of various optical filters using Handheld spectrometer.
8. Measurements of emission spectra of various light source.
9. Measurement of logarithmic decrement of a damped harmonic oscillator.
10. To determine the acceleration due to gravity using bar pendulum.
11. To determine the acceleration due to gravity using Kater's pendulum.
12. To determine the moment of inertia of a flywheel about its axis of rotation.
13. To determine the Young's modulus of the material of a given bar by bending.
14. To study different modes of oscillations using coupled pendulum.
15. To determine the frequency of A.C. mains using sonometer and an electromagnet.
16. To measure the frequency of a sine-wave voltage obtained from signal generator and to obtain Lissajous pattern on the CRO screen by feeding two sine wave voltages from two signal generator.
17. To determine the value of e/m by J J Thompson method.
18. To determine plank's constant.
19. To study the IV characteristics of a PN junction diode, Zener Diode and LED.
20. To study the charging and discharging of a capacitor to find the time constant.
21. To find the thermal conductivity of a poor conductor by Lee's disk method.
22. To study Hall effect and to measure carrier concentration and Hall coefficient for unknown semiconductor.
23. Measurement of high resistance by ballistic galvanometer.
24. To trace the B-H curve for a ferromagnetic material using CRO and to find the magnetic parameters from the B-H hysteresis loop.
25. Study of semiconductor devices (PN junction, Metal-insulator semiconductor diode etc.) by current-voltage (I-V) and capacitance-voltage (C-V) measurements using semiconductor parameter analyzer.
26. To determine the resistivity of Semiconductors by Four Probe Method at different temperatures and to calculate Bandgap from it.
27. To study and calibrate temperature transducers.
28. To study the gas sensing response characteristics (I-V characteristics) of Gas Sensors.
29. To study response and IV characteristics of infrared (IR) Sensor.
30. Determine the Surface area of Solids from Nitrogen isotherm using BET Technique.

Reference Books	
1	Geeta Sanon, "B. Sc. Practical Physics", 1st Edition, R Chand, and Co. New Delhi, 2019.
2	Indu Prakash,Ramkrishna and A.K. Jha, "A textbook of Practical Physics", 3rd Edition,Kitab Mahal, 2011.
3	Harnam Singh and P.S. Hemne, "B.Sc. Practical Physics", S Chand and Company, 2000.
4	C L Arora, "Practical Physics", S. Chand & Company Ltd., 2010
5	Manjeet Singh, Surender Duhan and Anita Devi, "Applied Physics Theory andExperiments", 1st Edition, Vayu Education of India Publications, 2011.

APPLIED CHEMISTRY	
Course Code: BAS-105 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 1

Introduction: Applied Chemistry essentially deals with a wide variety of topics related to Water Technology, Catalysis, Phase Rule, Nano-chemistry, Composite materials and Instrumental Techniques; from the development and characterization of new materials to the development of the technology to effectively apply knowledge in their field.

Course Objectives:

- The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.
- It aims to impart theoretical and technical knowledge applicable to various industries e.g., Textile, Petrochemicals, Heavy Chemical Industries, Food, Metallurgy etc.

Pre-requisite: None

Course Outcomes: Having successfully completed this course,

CO1: Students will apply the principles underlying various techniques of water and waste treatment, to develop the solutions to industrial problems.

CO2: Students will implement the concept of catalysis and phase rule for their applications in various fields of Engineering and Technology. This will enable them to develop the skills to find solutions towards scientific and engineering problems.

CO3: The students shall understand the recent research carried out on different types of composite materials; Synthesis, characterization and evaluation of Nanomaterials and composite materials and their applications. As an outcome, student will synthesize the nanomaterial followed by its characterization.

CO4: Young graduates will be able to analyze the physical and chemical properties of the aqueous solutions using experimental techniques of conductometry, potentiometry spectroscopy and thermal analysis.

CO-PO Mapping

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: low, 2: Medium, 3: High)												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	2	1	1	1	-	2	2	-	2
CO2	2	2	2	2	1	1	2	-	1	1	-	2
CO3	2	2	2	2	2	2	2	-	2	2	-	2
CO4	2	2	1	2	2	1	-	-	2	2	-	2

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with regular tutorial classes to enhance the problem-solving ability.

