**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**1st Year Curriculum Structure for B.Tech courses in Engineering & Technology**

(Applicable from the academic session 2018-2019)

| | |
|---|---|
| **Course Code** : BS-PH101/BS-PH201 | **Category** :Basic Science Courses |
| **Course Title** : Physics-I | **Semester** : First/ Second |
| **L-T-P**: **3-1-0** | **Credit:4** |
| **Pre-Requisites:** | |

**Course objectives :**

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

**1. Mechanics** ( 7L)

Problems including constraints & friction. Basic ideas of vector Calculus and partial differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped Harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.|CO-1|

**2. Optics**( 5L)

Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits ( only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications.|CO-2|

Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity. |CO-2|

Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples . |CO-3|

**3. Electromagnetism and Dielectric Magnetic Properties of Materials** (8L)

Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossottiequation(expression only), applications of dielectrics.|CO-4|

Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.|CO-4|



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**4. Quantum Mechanics**(16L)

Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.|CO-5|

**5. Statistical Mechanics**(8L)

Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics. |CO-6|

**Course outcomes:**

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization,etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

**Learning Resources:**

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited

2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley

3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press

4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati , McGraw Hill Education

5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education

6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education

7. Engineering Mechanics, M.K. Harbola, Cengage India

8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education

9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill

10. Mechanics (Dover Books on Physics) ,J. P. Den Hartog , Dover Publications Inc.

11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley

12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley

13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education

14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press

15. Optics ,Hecht, Pearson Education

16. Optics, Ghatak, McGraw Hill Education India Private Limited

17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors

18. Statistical Mechanics ,Pathria, Elsevier

19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemann

## CHEMISTRY-I

**Code : BSCH-101**
**Contacts : 3L +1T =4hrs**
**Credits :4**

**i) Atomic and molecular structure (10 lectures)**
Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

**ii) Spectroscopic techniques and applications (8 lectures)**
Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

**iii)Intermolecular forces and potential energy surfaces (4 lectures)**
Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

**iv)Use of free energy in chemical equilibria (8 lectures)**
First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

**v) Periodic properties (4 Lectures)**
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

**vi) Stereochemistry (4 lectures)**
Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

**vii) Organic reactions and synthesis of a drug molecule (4 lectures)**
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

**Learning Resources:**

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5
th Edition
http://bcs.whfreeman.com/vollhardtschore5e/default.asp

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|---|---|
| **Subject Code** : BS-BIO301 | **Category:** Basic Science course |
| **Subject Name** : Biology | **Semester** : Third |
| **L-T-P** : 3-0-0 | **Credit:3** |
| **Pre-Requisites:** No-prerequisite | |

## Course Content:

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | **Introduction**<br>*Purpose*: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.<br>Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. | 2 |
| 2 | **Classification**<br>*Purpose*: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.<br>Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M.musculus | 3 |
| 3 | **Genetics**<br>*Purpose*: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"<br>Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. | 4 |
| 4 | **Biomolecules**<br>*Purpose*: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine | 4 |

8. Apply thermodynamic principles to biological systems.
9. Identify and classify microorganisms.

## Learning Resources:


1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman andcompany, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
6. Biology for Engineers, Tata McGraw Hill (ISBN: 978-11-21439-931)


**Sample Video Lecture Links: (Made by Dr. Avik De, AP, BSHU, AEC)**

**https://drive.google.com/file/d/1ggvxDrfRYccuc-jR6LsI923Nk5aBr-Js/view?usp=sharing**

**https://drive.google.com/file/d/150q2PW677ZyZrQM5kalH9EFbrp9zfICq/view?usp=sharing**

| | |
|---|---|
| **Course Code** : BS-M202 | **Category** : Basic Science Course |
| **Course Title** : Mathematics – II B | **Semester** : Second (All stream except CSE & IT) |
| **L-T-P** : **3-1-0** | **Credit: 4** |
| **Pre-Requisites:** High School Mathematics and BS-M102 | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 1 | ***Multivariate Calculus (Integration):*** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. | 11 |
| 2 | ***First order ordinary differential equations:*** Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. | 5 |
| 3 | ***Ordinary differential equations of higher orders:*** Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties. | 9 |
| 4 | ***Complex Variable – Differentiation*** Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties. | 6 |
| 5 | ***Complex Variable – Integration*** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. | 9 |

