CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY

KANPUR

SYLLABUS

(B.Tech.)

COMPUTER SCIENCE AND ENGINEERING

(ARTIFICIAL INTELLIGENCE)

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

Syllabus
B.Tech. Computer Science and Engineering
(Specialization in Artificial Intelligence)

Semester-wise breakup of courses

Semester – I

		L	T	P	C
MTH – S101	Mathematics – I	3	1	0	4
PHY - S101	Physics – I	3	1	3	5
TCA – S102	Workshop Concepts	1	1	3	5
CHM – S101	Chemistry – I	3	0	3	5
ESC – S101	Basic Electrical & Electronics Engineering	3	1	3	5
UHV – S101	Universal Human Values-1	0	0	0	0

Semester – II

MTH – S102	Mathematics – II	3	1	0	4
PHY - S102	Physics – II	3	1	3	5
ISC – S101	Programming & Computing (C & LINUX)	3	0	3	5
TCA – S101	Engineering Drawing	0	2	4	5
HSS – S101	Communicative English	3	1	0	4

Semester – III

MTH – S201	Mathematics – III	3	1	0	4
CSE – S207	Object Oriented Programming with Python	3	0	3	5
CSE – S202	Digital Electronics & Logic Design	3	0	2	4
MTH – S301	Discrete Mathematics	3	1	0	4
UHV – S201	Universal Human Values-II	2	1	0	3

Semester – IV

HSS – S401	Engineering Economics	3	1	0	4
CSE – S208	Data Structure using Python	3	0	3	5
CSE – S206	Operating Systems	3	2	0	5
MTH - S504	Probability and Statistics	3	1	0	4
CSE – S205	Computer Organization	3	1	0	4

EVS – S101	Environmental Studies	2	0	0	2

Semester – V

CSE – S301	Data Base Management System	3	0	3	5
CSE – S302	Design and Analysis of Algorithms	3	1	0	4
CSE – S303T	Microprocessor	3	0	2	5
CSE – S304	Theory of Computation	3	1	0	4
CSE - S308	Introduction to Data Science	3	1	2	4

Semester – VI

CSE – S511 Advance	Database Management System	3	0	4	5
CSE – S306	Computer Networks	3	0	4	5
CSE – S307	Software Engineering	3	1	0	4
CAP - S101	Capstone Project	0	0	2	2
CSE – S520	Foundation of Machine Learning	3	0	2	5

Semester – VII

CSE – S513	Computer Vision	3	1	3	5
SST – S401	Summer Training	0	0	3	2
MRT- S401	Minor Project	0	0	6	4
CSE - S526	Deep Learning	3	1	4	5
Departmental Elective		----------			
Departmental Elective		----------			

Semester – VIII

MRT- S402	Major Project	0	0	0	16

List of Departmental Elective Courses

CSE – S516	Bioinformatics concepts: A Computer Sc. Perspective	3	1	0	4
CSE – S521	Data Mining & Data Warehousing	3	1	0	4
CSE – S523	Cloud Computing	3	1	0	4
CSE – S530	IOT	3	1	0	4

CSE - S527	Time series data analysis (Natural Language Processing + Speech recognition)	3	1	0	4
CSE – S525	Text Analytics	3	1	0	4
CSE – S509	Soft Computing	3	1	0	4
CSE – S507	Advance Computer Networks	3	1	0	4
CSE – S528	Nature inspired algorithms	3	1	0	4
CSE – S529	AI in network security	3	1	0	4
CSE - S528	Artificial Intelligence	3	1	0	4

Department of Computer Science & Engineering.

Detailed Syllabus of B.Tech (AI) Program Courses

Course Code: **MTH-S101** **Breakup: 3 – 1 – 0 – 4**
Course Name: **Mathematics-I**
Course Details:

Unit I
Applications of integrals **:** Areas between curves, Methods of finding volume : Slicing, solids of revolution , Cylindrical shell , Lengths of plane curves,Areas of Surface of revolution, Moments and Center of mass, Work, Fluid pressure and Forces .
Trapezoidal and Simpson rule , Improper integrals .

Unit II
Sequences**:** Definition, Monotonic sequences, Bounded sequences, Convergent and Divergent Sequences**.**
Series: Infinite series, Oscillating and Geometric series, their Convergence, Divergence . Tests of Convergence: n^{th} Term test of divergence, Integral test, Comparison Test, Limit Comparison test, Ratio test (Delambert), n^{th} root test (Cauchy root test), Alternating series, Absolute and conditional convergence..
Power Series**:** Power series and its convergence, Radius and interval of convergence, Term by term differentiation , Term by term integration, Product of power series, Taylor and Maclaurin series , convergence of Taylor series, Error estimates ,Taylor's Theorem with remainder .

Unit III
Vector Calculus: Vector valued functions , Arc length and Unit Tangent vector, Curvature, Torsion and TNB frame **.**
Partial Derivatives**:** Function of two or more variables (Limit, Continuity, Differentiability , Taylors Theorem) , Partial derivatives, Chain Rule, Partial Derivatives of higher orders, , Maxima and Minima and Saddle Point, Lagrange Multipliers, Exact differential, Jacobian, Leibnitz Theorem.
Directional derivatives, Gradient Vectors, Divergence and Curl , Tangent planes .