Contents

UNIT-I	8 Hours
Water Technology: Introduction and specification of water, Total Hardness and its determination (EDTA method)-(Numericals), Alkalinity-(Numericals), Boiler feed water, boiler problems – scale, sludge, priming & foaming, caustic embrittlement & corrosion : causes & prevention, Water Softening by Internal Treatment: carbonate & phosphate conditioning, colloidal conditioning & calgon treatment Water Softening by External Treatment: Lime-Soda Process, (Numericals), Zeolite & Ion-Exchange Process (Numericals). Water for Domestic use: Disinfection by Breakpoint chlorination.	
UNIT-II	6 Hours
Catalysis and Phase Rule: Catalyst and its characteristics, Types of catalysts, Concept of promoters, inhibitors and poisons, autocatalysis, physisorption, chemisorption, surface area. Theories of catalysis: Intermediate compound formation theory, adsorption or contact theory. Homogenous catalysis: Acid-Base catalysis-Types, Enzyme catalysis, Lock and key mechanism and turn over number. Phase rule-Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and sulphur system Application of phase rule to two component system- The Lead-Silver system (Pattinson's process), $FeCl_3$water system.	
UNIT-III	6 HOUR
Nano chemistry and Composite Materials: Nanoscience & nanotechnology; Top-down and bottom-up approaches for nanomaterial synthesis, properties of nanomaterials, Properties and applications of nanoscale materials: Carbon nanotubes, fullerenes, nano-metals, and biological nanomaterials Practical applications of nanomaterials in different areas Introduction, advantages of composite materials. Roles of matrix in composites, classification of matrix material and reinforcements. Fiber-reinforced composites and structural composites**.**	
UNIT IV	8 HOUR
Instrumental Methods of Analysis: Spectral Analysis: Electromagnetic radiations, Regions of electromagnetic spectrum and types of spectra, Lambert-Beer's Law (Numericals), Instrumentation and applications of UV-Vis and Infrared Spectroscopy. Thermal Analysis: Basic principle, instrumentation and applications of Thermo gravimetric analysis (TGA), Differential thermal analysis (DTA). Conductance and Electrochemistry**:** Conductivity of electrolytes: specific, equivalent and molar conductivity. Kohlrausch law of independent migration of ions. Conductometric titrations (Acid-base only). Electrochemical cell, electromotive force(emf) and its measurements, Nernst equation, Qualitative discussions of potentiometric titrations (Acid-Base, redox).	

Text Books

1	S. Rattan, "Text book on Engineering Chemistry", 7th Ed., S. K. Kataria & Sons, 2013.
2	P.C. Jain & M. Jain, "Engineering Chemistry", 16th Ed., Dhanpat Rai Publishing Co., 2013.

Reference Books

1	P.W. Atkins, "The Elements of Physical Chemistry", 6th Ed., Oxford University Press, 2012.
2	B.S. Bahl, G.D. Tuli, A. Bahl, "Essentials of Physical Chemistry", 24th Ed., S. Chand & Co., 2000.
3	D. A. Skoog, F. J. Holler and A. N. Timothy, "Principle of Instrumental Analysis", 6th Ed., Saunders College Publishing, Philadelphia, 2016.
4	O. G. Palanna, Engineering Chemistry, McGraw Hill Education (India) Pvt Ltd., 2017.
5	K. Sesha Maheswaramma, Mridula Chugh, Engineering Chemistry, 1st Ed., Pearson India Education Services Pvt. Ltd, 2016.

PRACTICAL COMPONENT

Introduction: Applied Chemistry Lab acquaints the students with fundamental laboratory equipments and their usage. The students gain hands on experience of conducting various experiments.

Course Objectives:

- The aim of this course is to make the students learn Iodometric titrations, Argentometric titration, complexometric titration, acid/base reactions, redox reactions etc.
- Also experiments on basic instruments like pH meter, Conductivity meter, Ostwald viscometer, Stalagmometer, UV visible spectrophotometer etc. would be carried out

Course Outcomes: Having successfully completed this course, the student will be able to

- Learn to work on a variety of instruments to be used later on.
- Young graduates gains knowledge of interdisciplinary branches of the chemistry namely Engineering, Inorganic, Physical, Analytical, nanotechnology, Industrial and Instrumentation Techniques.

Pedagogy: Hands on experience on laboratory equipment with self-explanatory lab manuals.

