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-AI, ECE-AI, AI-ML)
w.e.f
Academic Year-2022-2023 Onwards

First Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BAS-107	Applied Physics	2-1-2	4	**BAS**
2.	BAS-109	Applied Mathematics	3-1-0	4	**BAS**
3.	HMC-110	Communication Skills	3-1-0	4	**BAS**

Second Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BAS-106	Environmental Science	2-1-2	4	**BAS**
2.	BAS-108	Probability and Statistics	3-1-0	4	**BAS**

APPLIED PHYSICS (CSE-AI)

APPLIED PHYSICS	
Course Code: BAS-107 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 1

Introduction: Physics is a subject that is continuously evolving with latest research. The scientific principles of physics are basis of various devices, applications and technological breakthrough. This Applied Physics course has been designed to cover the wide ranging topics of the physics that have direct impact on technological advancements. In this course you will learn various concepts of modern and device-oriented physics that will enhance your ability to apply fundamentals to various applications.

Course Objectives:

- To introduce the students with the wide-ranging topics of the modern physics such as electromagnetic theory, quantum mechanics, optics, and its applications in the form of lasers and optical fiber communication. These topics form the underlyingprinciples of various technologies.
- 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: Gain knowledge of different concepts in Optics and optical devices.

CO2 : Understand the laws of Electromagnetic (EM) theory and solve engineering problems,based on propagation of EM waves in different media.

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:

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO	3	2	1	2	2	-	-	1	1	1	-	-	-	-	-
CO2	3	3	-	2	-	1	-	1	-	-	-	-	-	-	-
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 withoutderivation) Polarization, Malus Law, Brewster Law, Double Refraction, Nicol Prism, Production of Plane, Elliptically and Circularly Polarized Light.	
UNIT-2	**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-3	**7 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	**5 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, Acceptanceangle, 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 Kshirsagar and TVS Arun Murthy, "A Textbook of Engineering Physics", S Chand Publishing, 11th Edition, 2018.

Reference Books	
1	Wilson and J.F.B Hawkes, "Optoelectronics", 3rd Edition, Prentice Hall Europe, 1998.
2	F. K. Richtmyer, E. H. Kennard, and J. N. Cooper, "Introduction to ModernPhysics" 6th Edition, Tata Mc Graw Hill, 1997.
	D.J. Griffith, "Introduction to Electrodynamics ",4thEdition, Pearson EducationIndia Learning Private Limited, 2015.
3	Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, "Concepts of ModernPhysics", 7th Edition, Mc Graw Hill,2015 Eugene Hecht and A.R. Ganesan, "Optics",5th Edition, Pearson Education, 2019.
4	William H. Hayt and J. A Buck, 6th Edition, "Engineering Electromagnetism",2001.
5	Ajoy K. Ghatak, "Optics", 7th Edition, McGraw Hill Education India Private Limited, 2020.
6	David J Griffiths and Darrell F. Schroeter, "Introduction to Quantum Mechanics",3rd Edition, Cambridge University Press India Pvt Ltd, 2019.

PRACTICAL CONTENT

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 MATHEMATICS	
Course Code: BAS-109 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 and vector calculus.

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 and vector calculus 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, vectors.

Course Outcomes (CO)

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

C0 1. Determine rank, inverse, eigen values and eigen vectors of a matrix and apply them in engineering problems.

C0 2. Find the basis and dimension of vector spaces and apply the concept of vector spaces using linear transform. Also, understand the concept of Laplace Transforms and solve initial and boundary value problems using Laplace transforms.

C0 3. Evaluate partial derivatives and find the maxima/minima for functions of two or more variables to solve applied problems in engineering.

C0 4. Understand gradient, directional derivatives, divergence and curl. Use Greens', Stokes, Gauss theorems to evaluate multiple integrals.

