SEM II ECOmE

Syllabus

Course Name: Probability and Statistics [3:0:0=3]

Course Content:

Sample Space, Dependent and Independent Events, Conditional Probability, Bayes' Rule, Discrete and continuous random variables, Probability distribution functions, Joint probability distribution, Conditional probability distribution, Marginal probability distribution, Statistical independence, Mathematical Expectation, Variance, covariance, Mean/expected value of a random variable, Bernoulli, Binomial, Geometric, Poisson, Uniform, Normal distributions, Random sampling, Sampling distribution, Central limit theorem, t-distribution, F-distribution, Estimation of population parameters, confidence interval, prediction interval and tolerance interval, Testing of hypotheses, Null and Alternative Hypotheses, type-I and type-II errors, Test for means, Test for variances, P-value, Goodness of fit, Test for independence, Test for Homogeneity, Introduction to linear Regression, Simple linear regression model, Method of least square, Correlation Analysis, One way Analysis of Variance.

Course Outcomes:

CO1: Understand the concept of probability, conditional probability, Bayes' theorem, discrete and continuous random variables, different types of discrete and continuous probability distributions, mathematical expectations of random variables, sampling distribution of mean and variance, confidence interval, hypothesis testing, ANOVA and linear regression.

CO2: Apply different types of discrete and continuous probability distribution in practical applications, apply central limit theorem, t-distribution, chi-squared distribution, and F-distribution in hypothesis testing of mean and variance, difference of means and ratio of variances, test for independence, goodness of fit test to problems arising in Engineering.

CO3: Analyse different probability distributions in engineering problems and different techniques in hypothesis testing for mean and variance in the decision making and strategic problems arising in the real-world situations, analyse and validate the appropriate regression model between variables.

CO4: Data analysis and **s**tatistical modelling of real-world problems and finding their solutions using statistical tools as well as with the help of technology and writing a report to summarize the findings.

Textbook:

1) Ronald E. Walpole, Sharon L. Myers and Keying Ye, *Probability and Statistics for Engineers and Scientists*, ISBN: 978-93-325-1908-4, 9th Edition, Pearson, 2016.

Reference Book:

1) Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, ISBN: 13: 978-0-538-73352-6, 8th Edition, Brooks/Cole Cengage Learning, 2012.
2) Richard A. Johnson, *Probability and Statistics for Engineers*, ISBN: 978-81-203-4213-2, 8th Edition, Pearson, 2011.
3) Michael W Trosset, *An Introduction to Statistical Inference and Its Applications with R*, ISBN: 978-1584889472, 1st Edition, CRC Press, 2009.

Course Name: Engineering Physics **[2:0:2=3]**

Course Content:

UNIT-I (OPTICS):

Interference: Division of wavefront, Fresnel's biprism experiment, division of amplitude, thin film interference, Newton's rings experiment.

Diffraction: Fresnel and Fraunhofer diffraction. Single-slit and multi-slit diffraction.

Polarization: Description of linear, circular and elliptical polarization, double refraction, polarization by double refraction, Nicol prism, phase retardation plates: Quarter-wave and half-wave plates, specific rotation. Laurent's half-shade and biquartz polarimeter.

Laser: Fundamental properties and uses of lasers, absorption, spontaneous emission and stimulated emission, Einstein's coefficients, mechanism of light amplification in laser (qualitative), He-Ne laser, semiconductor laser.

UNIT-II (ELECTROMAGNETIC THEORY):

Introduction to gradient, divergence and curl. Review of Maxwell's equations. Displacement current. Propagation of electromagnetic waves in free space and dielectric medium. Continuity equation, Poynting theorem and Poynting vector.

UNIT-III (SOLID-STATE PHYSICS):

Introduction to crystal structure. Miller indices - directions and planes, origin of energy bands, Kronig-Penney model (qualitative), E-k diagram, classification into metals, semiconductors and insulators, Brillouin zones, concept of effective mass of electrons, Hall effect, solar cell.

Course Outcomes:

CO1: Understand basic and advanced concepts of wave optics, laser, electromagnetism and solid-state physics.

CO2: Apply Maxwell's equations to find relevant parameters/equations of electromagnetic waves propagating in free space and dielectric medium.

CO3: Analyze experimental data obtained in physics experiments to find/validate parameter/concept specified in experiment objective.

Textbook:

1) A. Ghatak, Optics, 6th edition. New Delhi: McGraw Hill Education (India) Private Limited, 2017.
2) O. Svelto, D. C. Hanna, Principles of lasers, 5th edition. Milan: Springer, 2010.
3) D. J. Griffiths, D. F. Schroeter, Introduction to Electrodynamics, 4th edition. Pearson, 2015.
4) C. Kittel, Introduction to Solid State Physics, 8th edition. Hoboken, NJ: John Wiley & Sons, Ltd., 2005.
5) P. A. Lynn, Electricity from Sunlight: An introduction to photovoltaics, 1st edition. Chichester, West Sussex: Wiley, 2010.