Evaluation Scheme:

Continuous Assessment Practical (CAP)	10marks
End Term Internal Practical (ETIP)	15marks

List of Experiments (Minimum Eight experiments to be performed)

1. Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.
2. Determine the amount of Oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.
3. Determine the amount of copper in the copper ore solution, provided hypo solution.
4. Determine the amount of chloride ions present in water using silver nitrate (Mohr's precipitation method)
5. Determination of Alkalinity in the water sample.
6. Determination of Hardness in the water sample.
7. Determine the strength of $KMnO_4$ solution using sodium oxalate.
8. Determine the surface tension of a liquid using drop weight method.
9. Determine viscosity of a given liquid (density to be determined).
10. Determine the cell constant of a conductivity cell and titration of strong acid/strong base conductometrically.
11. To determine of the solution of (a) λ_{max} of the solution of $KMno_4$ (b) verify beers law and find out the concentration of unknown solution using spectrophotometer
12. Determination concentration of iron in the given sample using Spectrophotometer
13. Determination of eutectic point and congruent melting point for a two component system by method of cooling curve.
14. Determine the concentration and dissociation constants of polyprotic acid

potentiometrically.

15. Synthesis of Ag/ZnO/CuO nanoparticles and record UV-Visible spectra.

REFERENCE BOOKS:

1. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, 6th edition, Pearson Education, 2009.
2. S.K. Bhasin and Sudha Rani, Laboratory Manual on Engg. Chemistry, Dhanpat Rai Publishing Company, 2006.
3. Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria & Sons, Delhi, 2011.
4. Janet Macfall, Catherine Deininger, Atricia Thomas-Laemont, Environmental ScienceLab Manual, 2nd Edition, Kendall Hunt Publishing, 2017

COMMUNICATION SKILLS	
Course Code: HMC-110 Contact Hours: L-3 T-1 P-0	Credits: 4 Semester: Odd, Even

Introduction: This course facilitates communication skills development by exposing the students to various nuances of effective communication. The course provides an in-depth understanding of several key concepts of Communication like importance and functions of communication, barriers to communication, active listening, group discussions, presentation skills etc. The course also provides valid inputs on the *ethical* dimension of communication to enable the students to be ethical communicators.

The highlight of the course is special emphasis on Employment Communication i.e. job application and resume writing along with preparing and appearing for Interviews and Group Discussions. The students will also be acquainted with various forms of business correspondence used in organizations on a regular basis like agenda and minutes of meetings, business letters, reports etc.

Course Objectives:

- To enable students to evaluate their personal communications styles and improve upon it.
- To help the students understand the contemporary trends in communication.
- To facilitate the students in becoming aware of different communication theories and their application.
- To encourage students to develop/create their own unique style of communication.

Pre-requisites: None

Course Outcomes – After completion of the course, the students should be able to:

CO1- Evaluate and analyze their personal communication style while adapting their communication to better expression of their ideas at workplace.

CO2- Enhance their knowledge of contemporary trends for effective Communication.

CO3- Effective comprehension and application of different Communication theories.

CO4- Synthesis their own unique communication style.

CO-PO mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	-	-	-	2	3	-	3
CO 2	-	-	-	-	-	-	-	1	2	3	-	3
CO 3	-	-	-	-	-	-	-	-	-	3	-	2
CO 4	-	-	-	-	-	-	-	-	-	3	-	2

Pedagogy: Apart from interactive class teaching, various individual and group assignments are given. Group discussions, JAMs, role plays and presentations are conducted in class to enable students to practically apply the theories learnt during the course.