**BSCICB 301** **Linear Algebra (BS)** **2L:0T:0P 2 credits**

**Module I** 10L

Real Matrices, Complex Matrices, Hermitian and skew Hermitian Matrices, Unitary Matrices, Elementary row and column operation, Echelon Matrix.

System of linear equation: LU Decomposition Method

Matrix of a Linear mapping, Null Space ,Range Space, Injectivity and Surjectivity, composition of linear Mapping, Invertible linear maps and Linear operators, Invertable operators.

**Module II** 10L

Inner product space: Definition and properties of inner product space, orthogonality, Cauchy Schwarz inequality, Norm and Orthogonal Basis and Gramm-Schmidt orthonormalisation.

Schur's Theorem, Linear functional, Riesz representation Theorem, Orthogonal orthogonal complement or dual subspace

Singular value and singular vectors singular value decomposition.

**Text book and Reference books:**

1. Advanced Engineering Mathematics, E Kreyszig, Wiley-India

2.Higher Algebra, S. K. Mapa, Levant Books.

3. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.

| CE(BS)302 | **Mathematics-III (Transform & Discrete Mathematics)** | 2L + 0T | 2 Credits |
|---|---|---|---|
| (Prerequisite 2c, 5b-d, 6b) | | | |
| **Module 1** | **Transform Calculus -I**<br>Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials;aplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions.Finding inverse Laplace transform by different methods, convolution theorem. Evaluation ofintegrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method | | 6 L |
| **Module 2** | **Transform Calculus-2**<br>Fourier transforms, Z-transform and Wavelet transforms. properties, methods, inverses and theirapplications | | 6 L |
| **Module 3** | **Sets, relations and functions**<br>Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types ofrelations, their compositions and inverses. Different types of functions, their compositions andinverses. | | 4 L |
| **Module 4** | **Propositional Logic**<br>Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deductiontheorem, etc. Decision problems of propositional logic. Introduction to first order logic and firstorder theory. | | 4 L |
| **Module 5** | **Partially ordered sets**<br>Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices.Boolean and pseudo Boolean lattices. | | 4 L |
| **Module 6** | **Algebraic Structures**<br>Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange'stheorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures.Error correcting code. Algebraic structures with two binary operations- ring, integral domain, andfield. Boolean algebra and boolean ring (Definitions and simple examples only). | | 4 L |
| **Module 7** | **Introduction to Counting**<br>Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation,combination, summations. Introduction to recurrence relation and generating functions. | | 3 L |
| **Module 8** | **Introduction to Graphs**<br>Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees. | | 3 L |
| **Reference** | 1.C. L. Liu, Elements of Discrete Mathematics. 2nd Ed., Tata McGraw-Hill, 2000.<br>2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures. World Scientific, 1999.<br>3. R.L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics. 2nd Ed., Addison-Wesley, 1994.<br>4. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill, 2007.<br>5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett, 2010.<br>6. N. Deo, Graph Theory, Prentice Hall of India, 1974.<br>7. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics,<br>2nd Ed., Tata McGraw-Hill, 1999.<br>8. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science,<br>Tata McGraw-Hill, 1997.<br>9. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.<br>10. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.<br>11. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.<br>12. S.B. Singh. Discrete Structures, Khanna Publishing House, 2019<br>13. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.<br>14. Chandrika Prasad, Advanced Engineering Mathematics, KPB | | |