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	2	2	1	1	1	-	-	-	-	-	-	-
CO 3	3	3	2	1	1	-	-	-	-	-	-	-
CO 4	3	2	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
Matrices :- Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form), Linear dependence, Consistency of linear system of equations and their solution, Characteristic equation, Eigen values and eigen vectors, Cayley-Hamilton Theorem (without proof)..	
UNIT-II	12 Hours
Vector Spaces :- A brief Introduction to Vector Spaces, Subspaces, Rank and Nullity, Linear Transformations **Laplace Transforms**: Defn, Laplace transforms of some standard functions, inverse Laplace transforms, Convolution theorem. Fourier Series: Fourier Series, Fourier Series of even and odd functions, Fourier Series of functions having arbitrary periods, half range expansion. Fourier Transforms: Fourier transform, Sine and Cosine transforms	
UNIT-III	12 Hours
Differential Calculus: Functions of several variables: Limits, continuity and differentiability, Successive differentiation, Leibnitz theorem, Partial differentiation, Euler's Theorem for homogenous equations. Composite functions, Change of variables, Taylor's and Maclaurin's Series, maxima and minima, Lagrange's method of undetermined multiplier.	
UNIT-IV	10 Hours
Vector Calculus: Vector point functions, Gradient, Divergence and Curl and their physical interpretation, Line integrals, Multiple Integrals, Change of order of integration, Surface and Volume integrals, Green's, Gauss Divergence and Stoke's theorems (without proof).	

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.
4.	Krishnamurthy, V.K., Mainra, V.P. and Arora, J.L., An introduction to Linear Algebra, Affiliated East West Press
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.

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.

ENVIRONMENTAL SCIENCES	
Course Code: BAS-106 Contact Hours: L-2 T-1 P-2 CourseCategory: 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 instrumentsin 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 labmanuals.

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 aloevera/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.

PROBABILITY AND STATISTICS	
Course Code: BAS 108 Contact Hours: L-3 T-1 P-0 Course Category: BAS	Credits: 4 Semester: II

Students will learn fundamental rules of Probability, discrete and continuous distributions, and statistical methods most commonly used in Computer Science and & Engineering.

Course Objectives:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two - dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.

Course Outcomes:

On completion of the course, the student should be able to:

CO1: Recall the basics of probability and apply it to determine total and conditional probabilities.

CO2: Understand the concepts of Random variable, different discrete and continuous probability distributions and use it to solve the statistical situations.

CO3: Evaluate the correlation between two variables and analyze statistical data using MS-Excel.

CO4: Determine probabilities of making errors in hypothesis testing and draw conclusions using critical values.

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	1	1	1	-	-	-	-	-	-	-
CO 2	2	2	1	1	1	-	-	-	-	-	-	-
CO 3	2	2	2	1	1	-	-	-	-	-	-	-
CO 4	3	3	2	1	1	-	-	-	-	-	-	-

Prerequisite: NIL

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding

Contents

UNIT – I	14 Hours
PROBABILITY AND RANDOM VARIABLES: Concept of probability, additive and multiplicative law of probability, total and conditional probabilities, Baye's theorem. Measures of central tendency, dispersion, kurtosis, moments. Random Variables, density and distribution functions, mathematical expectation, variance, standard deviation and moment generating function.	
UNIT – II	8 Hours
TWO –DIMENSIONAL RANDOM VARIABLES: Jointly distributed random variables, Marginal and conditional distributions, Expected values, Covariance and Correlation. Central limit theorem (for independent and identically distributed random variables).	
UNIT – III	10 Hours
PROBABILITY DISTRIBUTIONS AND REGRESSION: Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions. Linear Correlation, Correlation Coefficient, Rank Correlation Coefficient, Regression.	
UNIT – IV	10 Hours
APPLIED STATISTICS: Formation of Hypothesis, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and standard deviations. Test of significance for small samples: t- Test for single mean and difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.	
Case Study / Implementation of above concepts using Excel.	

Text Books

1.	Montgomery, Douglas C., and George C. Runger. "Applied Statistics and Probability for Engineers", Seventh Edition. John Wiley & Sons, 2018.
2.	Sheldon Ross M., Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, 6thEdtion, 2020.
3.	Rukmangadachari E., and Keshava, Reddy E. Probability and Statistics, Pearson Education India, 2015.
4.	Ravichandran J., Probability and Statistics for Engineers. Wiley India, 2010.

Reference Books

1.	Devore, Jay L. "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage, 2010.
2.	Scheaffer, Richard, Madhuri Mulekar, and James McClave. Probability and Statistics for Engineers. Nelson Education, 2010.
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