Contents

UNIT-I	10 Hours
Introducing Communication: Importance and function of Communication, Communication Cycle, Characteristics and Types of Communication, Channels and Medium of Communication, 7 C's of Communication, Barriers to Communication. Ethics of Communication (plagiarism, language sensitivity towards gender, caste, race, disability etc.	
UNIT-II	11 Hours
Everyday Communication: Non-Verbal Language (Symbols, Appearance, Paralanguage and Body Language, Proxemics, Chronemics), Listening Skills (Importance, Barriers, Essentials of Good Listening), Communication Skills (greetings, introducing, making requests, asking and giving permission, offering help and giving instructions and directions etc.), Understanding Telephone Skills (handling calls, leaving a message, asking and giving information and instructions etc.), Net Etiquettes.	
UNIT-III	11 Hours
Presentations & Employment Communication: Classroom Presentations (purpose, types, preparing and presenting – use of visual aids/ power point presentations), Group Discussion (purpose, strategies, guidelines etc.), Job Application (Resume and Cover Letter), Interview Skills (purpose, types of interviews, guidelines and preparing for facing the interviews). Presentation, Group discussion and Mock interview practice should be undertaken in class.	
UNIT-IV	10 Hours
Writing on the Job: Formal and Informal Writing, Basics of Paragraph Writing**,** Email Writing, Letters at the workplace, Meeting documentations (Agenda and Minutes of meeting etc.), Report Writing (characteristics, types, structure of formal report).	
Text Books	
1.	M. Raman and S. Sharma. Technical Communication: Principles and Practice, 3rd Edition, Oxford University Press, 2011.
2.	M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill Publications, 2005.
Reference Books	
1.	Lewis and Hedwig, Body Language: A Guide for Professionals, New Delhi, Response Books, 2000
2.	Sides and H. Charles, How to Write & Present Technical Information, Cambridge, CUP, 1999.
3.	S. Kumar and P. Lata. Language and Communication Skills for Engineers, Oxford University Press, 2018.
4.	Hasson, Gill. Brilliant Communication Skills. Pearson Education, 2012.

APPLIED MATHEMATICS – II	
Course Code: BAS-102 Contact Hours: L-3 T-1 P-0 Course Category: BAS	Credits: 4 Semester: 2

Introduction: Mathematics is used in almost every field of engineering be it computer science and information technology wherein it may be used in modelling, machine learning, image processing etc., or by electrical engineers for signal processing, control engineering or by mechanical engineers for design, modelling, manufacturing etc. But the problem faced by engineers is to how to apply the basic mathematical concepts in engineering problem which they would be dealing in coming years. The course covers vector calculus, linear ordinary differential equations of higher order, introduction of Laplace and Fourier transforms functions of complex variables.

Course Objectives:

- To introduce the calculus of vector functions and their applications.
- To introduce the theory and concepts of differential equations and their applications, Laplace and Fourier transformations which will equip them with adequate knowledge of mathematics to formulate and solve problems analytically.
- Students will be equipped with the understanding of the fundamental concepts of functions of complex variable and their calculus.

Prerequisite: Vectors, Ordinary differential equations of first order, calculus of functions of more than one variable, complex numbers.

Course Outcomes: Having successfully completed this course, the student will be able to

C0 1. Compute gradient, divergence and curl of scalar and vector point functions. Evaluate line, surface and volume integrals using Green's, Gauss's divergence and Stoke's theorem.

C0 2. Determine the solution of ordinary linear differential equations of higher order and apply them in engineering problems.

C0 3. Evaluate Laplace, inverse Laplace transforms and apply them to solve initial and boundary value problem.

C0 4. Determine the analyticity of complex valued functions and solve integrals of real and complex variable functions.

CO-PO Mapping:

PO / CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	1	-	-	-	-	-	-	-
CO 2	3	3	2	1	1	-	-	-	-	-	-	-
CO 3	3	3	2	1	1	-	-	-	-	-	-	-
CO 4	3	3	2	1	1	-	-	-	-	-	-	-

Pedagogy: Apart from class room teaching, main focus is to enhance problem solving ability supported by weekly assignments and discussing individual's doubts.

Contents

UNIT-I	10 Hours
Vector Calculus: Scalar and vector point functions, gradient, directional derivative, divergence, curl and their applications, Green's, Stoke's and Gauss divergence theorems (without proof).	
UNIT-II	10 Hours
Differential Equations : Linear differential equations of higher order with constant coefficients, simultaneous linear differential equations, method of undetermined coefficients and Variation of parameters, solution of homogeneous nonlinear differential equations (Cauchy's and Legendre's form).	
UNIT-III	12 Hours
Laplace Transforms: Basic properties of Laplace and inverse Laplace transform, convolution theorem. Laplace transform of unit step function, applications of Laplace transform to initial and boundary value problems. **Fourier series and Transforms** : Fourier series, Fourier series expansion of even and odd functions, Fourier half range series,Fourier transforms, transforms of derivatives and integrals.	
UNIT-IV	10 Hours
Complex Analysis: Functions of a complex variable, analytic functions, Cauchy-Riemann equations, complex line integrals, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, zeroes and singularities, calculation of residues and residue theorem.	