**Multivariate Normal Distribution:** Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

**Multiple Linear Regression Model:** Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.

**Multivariate Regression:** Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance

**Discriminant Analysis:** Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

**Principal Component Analysis:** Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

**Factor Analysis:** Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

**Cluster Analysis:** Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

**Text Books:**

1. An Introduction to Multivariate Statistical Analysis, T.W. Anderson.
2. Applied Multivariate Data Analysis, Vol I & II, J.D. Jobson.
3. Statistical Tests for Multivariate Analysis, H. Kris.
4. Programming Python, Mark Lutz.
5. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.
6. Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.
7. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing House.
8. Data Science and Analytics, V.K. Jain, Khanna Publishing House.

**Reference Books:**

1. Regression Diagnostics , Identifying Influential Data and Sources of Collinearety, D.A. Belsey, E. Kuh and R.E. Welsch
2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.
7. Python for Data Analysis, Wes Mc Kinney.

| Contents | | Hrs./week | Contents |
|---|---|---|---|
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and nonhomogeneous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. | **16** | **20** |
| 02 | Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule. | **16** | **25** |
| 03 | Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi- square test for goodness of fit and independence of attributes. | **16** | **25** |
| | Sub Total: | **48** | **70** |
| | Internal Assessment Examination & Preparation of Semester Examination | **4** | **30** |
| | Total: | **52** | **100** |



**Course Outcomes:**

The students will be able to:
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|---|---|---|---|
| 7 | **Linear discriminant function based classifier 5L**<br>Perceptron<br>Support vector machines | 5 | |
| 8 | **Non-metric methods for pattern classification 4L**<br>Non-numeric data or nominal data<br>Decision trees | 4 | |
| 9 | **Unsupervised learning and clustering 2L**<br>Criterion functions for clustering<br>Algorithms for clustering: K-means,<br>Hierarchical and other methods | 2 | |

**Text book and Reference books:**

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

**Numerical Methods**
**Code: OEC-IT601A**
**Contact: 3L**

| | |
|---|---|
| Name of the Course: | **Numerical Methods** |
| Course Code: OEC-IT601A | Semester: VI |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme** | **Examination Scheme** |
| Theory:3 hrs./week | Mid Semester exam: 15 |
| Tutorial: NIL | Assignment and Quiz: 10 marks |
| | Attendance: 5 marks |
| Practical: NIL | End Semester Exam:70 Marks |
| Credit Points: 3 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. | 2 | |
| 2 | Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. | 8 | |

| | | | |
|---|---|---|---|
| 3 | Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. | 3 | |
| 4. | Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. | 8 | |
| 5 | Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. | 3 | |
| 6 | Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. | 2 | |

**Text book and Reference books:**

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
6. Balagurusamy: Numerical Methods, Scitech.
7. Baburam: Numerical Methods, Pearson Education.
8. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

**Human Resource Development and Organizational Behavior**
**Code: OEC-IT601 B**
**Contact: 3L**

| Name of the Course: | **Human Resource Development and Organizational Behavior** | |
|---|---|---|
| Course Code: **OEC-IT601 B** | Semester: VI | |
| Duration:6 months | Maximum Marks:100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory:3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical: NIL | | End Semester Exam:70 Marks |
| Credit Points: | 3 | |

| **Teaching Scheme** | | **Examination Scheme** |
|---|---|---|
| Theory: 3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical: NIL | | End Semester Exam: 70 Marks |
| Credit Points: | 3 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Basic LPP and Applications; Various Components of LP Problem Formulation.**<br>Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method;<br>Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples<br>Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems. | 17 | |
| 2 | **Network Analysis**:Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).<br><br>Inventory Control:Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock. | 9 | |
| 3 | **Game Theory:**<br>Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance | 5 | |
| 4. | **Queuing Theory:**<br>Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems. | 5 | |