Unit IV
Multiple Integrals: Double and triple integral, Change of order, Change of variables, Application to area and volume, Dirichlet integral and applications.
Line, surface integrals , Path independence, Statement and problems of Green's, Stoke's and Gauss divergence theorems (without proof).

Text Books and Reference :
1. G.B.Thomas and R.L.Finney : Calculus and Analytical Geometry.
2. B.S. Grewal, Engineering Mathematics, Khanna Publishers, 2004.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

Course Code: PHY-S101 **Breakup: 3 – 1 – 3 – 5**
Course Name: Physics-I
Course Details:

Unit-I: Newton's laws and their applications, Friction, conservative forces and potentials, Work energy theorem, conservation of energy and linear momentum, variable mass system (rocket), impulse, system of particles and collision, Elementary rigid body kinematics, rotation motion, moment of inertia, and Gyroscopic motion.

Unit-II:Rigid body motion, angular momentum, fundamental of classical mechanics, Lagrangian and Hamiltonian formulation.

Unit-III:Motion in non-inertial frames, fractious forces, special theory of relativity, central forces, Gravitation motion under central forces and Kepler's Laws.

Unit-IV:Simple harmonic motion (SHM), small oscillations and resonance; Wave particle duality, de-Broglie matter's waves, Phase and group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications.

Unit-V:Wave function and its significance, Schrödinger equations (time dependent and independent), Schrödinger's wave equation for particle in one dimensional box, diffraction of X-rays by crystal planes, Bragg's spectrometer, Compton's effect.

Text Books and References:

1. Mechanics: D. S. Mathur
2. A textbook of Mechanics: J. C. Upadhyay
3. Concept of physics (I & II): H. C. Verma
4. Introduction to Mechanics: R. D. Kleppner and J. Kolenkow
5. Physics: Resnick, Halliday and Krane
6. Vector analysis: M. R. Spiegel
7. Classical Mechanics: Goldstien
8. Modern Physics: Author Beiser

Physics Lab
Course Details:

1. Graphical Analysis (Ref. UIET Laboratory Manual)
2. Trajectory of projectile (Ref. UIET Laboratory Manual)
   Apparatus Used (Trajectory Apparatus, Metal Balls, Channels, Vernier Callipers, Carbon & Graph Paper)
3. Moment of Inertia of Bicycle wheel (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Bicycle Wheel, Masses, Thread, Stopwatch, Meter Scale, Vernier Callipers)
4. Spring Oscillations (Ref. UIET Laboratory Manual)
   Apparatus Used (Spring Oscillation Apparatus, Stop Watch, Masses)

5. Coupled Pendulum (Ref. UIET Laboratory Manual)
   Apparatus Used (Coupled Pendulum Setup, Stop Watch, Scale)
6. Bifilar Suspension System (Ref. UIET Laboratory Manual)
   Apparatus Used (Bifilar Suspension System Setup, Stop Watch, Masses)
7. Frequency of AC Mains by Melde's Method (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Electrical Vibrator, String, Pulley, Small Pan, Weight Box & Physical Balance)
8. Kater's(Reversible) Pendulum (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Kater's Pendulum, Stop Watch)
9. Inertia Table (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Inertia Table, Stop Watch, Vernier Callipers, Split Disc, Balancing Weights, and Given Body(Disc))

Course Code: TCA-S101 **Breakup: 0 –2 – 4 – 5**
Course Name: Engineering Drawing
Course Details:

Introduction- Drawing instruments and their uses, BIS conventions, lettering dimensioning and free hand practicing.

Orthographic projections: Lines, planes and surfaces of objects, Sectional views, Auxiliary views, Space geometry: lines and planes, True lengths and shapes, Properties of parallelism, Perpendicularity and intersections of lines and planes, Simple intersections of solids and development of lateral simple solids.

Isometric Projections: Introduction , isometric scale, isometric projection of simple plane figures, isometric projection of tetrahedron, hexahedron (cube), right regular prisms , pyramids, cylinders, cones, spheres, cut spheres and combinations of solids.

Introduction to computer graphics: Some problems on above topics on computer graphics.

Text Books and References:

1. Narayana,K.L. & Kannaiah,P. "Engg.Graphics". Tata McGraw Hill, New Delhi.
2. Bhatt,N.D. "Elementary Engg. Drawing" Charotar Book stall. Anand.
3. Lakshminarayanan ,V and Vaish Wannar , R. S. "Engg.Graphics".Jain Brothers , New Delhi.
4. Chandra, A.M. & Chandra Satish, "Engg.Graphics".Narosa.
5. French & Vireck, "The Fundamental Of Engg. Drawing & Graphic Tech.". McGraw Hill.
6. Gill, P.S. "A Text Book Of Machine Drawing" Katson Publishing House , Ludhiana.

Course Code: ESC-S101 **Breakup: 3 –1 – 3 – 5**
Course Name: Basic Electrical & Electronics Engineering
Course Details:

Unit – I
Sinusoidal steady state circuit analysis, voltage, current, sinusoidal & phaser presentation single phase AC circuit – behavior of resistance, inductance & capacitance & their combination, impedance concept of power, power factor. Series & parallel resonance – band width & quality factor. Three phase circuits – phase voltage & current, line & phase quantities, phasor diagram, balanced & unbalanced loads, Measurement of R, L, and C.

Unit –II
Network Theory: Network theorems – Thevenin's, Norton, maximum power transfer theorem, star delta transformation, circuit theory concept – mesh & nodal analysis.