Reference Book:

1) R. A. Serway, J. W. Jewett, Jr., Physics for Scientists and Engineers with Modern Physics, 9th edition. Boston: Cengage Learning, 2014.
2) H. D. Young, R. A. Freedman, A. L. Ford, Sears & Zemansky's University Physics with Modern Physics, 14th Edition. Addison-Wesley, 2015.
3) K. Thyagarajan, A. Ghatak, Lasers: Fundamentals and Applications, 2nd edition. New York: Springer, 2010.
4) J. D. Jackson, Classical Electrodynamics, 3rd edition. Wiley, 2007.
5) A. Beiser, Concepts of Modern Physics, 6th edition. New York: Tata McGraw-Hill Education, 2003.

Course Name: Python Programming **[1:0:2=2]**

Course Content:

Python program structure, Syntax for Basic console I/O, Keywords, Variables, Assignments, expressions, Data Types, Operators and statements, Branching and repetition, Functions and Recursion, Lists and Tuples, Dictionaries and Structuring Data, Manipulating Strings, OOP concepts, Reading and Writing Files, Exceptions, Numerical and Scientific computing and plotting with Python, Standard libraries.

Course Outcomes:

CO1: Understanding of Python programming fundamentals, including syntax, data types, control structures, and functions.

CO2: Apply Python programs to solve real-world problems, demonstrating proficiency in using Python.

Textbook:

1) Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, How to Think Like a Computer Scientist: Learning with Python 3 Documentation, Green Tea Press, 3rd Edition, 2017.
2) Zed Shaw, Learn Python the Hard Way, Addison Wesley, 3rd edition, 2013.
3) John V Guttag, Introduction to Computation and Programming Using Python: With Application to Understanding Data, 2nd edition, MIT Press, 2016.
4) Guido van Rossum and the Python development team, Python Frequently Asked Questions, Release 3.5.2, 2016.
5) Kenneth Alfred Lambert, Fundamentals of Python: From First Programs Through Data Structures, Course Technology Inc, 1st edition, 2009.
6) John Paul Mueller, Begin Programming with Python for Dummies, For Dummies; 1st edition, 2014.
7) AI Sweigart, Automate the boring stuff with Python, No Starch Press, 1st edition, 2015.

8) John M. Zelle, Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc; 3rd Revised edition, 2016.
9) Mark Lutz, Learning Python, O'Reilly; 5th edition, 2013.

Course Name: Joy of Engineering **[2:0:2=3]**

Course Content:

Students will be given the background of the course - required knowledge to understand and design the projects and complete them in the stipulated time frame. Students will be given suitable guidance to learn the fundamental aspects of developing the prototype of a product. They will also learn the basics of project management techniques, the notion of single-board computing, interfacing sensors and related programming concepts, manufacturing workshops, sensors, web development concepts, business incubation concepts, and digital image processing. Students will be exposed to the basic concepts of IoT and sensors, applications of Artificial Intelligence, and Machine Learning.

Course Outcomes:

CO1: Understand the aspects of different technical concepts and identify a suitable problem for the project.

CO2: Analyse various possible solutions and technical specifications for the project.

CO3: Create a prototype of the project in groups with the required hardware/software simulation results.

Learning Resources: Reading and reference materials will be provided from time to time by the faculty and shared in the classroom or some public repository for students to download.

Course Name: Environmental science and Sustainability **[1:0:2=2]**

Course Content:

Introduction to Environmental Science and Sustainability, Matter, Energy, and Life, Ecosystems and the Biosphere, Community and Population Ecology, Conservation and Biodiversity, Environmental Hazards and Human Health, Water Availability and Use, Food and Hunger, Conventional and Sustainable Agriculture, Air Pollution, Climate Change, and Ozone Depletion, Conventional and Sustainable Energy, Solid and Hazardous Waste, Environmental Economics and Policies, Sustainability and Urban Infrastructure.

Course Outcomes

CO1: Understand the basic relationship between science, environment, and sustainability.

CO2: Apply principles of science to solve problems related to the environment.

CO3: Evaluate the problems and the possible solutions about the environment pertaining towards sustainability.

Textbook

1) Daniel J. Sherman and David R Montgomery, Title: Environmental science and sustainability, Edition: 1st and paperback, Vol. (if a multivolume work). Place of publication: Earth, Publisher: W. W. Norton and Company, Year: 2020, ISBN-10: 0393422100, ISBN-13: 978-0393422108.

Course Name: Practice School-I **(Audit Course)**

Course Content:

Practice School at BMU serves as a comprehensive link between industry exposure and university learning, fostering students' competence in corporate work settings and deepening their comprehension of the dynamic demands and challenges in a professional workplace. This educational initiative emphasizes experiential and collaborative learning, contributing significantly to innovation and research within the country.

PS-I provides an outstanding opportunity for students to engage with industries and gain insights into their industrial environment, working culture, and challenges. It serves as the inaugural experiential learning environment for freshman students. Within this program, Practice School–I (PS-I) stands as the first Audit course, featuring 4-5 compulsory industrial visits per student and is offered to all First Year Engineering Students.

As part of their experiential learning, students participating in PS-I not only engage with industries but also gain valuable exposure to their operational environment. Additionally, students are required to submit a comprehensive report on the company they visited, contributing to their learning and reflective assessment. This holistic approach ensures that students not only witness but actively engage with the professional world, preparing them for the challenges and opportunities in their future careers.

Course Outcomes:

CO1: Understand industrial operations and working culture through active engagement and observation.

CO2: Demonstrate enhanced communication and presentation skills through the submission of a comprehensive report on the visited company.