Text Books	
1.	D. G. Zill and W. S. Wright, "Advanced Engineering Mathematics", 6th Edition, The Jones and Bartlett Learning Publishers, 2016.
2.	Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing House Pvt. Ltd.2016.
3.	Grewal, B. S. , "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017
Reference Books	
1.	George B. Thomas Jr., Ross L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010
2.	Greenberg M., "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 1998
3.	Kreyszig. E. , "Advanced Engineering Mathematics", 10thEdition, John Wiley & Sons, 2010.

APPLIED PHYSICS – II	
Course Code: BAS-104 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester:2

Introduction: Applied physics introduces the basic concepts of physics to undergraduate students, with the application of scientific principles in various technological applications, devices, and systems. The course covers wide-ranging topics of physics which cover the underlying principles of electromagnetic theory, solid state physics, special theory of relativity and radiation and sensors. The syllabus is a perfect blend of classical laws with modern devices which will enhance the ability of students to apply fundamentals to various applications.

Course Objectives:

- To introduce students with the wide-ranging topics of physics which form the underlying physical principles of electromagnetic theory, solid state physics, special theory of relativity, X-rays and sensors.
- To impart an in-depth knowledge of everyday systems and phenomena surrounding them and explain the underlying physics.
- To enhance the ability of students to apply physics fundamentals to various modern applications for societal benefits.
- To develop a quantitative aptitude for solving engineering problems.
- To perform and interpret experiments using modern tools, techniques and write effective lab reports to various engineering problems, with an understanding of the limitations

Pre-requisites: None

Course Outcomes: Having successfully completed this course, the student will be able to

CO1: Understand the laws of Electromagnetic (EM) theory and solve engineering problems, based on propagation of EM waves in different media.

CO2: Enhance the knowledge of solid-state physics concepts and understand the band structure of solids with modern device applications.

CO3: Describe the basic postulates of special theory of relativity and learn the space time transformations to formulate different relativistic phenomena

CO4: Describe the principle, design and applications of X-rays and various types of sensors with their characteristics.

CO-PO Mapping:

S.No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	---	2	---	1	---	1	---	---	---	---
CO2	3	2	2	2	2	2	---	1	1	2	---	---
CO3	3	3	---	2	---	---	---	---	---	---	---	---
CO4	3	1	2	2	2	2	2	2	1	1	---	---

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes to enhance the problem-solving ability.

Contents

UNIT-1 **8 Hours**

ELECTRO MAGNETIC THEORY

Introduction to gradient divergence, curl, Gauss divergence theorem and Stoke's theorem (without proof). Electromagnetic Waves, Electromagnetic spectrum, Equation of Continuity, Maxwell's Equations, Poynting Theorem (No Derivation), Propagation of Electromagnetic Waves in Free Space, Dielectric and Conducting Medium (Qualitative), Skin Depth.

UNIT-2 **8 Hours**

SOLID STATE PHYSICS

Space lattice, Unit cell and Translation Vector, Wigner Seitz cell, reciprocal lattice, Miller Indices, Bose-Einstein, and Fermi -Dirac Distribution functions (formula only). Fermi level, Density of states. Bloch Theorem and Kronig-Penney model (Qualitative), E-K diagram, Band structure in Metals, Semiconductors, and Insulators, Intrinsic and Extrinsic Semiconductors, Fermi Energy Level for Undoped and Doped Semiconductors, pn-junction, Zener Diode (voltage regulation).

UNIT-3 **6 Hours**

SPECIAL THEORY OF RELATIVITY (STR)

Introduction to frames of reference (inertial and non-inertial), Galilean and Lorentz transformation, Postulates of Special Theory of Relativity, Time dilation, Length contraction, Relativistic addition of Velocities.

UNIT-4 **6 Hours**

RADIATIONS AND SENSORS

Production of X-rays, Moseley's law, Bragg's law, X-ray diffraction and its applications Sensor, Signals and Response, Sensor Characteristics (Transfer Function, Sensitivity, non-linearity, Saturation, Dead Band, Resolution and Selectivity), LDR, Temperature sensor - thermocouple.