Unit – III
Magnetic circuit concepts: self inductance , magnetic coupling analysis of single tuned & double tuned circuit involving mutual inductance , introduction to transformer.

Unit – IV
Basic Instruments, electrical measurement – measurement of voltage , current , power & energy, voltmeters & ammeter , wattmeter , energy meter , three phase power measurement , electronics instrument – multimeter, CRO(analog & digital),An overview of voltage regulator.

Unit – V
Introduction to basic electronics devices – junction diode, BJT, amplifier, op-amps & instrumentation amplifier with mathematical operation.
Number System: Introduction to binary, octal, decimal & hexadecimal systems, representation of negative numbers, 1's, 2's, 9's, 10's complement and their arithmetic.

Text Books and References:

1. W.H.Hayt & J.E. Kemmerly : Engg. Circuit Analysis , Mc Graw Hill.
2. N.N. Bhargava : 'Basic Electronics',Tata McGraw Hill.
3. Malvino, A.P. / "Electronics Principles" / Tata McGraw-Hill / 6th Ed.
4. Morris Mano, "Digital Computer Design" PHI
5 Del Toro : Principles of Electrical Engg. – PHI
6 Boylstad & Neshishkey, "Electronic devices & circuits" , PHI
7. Malvino & Leech "Digital Principle and application", TMH

Basic Electrical & Electronics Engineering Lab

1. Familiarization with the Electronic Instruments.
2. Familiarization with electronic components and Bread board.
3. To verify the Thevenin theorem.
4. To verify the Superposition theorem.
5. Measurement of voltage and frequency with CRO.
6. To study half wave rectifier.
7. To study full wave bridge rectifier.
8. To study full wave bridge rectifier with filter.
9. To study and verify the truth table of different logic gates using digital IC.
10. To study different type of transformer and there operation.
11. To study basic wiring and design a switchboard/extension board.
12. To study the polarity test of a single phase transformer.
13. To study the open & short circuit test of a transformer and calibration losses.
14. To study the load test and efficiency of a single phase transformer.

Course Code: HSS-S101 **Breakup: 3 –1 – 0 – 4**
Course Name: Communicative English
Course Details:

Unit 1: Basics of Technical Communication: Technical Communication: features; Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Barriers to Communication.

Unit 2: Constituents of Technical Written Communication: Word formation, Prefix and Suffix; Synonyms and Antonyms; Homophones; One Word Substitution; Technical Terms; Paragraph Development: Techniques and Methods -Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation- various steps.

Unit 3: Forms of Technical Communication: Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Memos, Notices, Circulars; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance.

Unit 4: Presentation Strategies: Defining Purpose; Audience & Locale; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Space; Setting Nuances of Voice Dynamics; Time- Dimension.

Unit 5: Value- Based Text Readings: Following essays form the suggested text book with emphasis on Mechanics of writing,
(i) The Language of Literature and Science by A.Huxley
(ii) Man and Nature by J.Bronowski
(iii) The Mother of the Sciences by A.J.Bahm
(iv) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
(v) The Effect of Scientific Temper on Man by Bertrand Russell.

Text Books and References:

1. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, New Delhi.
2. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press 2007, New Delhi.
3. Effective Technical Communication by Barun K. Mitra, Oxford Univ. Press, 2006, New Delhi
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.
5. How to Build Better Vocabulary by M.Rosen Blum, Bloomsbury Pub. London.
6. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors; Delhi.
7. Developing Communication Skills by Krishna Mohan, Meera Banerji- Macmillan India Ltd. Delhi.

Course Code: **MTH-S102** **Breakup: 3 – 1 – 0 – 4**
Course Name: **Mathematics-II**
Course Details:

Unit-I

Linear Algebra
Matrices, Elementary row and column operations, Echelon form, Rank of matrix, Determinants . Vector spaces, Linear dependence and Independence, Linear transforms and matrices, Consistency of linear system of equations and their solution, Special matrices : Symmetric, Hermtion etc, Characteristic equation, Cayley-Hamilton theorem(statement only), Eigen values and eigen vectors, Diagonalisation .

Unit-II

First order differential Equations : Seperable,Exact Differential Equation ,Integrating Factors, Linear differential equations with constant coefficients, Homogeneous linear differential equations, Bernouille Equation, Simultaneous linear differential equations, Differential equations of first order but not first degree, Claiurat's equation, Homogeneous linear differential equations of second order with constant coefficients, Complex root case, Differential operators, Euler-Cauchy equation Existence and uniqueness, Wronskain, Nonhomogeneous equations,
Solution by undetermined coefficients, solution by variation of parameters.
Series solution: Strum-Liouville problems , Ordinary differential equations of 2^{nd} order with variable coefficients (Frobenius Method), Orthogonal polynomials, Bessel functions .

Unit-III: Laplace Transform

Laplace transform, Existence Theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step function, Dirac Delta function, Laplace transform of periodic functions, Convolution Theorem, Applications to solve simple linear and simultaneous differential equations.

Text Books and Reference :

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
2. B.S. Grewal, Higher Engineering Mathematics, KhanPublishers,2005.
3. C. Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd. 2003.
4. G.F. Simmons, Differential Equations, Tata Mc Graw-Hill Publishing Company Ltd. 1981.