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|---|---|
| **Course Code** : BS-M101 | **Category** : Basic Science Course |
| **Course Title** : Mathematics – I A | **Semester** : First (CSE & IT) |
| **L-T-P** : **3-1-0** | **Credit: 4** |
| **Pre-Requisites: High School Mathematics** | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 1 | ***Calculus (Integration):*** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. | 8 |
| 2 | ***Calculus (Differentiation):*** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima. | 6 |
| 3 | ***Matrices:*** Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination. | 7 |
| 4 | ***Vector Spaces:*** Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map. | 9 |
| 5 | ***Vector Spaces (Continued):*** Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization. | 10 |

**Course Outcomes:**

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

| | |
|---|---|
| **Course Code** : BS-M201 | **Category** : Basic Science Course |
| **Course Title** : Mathematics – II A | **Semester** : Second (CSE &IT) |
| **L-T-P** : **3-1-0** | **Credit: 4** |
| **Pre-Requisites:** High School Mathematics and BS-M101 | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 1 | **Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. | 11 |
| 2 | **Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities. | 4 |
| 3 | **Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule. | 5 |
| 4 | **Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. | 8 |
| 5 | **Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. | 8 |
| 6 | **Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. | 4 |

**Course Outcomes:**

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

| BS-M301 | Probality and Satistics | 3L:0T: 3P | 3 credits |
|---|---|---|---|

***Module 1: Basic Probability:*** **8L**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

***Module 2: Continuous Probability Distributions:*** **4L**

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.

***Module 3: Bivariate Distributions:*** **4L**

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

***Module 4: Basic Statistics:*** **6L**

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression - Rank correlation.

***Module 5: Applied Statistics:*** **6L**

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

***Module 6: Small samples:*** **4L**

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

**Suggested Text/Reference Books**

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
(iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
(vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
(vii) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
(viii) Chandrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi, 2018.
(ix) Manish Sharma & Amit Gupta, Business Statistics, Khanna Book Publishing Company, New Delhi, 2012.

**Course Outcomes**

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

The students will learn:

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.

| | | | |
|---|---|---|---|
| **BS-M401** | **Numerical Methods (BS)** | **2L:0T:0P** | **2 credits** |

**Module I** **10L**

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.
Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

**Module II** **8L**

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.

**Module III** **4L**

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference
method. (6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. R.S. Salaria, Computer Oriented Numerical Methods, Khanna Publishing House.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Sc. in Data Science**
**(Effective for Academic session 2019-20)**

# BSCDA – 102: DISCRETE MATHEMATICS

**Objectives**

To enable the students to:

- Develop Mathematical thinking in Computer Science.
- Understanding Combinatorics and Probability.
- Understand the concept of Graph theory.
- Understand number theory and cryptography.

| Units | Course Content |
|---|---|
| 1 | **Mathematical thinking in Computer Science**<br>Induction, Recursion, Logic, Invariants, Examples, Optimality |
| 2 | **Combinatorics and Probability**<br>Basic Probability and Venn diagram, Compound Probability of independent events, Dependant events, Permutations and Combinations, Probability using Combinatorics |
| 3 | **Introduction to Graph theory**<br>Fundamental Concepts and Basic Results, Graph Isomorphism, Subgraphs, the Complement of a Graph, Bipartite Graphs and Trees, Vertex-Colourings of Graphs, Matchings in Bipartite Graphs, Eulerian Multigraphs and Hamiltonian Graphs, Digraphs and Tournaments |
| 4 | **Number theory and Cryptography**<br>RSA, key generation, encryption, decryption, cryptographic hash, signing messages |
| 5 | **Delivery Problem**<br>Proof techniques, P vs NP problem |