Textbooks

1	H. K. Malik and A. K. Singh, "Engineering Physics", 2nd Edition, Mc Graw Hill Ed, 2017.
2	M. C. Jain, "Textbook of Engineering Physics", 1st Edition, Vol. I and II, Phi LearningPvt Limited, 2009.
3	G. Aruldhas, "Engineering Physics", Phi Learning Pvt Limited 2010.

4	Abhijit Nayak, “Engineering Physics”, S K Kataria and sons, 2011
5	M N Avadhanulu, P G Kshirsagarand TVS Arun Murthy, “A Textbook of Engineering Physics”, S Chand Publishing, 11th Edition, 2018.

Reference Books

1	Charles Kittel, “Introduction to Solid State Physics”, Wiley India Edition, 2019.
2	N. David and Neil W. Ashcroft, “Solid State Physics”, 1st Edition, Cengage Publication, 2003.
3	Wilson and J.F.B Hawkes, “Optoelectronics”, 3rd Edition, Prentice Hall Europe, 1998.
4	F. K. Richtmyer, E. H. Kennard, and J. N. Cooper, “Introduction to Modern Physics”6th Edition, Tata Mc Graw Hill, 1997.
5	D.J. Griffith, “Introduction to Electrodynamics “,4thEdition, Pearson Education India Learning Private Limited, 2015.
6	Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, “Concepts of ModernPhysics”, 7th Edition, Mc Graw Hill,2015
7	William H. Hayt and J. A Buck, 6th Edition, “Engineering Electromagnetism”, 2001.
8	David J Griffiths and Darrell F. Schroeter, “Introduction to Quantum Mechanics”, 3rd Edition, Cambridge University Press India Pvt Ltd, 2019.
9	Handbook of Modern Sensors: Physics, Designs, and Applications, Jacob Fraden,4thEdition, Springer, 2010.
10	R.K. Puri and V.K. Babbar, “Solid State Physics”, S Chand Publication, 2010

ENVIRONMENTAL SCIENCES	
Course Code: BAS-106 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 2

Introduction: A scientific study of the natural world and how it is influenced by people. It Surveys environmental studies, examining ecological, socioeconomic, and technological factors that influence the quality of life on Earth.

Course Objectives:

- Environmental science prepares students for career success in environmental monitoring and remediation, natural resources and conservation, public health, industrial environmental management.
- The curriculum is so designed that the students get an in-depth knowledge of the environment and various issues arising due to mismanagement of resources.

Pre-requisites: None

Course Outcomes: Having successfully completed this course,

CO1: Students will be able understand about the availability and sustainable use of natural resources and concept of ecosystems and biodiversity.

CO2: Students will understand and evaluate the transnational character of environmental problems, their sources, sinks and control strategies along with their short-term and long term impacts to humans. Students will also learn to apply green methodologies to find solutions to address various environmental issues.

CO3: Students will understand the concept of fuel technology and implement their interpretative skills to evaluate the usage and application of alternate energy sources for sustainability.

CO4: Young graduates would understand the interconnected and interdisciplinary branches like Toxicology, synthesis and applications of Eco friendly polymers and demonstrate an integrative approach to environmental issues with a focus on sustainability.

CO-PO Mapping

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

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes to enhance the problem-solving ability.