Course Code: **PHY-S102** **Breakup: 3 – 1 – 3 – 5**
Course Name: **Physics-II**
Course Details:

Unit-I: Vector analysis: scalars, vectors, vector differentiation, gradient, divergence and curl, vector, integration, Gauss divergence and Stoke's theorem, co-ordinate systems

(spherical polar & cylindrical), Electrostatics: electric fields, potentials, Gauss's law, electric dipoles and multipoles, polarization, bound charges, linear dielectrics and force on dielectrics, electric displacement, boundary condition of E and D, work and energy of electrostatics, Laplace's equation and uniqueness theorem, image theory.

Unit-II: Motion of charge in electric and magnetic field, Magnetostatics: current density, magnetic fields, Ampére's law, Faraday's law, magnetic potential, magnetic polarization, bound current, magnetic properties of materials (para, dia and ferro), boundary condition of B and H, basic idea of superconductor.

Unit-III: Displacement current, Maxwell's equations for free space and matter (dielectric and conductor), Electromagnetic waves, Poynting vector.

Unit-IV: Origin the refractive index, Interference: division of wave-front and division of amplitude; diffraction: Fraunhoffer, Grating, Resolving power (grating, prism, telescope and microscope); polarization: Phenomena of double refraction, Nicol prism, optical activity Production and analysis of plane, circular and elliptical polarized light, Frenels theory of optical activities and Polarimeters.

Unit-V: Fiber optics and photonics: Fundamental ideas about optical fiber, types of fibers, Total Internal Reflection (TIR), critical angle, acceptance angle and application, basic principal of Laser and Holography and fundamental ideas about photonics.

Text Books and References

1. Optics: Ajoy Ghatak
2. A textbook of OPTICS: Subrahmanyam, Brijlal and Avadhanulu
3. Electrodynamics: David J. Griffith
4. Classical electrodynamics: J. D. Jackson
5. Modern Physics: Author Beiser
6. Photonic Crystals: J. D. Joannopoulos, R. D. Meade, and R. D. Winn

Physics Lab-II

1. Newton's Ring (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Traveling Microscope, Support for Glass Plate inclined at 45^0 to the Vertical, Short Focus Convex Lens, Sodium Lamp, Plano Convex Lens, An Optically Plane Glass Plate)
2. Prism Spectrometer (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Spectrometer, Glass Prism, Reading Lens, Mercury Lamp)
3. Plane Transmission Grating (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Spectrometer, Diffraction Grating, Mercury Lamp)
4. Ballistic Galvanometer (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Ballistic Galvanometer, Morse key, Damping key, Condenser, Rheostat, Volt Meter, Storage Battery, Connection Wires)
5. Carey Foster's Bridge (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Carey Foster's Bridge, Laclanche cell, Resistance Box, Galvanometer, Plug Key, Copper Strip)

6. Fresnel's Biprism (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Sodium Lamp, Biprism, Convex Lens, Optical Bench with Four Uprights)
7. Variation of Magnetic Field (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Stewart and Gee type Tangent Galvanometer, Storage Battery, Commutator, Ammeter, Rheostat, One way Plug Key, Connection Wires)
8. Polarimeter (Ref. Book by K. K. Dey, B. N. Dutta)
   Apparatus Used (Sodium Lamp, Polarimeter, Physical Balance)

Course Code: **ISC – S101** **Breakup:** **3 – 0 – 3 – 5**
Course Name: **Programming & Computing(C & LINUX)**
Course Details:

Basic concepts of Computers, Basic UNIX Concepts and Vi - Editor

Introduction to C: Basic Programming concepts, Program structure in C, Variables and Constants, Data types, Conditional statements, control statements, Functions, Arrays, Structures, Introduction to pointers, Introduction to File Systems.

Text Books and References:

1. Programming in C, Schaum Series
2. The 'C' Programming, Denis Ritchi (PHI)
3. Programming in C, Venugopal (TMH)
4. Let us C, Yashant Kanetkar (BPB)
5. Programming in C, Balaguruswami (TMH)

Computer Programming Lab:

Learning OS Commands
Practice of all Internal and External DOS Commands, Writing simple batch programs, Exposure to Windows environment, Practice of UNIX commands and Vi editor, Writing simple shell script

C Programming:Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input Output Formatting, Control structures, arrays, functions, structures, pointers and basic file handling.

Course Code: **TCA – S102** **Breakup:** **1 – 1 – 3 – 5**
Course Name: **Workshop Concepts**
Course Details:

Historical perspectives; Classification of Manufacturing process.

Machining: Basic principles of lathe machine & operations performed on it. Basic description of machines & operations of shaper-planer, drilling, milling, grinding.Unconventional machining processes , Machine tools.

Casting processes:pattern & allowances. Moulding sands & its desirable properties. Mould making with the use of a core. Gating system. Casting defects & remedies. Cupola furnace. Die-casting & its uses.

Metal forming: Basic metal forming operations & uses of such as-forging, rolling, wire& tube drawing/making & extrusion, & its products/applications, press work & die & punch assembly, cutting & forming, its application. Hot working vs Cold working. Powder metallurgy: powder metallurgy process & its applications, plastic-products manufacturing, galvanizing & electroplating.

Welding: Importance & basics concepts of welding, classification of welding processes. Gas welding, types of flames, Electric arc welding. Resistance welding. Soldering & brazing and its uses. Modern trends in manufacturing, Automation. Introduction to NC/CNC/DNC,FMS,CAD/CAM,CIM and factory of future.