**References**


1. Discrete Mathematics with Graph theory and Combinatorics, By T Veerarajan.
2. Discrete Structures, S.B. Singh
3. Discrete Mathematics and Graph Theory, By Bhavanari S
4. Discrete Mathematics, By Dhami and Bisht
5. Discrete Mathematics and its Applications, By Kenneth Rosen
6. Combinatorics & Graphic Theory by S.B. Singh

| Code: MCAN-104 | Paper: Discrete Mathematics | |
|---|---|---|
| Contacts Hours / Week: 4 | Total Contact Hours: 40 | Credit: 4 |

**Course Outcome:**

After successful completion of this course, students will be able to:

- ✓ Interpret the problems that can be formulated in terms of graphs and trees.
- ✓ Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph coloring etc.
- ✓ Achieve the ability to think and reason abstract mathematical definitions and ideas relating to integers through concepts of well-ordering principle, division algorithm, greatest common divisors and congruence.
- ✓ Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.
- ✓ Analyze the logical fundamentals of basic computational concepts.
- ✓ Compare the notions of converse, contrapositive, inverse etc. in order to consolidate the comprehension of the logical subtleties involved in computational mathematics.

| UNITS | COURSE CONTENT |
|---|---|
| 1 | **Logic and Proofs** (3L)<br>Propositional logic, Propositional equivalences, Predicates and quantifiers, Nested quantifiers, Rules of inference. |
| 2 | **Principles of Mathematical Induction** (5L)<br>The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. |
| 3 | **Sets and Sequence** (8L)<br>Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Fuzzy set, Basic properties of fuzzy set. |
| 4 | **Counting and Combinatorics** (8L)<br>Counting, Sum and product rule, Principle of Inclusion Exclusion. Pigeon Hole Principle, Counting by Bijections. Double Counting. Linear Recurrence relations - methods of solutions. Generating Functions. Permutations and Combination. |
| 5 | **Algebraic Structure** (9L)<br>Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form |
| 6 | **Graph and Tree** (7L)<br>Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances. |

**Reference Books:**


- S.B. Singh, Discrete Structures, Khanna Book Publishing, Delhi
- Kandel& Baker- Discrete Mathematics for Comp. Scientists & Mathematicians, Mott, PHI
- C.L.Liu- Discrete Mathematical Structure, C.L.Liu,TMH
- G.S.RAO- Discrete Mathematical Structure, New Age International
- DeoNarsingh - Graph Theory With Applications To Engineering And Computer Science, PHI Learning
- Arumugam, Ramachandran- Invitation to Graph Theory, Scitech Publications (India)

| | |
|---|---|
| **Course Code** : BS-M202 | **Category** : Basic Science Course |
| **Course Title** : Mathematics – II B | **Semester** : Second (All stream except CSE & IT) |
| **L-T-P : 3-1-0** | **Credit: 4** |
| **Pre-Requisites:** High School Mathematics and BS-M102 | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 1 | ***Multivariate Calculus (Integration):*** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. | 11 |
| 2 | ***First order ordinary differential equations:*** Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. | 5 |
| 3 | ***Ordinary differential equations of higher orders:*** Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties. | 9 |
| 4 | ***Complex Variable – Differentiation*** Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties. | 6 |
| 5 | ***Complex Variable – Integration*** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. | 9 |

| BS-M401 | Numerical Methods (BS) | 2L:0T:0P | 2 credits |
|---|---|---|---|

**Module I** **10L**

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.
Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

**Module II** **8L**

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.

**Module III** **4L**

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference
method. (6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. R.S. Salaria, Computer Oriented Numerical Methods, Khanna Publishing House.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

| | | | |
|---|---|---|---|
| **BS-M491** | **Numerical Methods Lab (BS)** | **0L:0T:2P** | **1 credits** |

Assignments on Newton forward /backward, Lagrange's interpolation.

2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.

3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.

4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.

5. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.