Contents

UNIT-I	6 Hours
Natural Resources, Conservation and Management: Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water. Mineral resources: Environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs renewable and non-renewable energy sources. Resource Management-Concept of Sustainable development, Environmental Management Systems, Environmental Impact Assessment, Biodiversity- conservation and threats.	
UNIT-II	8 Hours
Environmental Pollution and Control: Air Pollution: Types of air pollutants; Source, effects, sink & control of common air pollutants (CO, oxides of nitrogen & sulphur, hydrocarbons and particulates), Photochemical smog, acid rain, greenhouse effect, global warming, Carbon dioxide sequestration and the concept of Carbon Credits Water Pollution: Classification of pollutants and their sources, Waste water treatment (Primary, secondary and tertiary treatment), Impact of water pollution on hydrological ecosystems. Solid and Hazardous Waste Pollution: Classification, waste treatment and disposal methods: Sanitary landfill, thermal processes, chemical and biological processes, disposal methods for nuclear waste, nuclear disaster (case study), disposal methods for e-waste. Green Technology And Green Chemistry: Introduction to concept of Green Technology and Zero Waste Technology, Green Chemistry & its basic principles, Atom Economy, evaluation of feedstock, reaction types, methods, reagents and solvents.	
UNIT-III	8 HOUR
Fuels and Alternate Energy Sources: Classification, Calorific value of fuels (gross and net), Dulong's formula, Determination of calorific value of fuels using bomb's calorimeter, Determination of calorific value of fuels using Boy's Gas Calorimeter (Numericals). Liquid fuels-petroleum chemical composition, fractional distillation, Cracking – Thermal & catalytic cracking, Octane &Cetane numbers with their significance. Analysis of flue gases (Orsat's Apparatus)-(Numericals), Combustion of fuels. Use of alternate energy sources including solar energy harnessing (photovoltaics), wind energy, hydroenergy, geothermal energy, ocean energy, biodiesel, power alcohol, biomass energy.	
UNIT IV	6 HOUR
Chemical Toxicology and Eco-Friendly Polymers Toxicology: terminology & toxic effects, chemical interactions, impact of toxic chemicals on enzymes, Biochemical effects of arsenic, mercury, lead, chromium, & cadmium. Polymers Introduction: Functionality of monomer, polymerization, degree of polymerization, Number average and weight average molecular weight of polymers. Environmental degradation of polymers: Biodegradable, Photo-biodegradable polymers, Hydrolysis & Hydro-biodegradable polymers Biopolymers & Bioplastics.	

Text Books	
1	Ranu Gadi, Sunita Rattan, Sushmita Mohapatra. A Text book of Environmental Studies (with experiments), 4th Ed., S.K. Kataria & Sons, 2014.
2	S. Rattan, "Applied Chemistry", S.K. Kataria & Sons, 2013.
3	S.S. Dara, D.D. Mishra. A Textbook of Environmental Chemistry and Pollution Control (With Energy, Ecology, Ethics and Society) S. Chand and Company Pvt. Ltd. (India), 2011.
Reference Books	
1	Richard T. Wright, Environmental Science, 9thEdition, Pearson Education, 2007.
2	Gerard Kiely, Environmental Engineering, special Indian edition The McGraw-Hill Companies, 2007.
3	E. Barucha, Textbook of Environmental Studies for Undergraduate Courses, Universities Press (India) Pvt. Ltd., 2005.
4	C.N. Sawyer, P.L. McCarty, and G.F. Parkin, "Chemistry for Environmental Engg. and Science", 5th Ed., The McGraw-Hill Companies, 2003.
5	R. Rajagopalan, Environmental studies from crisis to cure, 3rd edition, Oxford University Press., 2016.

PRACTICAL COMPONENT

Introduction: Environmental Studies Lab acquaints the students with fundamental laboratory equipments and their usage. The students gain hands on experience of conducting various experiments.

Course Objectives:

- The aim of this course is to make the students learn the usage of basic instruments in Sciences like BOD Incubator, Bomb Calorimeter, pH meter, conductivity meter etc.
- Students will demonstrate interpretative skills including the ability to analyze data statistically, assess reliability, interpret results and draw reasonable conclusions.

Course Outcomes:

Having successfully completed this course, the student will be able to

- Learn to work on a variety of instruments to be used later on.
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales

Pedagogy: Hands on experience on laboratory equipments with self-explanatory lab manuals.

Evaluation Scheme:

Continuous Assessment Practical (CAP)	10marks
End Term Internal Practical (ETIP)	15marks

List of Experiments (Minimum eight experiments to be performed)

1. Determination of Dissolved Oxygen (DO) in the water sample.
2. Determination of Biological oxygen demand (BOD) in the water sample.
3. Determination of Chemical oxygen demand (COD) in the water sample.
4. Determination of pH, conductivity and TDS in different drinking water samples and preparation of report.
5. Determination of Residual Chlorine in the water sample.
6. Determination of Ammonia in the water sample.
7. Determination of Calorific Value of fuels using Bomb calorimeter.
8. Determination of Free Carbon Dioxide in the water sample.
9. Estimation of sulphur in given coal sample gravimetrically
10. Determination of molecular weight of polystyrene sample using viscometric method
11. Acetylation of primary amines using green methodology
12. Preparation of urea formaldehyde resin and functional group analysis using IR spectroscopy.
13. Preparation of aloe vera/avocado soap by green method of saponification.
14. Preparation of biodiesel from waste cooking oil using KOH as the catalyst.