Text Books and References:

1. Chapman,W A J & Arnold ,E "Workshop Technology ; vol. I,II&III" Viva Low Priced Student Edition.
2. Raghuwanshi,B S "Workshop Technology ; vol. I&II" Dhanpat Rai & Sons
3. Chaudhary, Hajra "Elements of Workshop Technology ; vol. I&II" Media Promoters & Publishers.

Workshop Practice

1. Foundry (1 turn)
2. Welding (3 turns)
   a. Gas Welding (1 turn)
   b. Arc Welding (2 turns)
      (i). Lap Joint (1 turn)
      (ii) Butt Joint (1 turn)
3. M/C Shop (4 Turns)
4. Fitting & Sheet Metal Work (1 turn+1 turn)
5. Carpentry Shop(1 turn)
6. Black-smithy shop(1 turn)

Text Books and References:

1. Chapman,W A J & Arnold ,E "Workshop Technology ; vol. I,II&III" Viva Low Priced Student Edition.
2. Raghuwanshi,B S "Workshop Technology ; vol. I&II" Dhanpat Rai & Sons .
3. Chaudhary, Hajra "Elements of Workshop Technology ; vol. I&II" Media Promoters & Publishers.

Course Code: **CHM – S101** **Breakup:** **3 – 0 – 3 – 5**
Course Name: **Chemistry - I**
Course Details:

UNIT-I - Atoms and Molecules: Need for wave mechanical picture of atomic structure [Photoelectric effect, de Broglie concept of matter waves], Derivation of schrodinger wave equation [as an example particle moving in unidimensional potential well] Chemical Bonding- Orbital concepts in bonding, V.B. and M.O. theory, M.O. diagrams, Intermolecular interactions.

UNIT-II - Reaction Dynamics: Order, Molecularity, Rate law, Integrated rate equations, Methods of determining of order of reaction, Complex reaction kinetics- chain reactions and reversible reactions in detail, Catalysis and enzyme catalysis

UNIT-III - Electrochemistry: Arrhenius theory of electrolytic dissociation, Transport number, Kohlrausch's law, Solubility product, Redox reaction, Electrochemical and concentration cells.

UNIT-IV- Stereochemistry: Introduction, Chirality, Enantiomers, Diastereomers, Projection formula of a tetrahedral carbon, Geometrical isomerism, Conformers

UNIT- V- Spectroscopic Techniques: General introduction to IR, NMR and Mass spectroscopy

UNIT-VI - Organic Reactions: Introduction, Electron displacement effects, Organic intermediates, Types of reactions [addition, elimination and substitution reactions]

UNIT-VII - Photochemistry: Photoexcitation of organic molecules, Jablonski diagram, Laws of photochemistry and quantum yield, Some examples of photochemical reactions, Chemistry of vision and other applications of photochemistry.

UNIT-VIII - Transition Metal Chemistry: Stucture of coordination compounds corresponding to coordination number up to 6, Tpes of ligands, Isomerism [geometrical, optical, ionization, linkage and coordination], Theories of bonding in coordination compounds- crystal field theory, Valence bond theory, Chelation.

UNIT-IX - Laboratory Practical Classes:

Text Books and References:

Physical Chemistry- 1. P.W. Atkins
2. Puri & Sharma
Organic Chemistry- 1. Morisson & Boyd
2. Bahl and Bahl
Inorganic Chemistry- 1. J.D. Lee
2. R.P. Rastogi
Engineering Chemistry- Shashi Chawla

Chemistry Lab- I

Exp. 01. To estimate the strength of the given unknown solution of Mohr's salt (Ferrous ammonium sulphate ($FeSO_4(NH_4)_2SO_4.6H_2O$) using $KMnO_4$ solution as an intermediate.

Exp. 02. To prepare a sample of p-nitroacetanilide.

Exp. 03. To prepare a sample of Aspirin.

Exp. 04. Preparation of Tris (Thiourea) Copper (I) sulphate.

Exp. 05. Preparation of Hexamine Nickel (II) chloride $[Ni(NH_3)_6]Cl_2$.

Exp. 06. Estimation of commercial caustic soda: Determination of the amounts of sodium carbonate and sodium hydroxide present together in the given commercial caustic soda.

Exp. 07. Estimation of calcium ions present in tap water.

Exp. 08. To determine the partition coefficient of acetic acid between n-butanol and water.

Exp. 09. To study the photochemical reduction of a ferric salt (Blue printing).

Exp. 10. To determine the viscosity of a given liquid (30% sugar solution) at room temperature using Ostwald's viscometer.

Exp. 11. To separate Ag(I), Hg (I) and Pb (II) ions by paper chromatography and calculate their RF values.

Exp. 12. Understanding reaction kinetics and calculating the rate and order of a reaction.

Exp.13. To study the kinetics of methyl acetate hydrolysis catalyzed by 0.5N HCl solution.

Course Code: MTH-S201 **Breakup: 3 – 1 – 0 – 4**
Course Name: Mathematics - III
Course Details:

Unit – I : Function of a Complex variable

Complex numbers- power and roots, limits, continuity and derivative of functions of complex variable, Analytic functions, Cauchy-Reimann equations, Harmonic function, Harmonic conjugate of analytic function and methods of finding it, Complex Exponential, Trigonometric, Hyperbolic and Logarithm function.