6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

| | | | |
|---|---|---|---|
| 7 | **Linear discriminant function based classifier 5L**<br>Perceptron<br>Support vector machines | 5 | |
| 8 | **Non-metric methods for pattern classification 4L**<br>Non-numeric data or nominal data<br>Decision trees | 4 | |
| 9 | **Unsupervised learning and clustering 2L**<br>Criterion functions for clustering<br>Algorithms for clustering: K-means,<br>Hierarchical and other methods | 2 | |

**Text book and Reference books:**

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

**Numerical Methods**
**Code: OEC-IT601A**
**Contact: 3L**

| Name of the Course: | **Numerical Methods** |
|---|---|
| Course Code: OEC-IT601A | Semester: VI |
| Duration:6 months | Maximum Marks:100 |

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Theory:3 hrs./week | Mid Semester exam: 15 |
| Tutorial: NIL | Assignment and Quiz: 10 marks |
| | Attendance: 5 marks |
| Practical: NIL | End Semester Exam:70 Marks |
| Credit Points: 3 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. | 2 | |
| 2 | Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. | 8 | |

| | | | |
|---|---|---|---|
| 3 | Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. | 3 | |
| 4. | Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. | 8 | |
| 5 | Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. | 3 | |
| 6 | Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. | 2 | |

**Text book and Reference books:**

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
6. Balagurusamy: Numerical Methods, Scitech.
7. Baburam: Numerical Methods, Pearson Education.
8. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

**Human Resource Development and Organizational Behavior**
**Code: OEC-IT601 B**
**Contact: 3L**

| Name of the Course: | **Human Resource Development and Organizational Behavior** |
|---|---|
| Course Code: **OEC-IT601 B** | Semester: VI |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme** | **Examination Scheme** |
| Theory:3 hrs./week | Mid Semester exam: 15 |
| Tutorial: NIL | Assignment and Quiz: 10 marks |
| | Attendance: 5 marks |
| Practical: NIL | End Semester Exam:70 Marks |
| Credit Points: 3 | |

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**Syllabus for B. Tech in Electrical Engineering**
(Applicable from the academic session 2018-2019)

4. solve problems with the application of theories and principle of motion , friction and rigid bodies.
5. analyze torsional motion and bending moment.

Special Remarks:
The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

| | | | |
|---|---|---|---|
| **Name of the course** | | **MATHEMATICS-III** | |
| **Course Code: BS- M 301** | | **Semester: 3rd** | |
| **Duration: 6 months** | | **Maximum Marks: 100** | |
| | | | |
| **Teaching Scheme** | | **Examination Scheme** | |
| Theory: 3 hrs/week | | Mid Semester Exam: 15 Marks | |
| Tutorial: 0 hr/week | | Assignment & Quiz: 10 Marks | |
| Practical: 0 hrs/week | | Attendance: 05 Marks | |
| Credit Points: 3 | | End Semester Exam: 70 Marks | |
| | | | |
| **Objective:** | | | |
| 1. | To understand Probability theory required an Electrical Engineer to apply in profession. | | |
| 2. | To understand numerical methods to solve engineering problem | | |
| 3. | To understand basics of Z transform to solve engineering problems. | | |
| **Pre-Requisite** | | | |
| 1. | Mathematics ( 10+2 ) | | |
| Unit | Content | Hrs | Marks |
| 1 | **Probability:**<br>Basic Probability Theory: Classical definition and its limitations. Axiomatic definition. Some elementary deduction: i) $P(O)=0$, ii) $0 \le P(A) \le 1$, iii) $P(A')=1-P(A)$ etc. where the symbols have their usual meanings. Frequency interpretation of probability. | 1 | |
| | Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pair wise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems. | 3 | |
| | Random Variable & Probability Distributions. Expectation: Definition of random variable. Continuous and discrete random variables. Probability density function & probability | 2 | |

| | | | |
|---|---|---|---|
| | mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples.<br><br>Some important discrete distributions: Binomial & Poisson distributions and related problems. Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only. | 2 | |
| 2 | **Numerical Methods:**<br>Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.<br><br>Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.<br><br>Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.<br><br>Numerical solution of a system of linear equations:<br>Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.<br><br>Numerical solution of Algebraic equation:<br>Bisection method, Regula-Falsi method, Newton-Raphson method.<br><br>Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. | 4<br><br>5<br><br>3<br><br>6<br><br>4<br><br>6 | |
| 3 | **Z transform:**<br>Sequence, Representation of sequence, Basic operations on sequences, Z-transforms, Properties of Z-transforms, Change of scale, Shifting property, Inverse Z-transform, Solution of difference equation , Region of convergence. | 4 | |