REFERENCE BOOKS:

1. Standard Methods for the Examination of Water and Wastewater, American Public Health Association (APHA), American Water Works Association (AWWA) & Water Environment Federation (WEF), 2005.
2. Experiments in Applied Chemistry, Sunita Rattan, Publ.: S.K. Kataria & Sons, Delhi, Edition 2011.
3. Laboratory Manual on Engg. Chemistry, S.K. Bhasin and Sudha Rani, Dhanpat Rai Publ. Comp., New Delhi, Edition 2009.

COMMUNICATION SKILLS	
Course Code: HMC-110 Contact Hours: L-3 T-1 P-0	Credits: 4 Semester: Odd, Even

Introduction: This course facilitates communication skills development by exposing the students to various nuances of effective communication. The course provides an in-depth understanding of several key concepts of Communication like importance and functions of communication, barriers to communication, active listening, group discussions, presentation skills etc. The course also provides valid inputs on the *ethical* dimension of communication to enable the students to be ethical communicators.

The highlight of the course is special emphasis on Employment Communication i.e. job application and resume writing along with preparing and appearing for Interviews and Group Discussions. The students will also be acquainted with various forms of business correspondence used in organizations on a regular basis like agenda and minutes of meetings, business letters, reports etc.

Pre-requisites: None

Course Outcomes – After completion of the course, the students should be able to:

CO1- Evaluate and analyze their personal communication style while adapting their communication to better expression of their ideas at workplace.

CO2- Enhance their knowledge of contemporary trends for effective Communication.

CO3- Effective comprehension and application of different Communication theories.

CO4- Synthesis their own unique communication style.

CO-PO mapping:

PO / CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	-	-	-	2	3	-	3
CO 2	-	-	-	-	-	-	-	1	2	3	-	3
CO 3	-	-	-	-	-	-	-	-	-	3	-	2
CO 4	-	-	-	-	-	-	-	-	-	3	-	2

Pedagogy: Apart from interactive class teaching, various individual and group assignments are given. Group discussions, JAMs, role plays and presentations are conducted in class to enable students to practically apply the theories learnt during the course.

Contents

UNIT-I	10 Hours
Introducing Communication: Importance and function of Communication, Communication Cycle, Characteristics and Types of Communication, Channels and Medium of Communication, 7 C's of Communication, Barriers to Communication. Ethics of Communication (plagiarism, language sensitivity towards gender, caste, race, disability etc.	
UNIT-II	11 Hours
Everyday Communication: Non-Verbal Language (Symbols, Appearance, Paralanguage and Body Language, Proxemics, Chronemics), Listening Skills (Importance, Barriers, Essentials of Good Listening), Communication Skills (greetings, introducing, making requests, asking and giving permission, offering help and giving instructions and directions etc.), Understanding Telephone Skills (handling calls, leaving a message, asking and giving information and instructions etc.), Net Etiquettes.	
UNIT-III	11 Hours
Presentations & Employment Communication: Classroom Presentations (purpose, types, preparing and presenting – use of visual aids/ power point presentations), Group Discussion (purpose, strategies, guidelines etc.), Job Application (Resume and Cover Letter), Interview Skills (purpose, types of interviews, guidelines and preparing for facing the interviews). Presentation, Group discussion and Mock interview practice should be undertaken in class.	
UNIT-IV	10 Hours
Writing on the Job: Formal and Informal Writing, Basics of Paragraph Writing**,** Email Writing, Letters at the workplace, Meeting documentations (Agenda and Minutes of meeting etc.), Report Writing (characteristics, types, structure of formal report).	
Text Books	
1.	M. Raman and S. Sharma. Technical Communication: Principles and Practice, 3rd Edition, Oxford University Press, 2011.
2.	M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill Publications, 2005.
Reference Books	
1.	Lewis and Hedwig, Body Language: A Guide for Professionals, New Delhi, Response Books, 2000
2.	Sides and H. Charles, How to Write & Present Technical Information, Cambridge, CUP, 1999.
3.	S. Kumar and P. Lata. Language and Communication Skills for Engineers, Oxford University Press, 2018.
4.	Hasson, Gill. Brilliant Communication Skills. Pearson Education, 2012.