Unit – II : Complex Integration

Line integral in complex plane(definite and indefinite), Cauchy's Integral theorem, Cauchy's Integral formula, Derivatives of analytic functions, Cauchy's Inequality, Liouville's theorem, Morera's theorem, Power series representation of analytic function and radius of convergence,Taylor's and Laurent's series, singularities, Residue theorem, Evaluation of real integrals, Improper Integrals of rational functions, Fourier integrals.

Unit – III : Fourier Series

Periodic functions, Trignometric series, Fourier series of period 2π , Eulers formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series, Complex fourier series, Fourier Integrals, Fourier Sine and Cosine Transform.

Unit – IV : Partial Differential Equations

Solution of first order partial differential equations-Linear and nonlinear(Charpit's method), Linear partial differential equations with constant coefficients of second order and their

classifications - parabolic, elliptic and hyperbolic with illustrative examples. Methods of finding solutions using seperation of variables method. Wave and Heat equations upto two dimension

Unit – V : Probability and Statistics
Basics of probability, Bayes theorem, Random variables, Probability and density fuctions, Binomial, Poisson and Normal distributions.

Text Books and Reference :
1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
2. B.S. Grewal, Higher Engineering Mathematics, KhanPublishers, 2005.

Course Code: **UHV-102** **Breakup: 3 – 1 – 0 – 4**
Course Name: **Universal Human Values-II**
Course Details:

Module 1 – Introduction to Value Education

Lecture 1: Understanding Value Education, Lecture 2: Self-exploration as the Process for Value Education, Lecture 3: Continuous Happiness and Prosperity – the Basic Human Aspirations, Lecture 4: Right Understanding, Relationship and Physical Facility Tutorial 2: Practice Session PS*2Exploring Human Consciousness* Lecture 5: Happiness and Prosperity – Current Scenario, Lecture 6: Method to Fulfill the Basic Human Aspirations, Tutorial 3: Practice Session PS*3 Exploring Natural Acceptance*

Module 2 – Harmony in the Human Being

Lecture 7: Understanding Human being as the Co-existence of the Self and the Body, Lecture 8: Distinguishing between the Needs of the Self and the Body, Tutorial 4: Practice Session PS*4Exploring the difference of Needs of Self andBody,* Lecture 9: The Body as an Instrument of the Self, Lecture 10: Understanding Harmony in the Self, Tutorial 5: Practice Session PS*5Exploring Sources of Imagination in the Self,* Lecture 11: Harmony of the Self with the Body, Lecture 12: Programme to ensure self-regulation and Health, Tutorial 6: Practice Session PS*6 Exploring Harmony of Self with the Body*

Module 3 – Harmony in the Family and Society

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction, Lecture 14: Values in Human-to-Human Relationship, Lecture 15: 'Trust' – the Foundational Value in Relationship Tutorial 7: Practice Session PS*7 Exploring the Feeling of Trust* Lecture 16: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS*8Exploring the Feeling of Respect,* Lecture 17: Understanding Harmony in the Society, Lecture 18: Vision for the Universal Human Order, Tutorial 9: Practice Session PS*9 Exploring Systems to fulfil Human Goal,*

Module 4 – Harmony in the Nature/Existence

Lecture 19: Understanding Harmony in the Nature, Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Tutorial 10: Practice Session PS*10 Exploring the Four Orders of Nature,* Lecture 21: Realizing Existence as Co-

existence at All Levels, Lecture 22: The Holistic Perception of Harmony in Existence, Tutorial 11: Practice Session PS*11 Exploring Co-existence in Existence,*

Module 5 – Implications of the Holistic Understanding – a Look at Professional Ethics

Lecture 23: Natural Acceptance of Human Values, Lecture 24: Definitiveness of (Ethical) Human Conduct, Tutorial 12: Practice Session PS*12 Exploring Ethical Human Conduct,* Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Lecture 26: Competence in Professional Ethics, Tutorial 13: Practice Session PS*13 Exploring Humanistic Models in Education,* Lecture 27: Holistic Technologies, Production Systems and Management Models- Typical Case Studies, Lecture 28: Strategies for Transition towards Value-based Life and Profession

Text Book and Teachers Manual

a. The Textbook *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-47-1

b. The Teacher's Manual

Teachers' Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa

Course Code: **CSE- S207** **Breakup:** **3 – 0 – 3 – 5**
Course Name: **Object Oriented Programming with Python**
Course Details:

Introduction: The Programming Cycle for Python , Python IDE, Interacting with Python Programs , Elements of Python, Type Conversion.
Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression.
Conditionals: Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and Elif statement in Python, Expression Evaluation & Float Representation.
Loops: Purpose and working of loops , While loop including its working, For Loop , Nested Loops , Break and Continue.

Function: Parts of A Function , Execution of A Function , Keyword and Default Arguments ,Scope Rules. Strings : Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings.
Python Data Structure : Tuples , Unpacking Sequences , Lists , Mutable Sequences , List Comprehension , Sets , Dictionaries
Higher Order Functions: Treat functions as first class Objects , Lambda Expressions
Sieve of Eratosthenes: generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes.
File I/O : File input and output operations in Python Programming , Exceptions and Assertions, Modules : Introduction , Importing Modules , Abstract Data Types : Abstract data types and ADT interface in Python Programming.
Classes : Class definition and other operations in the classes , Special Methods (such as _init_,_str_, comparison methods and Arithmetic methods etc.) , Class Example , Inheritance , Inheritance and OOP.Iterators & Recursion: Recursive Fibonacci , Tower Of Hanoi
Search : Simple Search and Estimating Search Time , Binary Search and Estimating Binary Search Time Sorting & Merging: Selection Sort , Merge List , Merge Sort , Higher Order Sort

Text books:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015. 6.Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
7. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.
8. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

Object Oriented Programming with Python Lab

1. To write a python program that takes in command line arguments as input and print the number of arguments.
2. To write a python program to perform Matrix Multiplication.
3. To write a python program to compute the GCD of two numbers.
4. To write a python program to find the most frequent words in a text file.
5. To write a python program find the square root of a number (Newton’s method).
6. To write a python program exponentiation (power of a number).
7. To write a python program find the maximum of a list of numbers.
8. To write a python program linear search.
9. To write a python program Binary search.