Text books:

1. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**Syllabus for B. Tech in Electrical Engineering**
(Applicable from the academic session 2018-2019)

| | |
|---|---|
| **Name of the course** | Numerical Methods laboratory |
| **Course Code: PC-CS 391** | **Semester: 3rd** |
| **Duration: 6 months** | **Maximum marks:100** |
| | |
| **Teaching Scheme** | **Examination scheme:** |
| Theory: Nil | **Continuous Internal Assessment:40** |
| Tutorial: Nil | **External Assessment: 60** |
| Practical: 2 hrs/week | |
| Credit Points:1 | |
| | |

| | **Laboratory Experiments:** |
|---|---|
| 1. | Assignments on Newton forward /backward, Lagrange's interpolation. |
| 2. | Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. |
| 3. | Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations |
| 4. | Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods. |
| 5. | Assignments on ordinary differential equation: Euler's and Runga-Kutta methods. |
| 6. | Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica. |

Course Outcome: After completion of this course, the learners will be able to

1. solve
   - problems with Newton forward /backward, Lagrange's interpolation
   - problems of numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule
   - problems to find numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
   - problems to find numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
   - ordinary differential equation by Euler's and Runga-Kutta methods.
2. find appropriate numerical methods to solve engineering problems.
3. use software package to solve numerical problems.

Special Remarks:
The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

**Mathematics-III (Differential Calculus)**
**Code: BSC-301**
**Contacts: 2L**

| | | |
|---|---|---|
| Name of the Course: | **Mathematics-III (Differential Calculus)** | |
| Course Code: BSC-301 | Semester: III | |
| Duration: 6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory:2 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical: NIL | | End Semester Exam: 70 Marks |
| Credit Points: | 2 | |

| | |
|---|---|
| **Objective:** | |
| 1 | To know Convergence of sequence and series |
| 2 | To know Limit, continuity and partial derivatives, Chain rule, Implicit function |
| 3 | To know First Order Differential Equation, Exact, Linear and Bernoulli's equations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph |
| **Pre-Requisite:** | |
| 1 | Concept Linear Algebra Determinant and its properties (up to third order) |
| 2 | Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions. | 8 | |
| 2 | Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems. | 7 | |
| 3 | Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems. | 8 | |
| 4. | First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x | 9 | |

| | | | |
|---|---|---|---|
| | and Clairaut's form, general & singular solution. [5L]<br>Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L] | | |
| 5 | Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph.<br>Matrix Representation: Incidence & Adjacency matrix.<br>Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree. | 8 | |

**Text book and Reference books:**

1. Higher Algebra, S. K. Mapa, Levant Books.
2. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.
3. Co-ordinate Geometry, S. L. Loney
4. Integral Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
5. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
6. Advanced Engineering Mathematics, E Kreyszig
7. Advanced Engineering Mathematics, Chandrika Prasad & Reena Garg, Khanna Publishing House (AICTE Recommended Textbook -2018)

**Course Outcomes:**

On completion of the course students will be able to

BSC-301.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives.

BSC-301.2 Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.

BSC-301.3 Use tree and graph algorithms to solve problems

BSC-301.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

## Discrete Mathematics (PCC-CSBS302)

**Boolean algebra**: Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

**Abstract algebra**: Set, relation, group, ring, field.

**Combinatorics**: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

**Graph Theory**: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

**Logic**: Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

**Text Books:**

1. Topics in Algebra, I. N. Herstein, John Wiley and Sons.
2. Digital Logic & Computer Design, M. Morris Mano, Pearson.
3. Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw Hill, New Delhi.
4. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
5. Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore.
6. Discrete Structures, S.B. Singh, Khanna Publishing House.