10. To write a python program selection sort.
11. To write a python program Insertion sort.
12. To write a python program merge sort.
13. To write a python program first n prime numbers.
14. To write a python program simulate bouncing ball in Pygam

Course code: **CSE-S202** **Breakup:** **3 – 0 – 2 – 4**
Course Name: **Digital Electronics and Logic Design**
Course Details:

Basic Concepts and Boolean Algebra
Number system and conversions, Boolean algebra and simplification, Minimum and maximum expansion, sum of products and product of sums, Minimization of Boolean functions, Karnaugh map Quine Mc Cluskey method, Prime implications and essential prime implicants.

Logic Gates and Gate Networks
Logic gates of different families circuits characteristics and comparisons tri-state gates, Multilevel gates networks, NAND and OR implementation use of alternate gate symbols, mixed logic and polarity indication, multiple output networks.

Combinational Logic Circuits
Problem formation and design of combinational circuits, Adder/Subtractor, Encoder/Decoder, MUX/DEMUX, Code converters and comparators, Design using standard IC's, Programmable Logic devices, ROM, PAL, PLA and PGAs, Design using PLDs.

Sequential Logic Circuits
Flip-Flops, SR, JK, D and T triggering, Master Slave Flip flops, Synchronous and Asynchronous, Analysis of clocked sequential circuits, State diagram, State table, Design of sequential circuits, counters, shift registers and sequence generation and detection.

Synchronous And an Asynchronous State Machines
State minimization, State assignment, Incomplete specified state machines, Fundamental mode and pulse mode sequential circuits, Hazards, Essential Hazards, Design of hazard free networks, VHDL.

Text Books and References:

1. Charles H. Roth, Jr., Fundamentals of Logic Design, JAICO PUBL. HOUSE, Mumbai, Fourth edition 1992
2. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India, 1979
3. William I. Fletcher, An Engineering Approach to Digital Design, PHI
4. Alan B. Marcovitz, Introduction to Logic Design, McGraw Hill, 2001

Digital Electronics and Logic Design Lab
Verification of All logic Gates, Other Gate implementation using Universal Gates NAND / NOR ,Implementation of Adder / Subtractor using Basic gates , Bread-board implementation of various flip-flops, Bread-board implementation of counters & shift registers, Adder/ Subtractor operation using IC7483 4 bit/ 8 bit, Demultiplexer / Decoder operation using IC-74138, Modulo N counter using programmable counter 74190.

Course Code: **MTH-S301** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Discrete Mathematics**
Course Details:

Unit-I Logic: Introduction to formal logic, Formulae of prepositional logic, Truth tables, Tautology, Satisfiability, Contradiction, Normal and principle normal forms, Completeness. Theory of inference Predicate calculus: Quantifiers, Inference Theory of predicate logic, Validity, Consistency and Completeness.

Unit-II
Sets, Operations on sets, Ordered pairs, Functions and Sequences, Recursive definitions, Relations, Partially ordered sets, Equivalence relations, Composition of relations, Closures, Hasse Diagram's, Lattices (Definition and some properties).
Unit-III
Algebraic structures : Definition, semi groups, Groups, Subgroups, Cyclic groups, Grop Homomorphism, Isomorphism, automorphism (Definitions) Properties of Homomorphism , Cosets, Lagrange's Theorem, Normal Subgroups. Rings, Fields (Definitions only).
Unit-IV
Graph Theory: Incedence, Degrees, Walks, Paths, Circuits, Charectarization, Connectedness, Euler graphs, Hamiltonian graphs, Travelling salesman problem, Shortest distance algorithm (Djkstra's), Trees, Binary trees, Spanning trees, Spanning tree algorithms Kruksal's, Prim's .Planar graphs (Eulerformula, Kuratowski's two graphs) .
Unit-V
Introduction to combinatorics: Counting techniques, pigeon–hole principle, Mathematical induction, Strong induction , Permutations and Combination
Unit-VI
Generating functions, Recurrence relations and their solutions.