**Reference Books:**

1. Introduction to linear algebra. Gilbert Strang.
2. Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.
3. Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.
4. Introduction to Mathematical Logic, (Second Edition), E. Mendelsohn, Van-Nostrand, London.

# Economics for Engineers

*HU-501*

*Contracts: 3L*

*Credits- 3*

1. Economic Decisions Making – Overview, Problems, Role, Decision making process. [CO1]
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs. Book Costs, Life-Cycle Costs; Types of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits. [CO1]
3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest. [CO2]
4. Present worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. [CO2]
5. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; [CO3]

   Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis in the Public Sector -Quantifying And Valuing Benefits & drawbacks. [CO4]

6: Uncertainty in Future Events - Estimates and Their Use In Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs. Return, Simulation, Real Options. [CO4]

7. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation and Expenses, Types Of Property, DepreciationCalculation Fundamentals, Depreciation and Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements of Tax Regulations For Depreciation And Capital Allowances. [CO4]
8. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of A New Asset, Marginal Cost, Minimum Cost Life Problems. [CO5]
9. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs. Commodity Indexes, Use of Price Indexes in Engineering Economic Analysis, Cash Flows that inflate at different Rates. [CO5]
10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation. [CO6]

***Readings***

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,DavidB.Pratt : Principle of Engineering Economic Analysis, John Wiley

**Maulana Abul Kalam Azad University of Technology, West Bengal**

**(Formerly West Bengal University of Technology)**

1st Year Curriculum Structure for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)

Course Code : HM-HU291 Category : Humanities and Social Sciences including Management courses

Course Title : Language Laboratory Semester : Second

L-T-P : 0-0-2 Credit:1

**Pre-Requisites:**

1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; 3P

2) Honing 'Speaking Skill' and its sub skills 2P

3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech 2P

4) Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode) 2P

5) Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success 2P

6) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD 4P

7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual / Inferential Comprehension; 2P

8) Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions 2P

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

# SYLLABUS

## SEMESTER - III
**Theory**

**HU-301** **VALUES & ETHICS IN PROFESSION**
**Contracts:3**
**L Credits- 3**

Science, Technology and Engineering as knowledge and as Social and Professional Activities

***Effects of Technological Growth:***

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development
Energy Crisis: Renewable Energy Resources
Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology Movement of Schumacher; later developments
Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

***Ethics of Profession:***

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

***Profession and Human Values:***

Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility. ***Books:***


1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

# SYLLABUS

## Maulana Abul Kalam Azad University of Technology, West Bengal

## (Formerly West Bengal University of Technology)

1st Year Curriculum Structure for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)

Course Code : HM-HU201 Category : Humanities and Social Sciences including Management courses

Course Title : English Semester : Second

L-T-P : 2-0-0 Credit:2

Pre-Requisites:

**Detailed contents**

1. Vocabulary Building

1.1 The concept of Word Formation

1.2 Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.4 Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Prepositions

3.6 Redundancies

3.7 Clichés

4. Nature and Style of sensible Writing

4.1 Describing

4.2 Defining

4.3 Classifying

4.4 Providing examples or evidence

4.5 Writing introduction and conclusion

5. Writing Practices

5.1 Comprehension

5.2 Précis Writing

5.3 Essay Writing

6. Oral Communication

- (This unit involves interactive practice sessions in Language Lab)
- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

**Learning Resources:**

(i) Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii) Practical English Usage. Michael Swan. OUP. 1995.
(iii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
(v) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

**Course Outcomes**

The student will acquire basic proficiency in English including reading and listening comprehension, wr
and speaking skills.