Text Books and Reference :

1. C.L.Liu : Discrete Mathematics
2. B.Kolman,R.C.Busby, and S.C.Ross, Discrete mathematical structures, 5/e, Prentice Hall, 2004
3. J.L.Mott, A.Kandel and T.P.Baker : Discrete mathematical structures For computer scientists & Mathematicians , Prentice–Hall India
4. J.P.Trembley, R. Manohar, Discrete mathematical structures with applications to computer science,
   McGraw –Hill, Inc. New York, NY, 1975

Course Code: **HSS-S401** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Engineering Economics**
Course Details:

Unit -I
Definition and scope of engineering economics
Concept of supply and demand
Price elasticity and cross elasticity of demand
Production

Engineering costs and cost estimation
Concept of time value of money
Cash flow analysis
Unit-II
Perfect competition
Monopoly
Monopolistic competition
Unit-III
National Income, GDP
Inflation, Deflation and treatment
Unit-IV
Functions of RBI
Indian Tax System

Text Books and References:

1. Henderson, M. James and Quandt, E. Richards, "Microeconomic Theory: A Mathematical Approach".
2. Koutsoyiannis, A., "Modern micro economics".ardwick, Philip., Khan Bahadure., Langmeed, John, "An Introduction to modern economics".
3. Samuelson, A. Paul, "Economics".
4. Shapiro, Edward. "Macro economics".
5. Newnan, G. Donald, Eschenbach, G.Ted, Lavelle, P. Jerome, "Engineering Economic Analysis".

Course Code: **CSE- S208** **Breakup:** **3 – 0 – 3 – 5**
Course Name: **Data Structure Using Python**
Course Details:

Informal introduction to programmin, algorithms and data structures viagcd, Downloading and installing Python, gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions, Python: types, expressions, strings, lists, tuples, Python memory model: names, mutable and immutable values, List operations: slices etc Binary search, Inductive function denitions: numerical and structural induction, Elementary inductive sorting: selection and insertion sort, In-place sorting

Basic algorithmic analysis: input size, asymptotic complexity, O() notation, Arrays vs lists, Merge sort, Quicksort, Stable sorting, Dictionaries, More on Python functions: optional arguments, default values, Passing functions as arguments, Higher order functions on lists: map, lter, list comprehension

Exception handling, Basic input/output, Handling files, String processing, Backtracking: N Queens, recording all solutions, Scope in Python: local, global, nonlocal names, Nested functions, Data structures: stack, queue, Heaps.

Abstract datatypes, Classes and objects in Python, "Linked" lists: find, insert, delete, Binary search trees: find, insert, delete, Height-balanced binary search trees, Effcient evaluation of recursive denitions: memorization, Dynamic programming: examples, Other programming languages: C and manual memory management, Other programming paradigms: functional programming

Text Books:

1. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press 2018. 2.
2. Anurag Gupta, G.P. Biswas, “Python Programming: Problem Solving, Packages and Libraries”, McGrawHill, 2020.
3. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second edition,
4. Updated for Python 3, Shroff/O'Reilly Publishers, 2016
5. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2", Network Theory Ltd., 2011.
6. John V Guttag, “Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
7. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016

Data Structures Lab

Write Program in Python for following:

1. Array implementation of Stack, Queue, Circular Queue
2. Linked list implementation using Dynamic memory Allocation, deletions and insertions, Linked Implementation of Stack, Queue, Circular Queue
3. Implementation of Tree Structures, Binary Tree, Tree Traversals, Binary Search Tree, Insertion and Deletion in BST, Simple implementation of Multiway search trees
4. Implementation of Searching and Sorting Algorithms
5. Graph Implementation, BFS, DFS.

Course Code: **CSE-S206** **Breakup:** **3 – 2 – 0 – 5**
Course Name: **Operating System**
Course Details:

Introduction and history of operating system

Process Management: Process Synchronization and mutual exclusion, Two process solution and Dekker’s algorithm, semaphores monitors, Examples (Producer – consumer, reader-writer, dining philosophers, etc.)

CPU Scheduling: Multiprogramming and time sharing, Scheduling approaches (shortest–job–first, first–in–first–out, Round Robin, etc.)

Deadlock: Modeling, detection and recovery, prevention and avoidance.

Interprocess communication: Shared memory, message passing pipes.

Input/ output: Devices controllers and device drivers, disk scheduling, other devices

Memory Management: with and without swapping, virtual memory- paging and segmentation, page replacement algorithm, Implementation.

File System: FS services, Disk source management, Directory and data structure .Security, Protection, Access right.

Text Books and References:

1. A.Silberschatz and P.B. Galvin, Operating system concepts, Addition Wesley, Fourth edition, 1994. (reprinted 1995)
2. Harris Schaum's outline operating System TMH
3. Tanenbaum – Advanced operating System
4. Milan Milankovic – Operating System
5. stallings – Operating System
6. Crowley – Operating system design.

Course Code: **MTH-S 504** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Probability and Statistics**
Course Details:

Probability: Sample Space , Events , Counting Sample Points ,Probability of an Event , Additive Rules , Conditional Probability, Independence and Product Rules , Bayes' Rule Random Variables and Probability Distributions , Concept of a Random Variable , Discrete Probability Distributions , Continuous Probability Distributions ,Joint Probability Distributions.

Mathematical Expectation : Mean of a Random Variable , Variance and Covariance of Random Variables , Means and Variances of Linear Combinations of Random Variables , Chebyshev's Theorem, Some Discrete Probability Distributions :Introduction and Motivation , Binomial and Multinomial Distributions,Hypergeometric Distribution, Negative Binomial and Geometric Distributions , Poisson Distribution and the Poisson Process .

Some Continuous Probability Distributions : Continuous Uniform Distribution , Normal Distribution , Areas under the Normal Curve , Applications of the Normal Distribution , Normal Approximation to the Binomial , Gamma and Exponential Distributions , Chi-Squared Distribution, Sampling Distributions and More Graphical Tools : Random Sampling and Sampling Distributions , Some Important Statistics , Sampling Distributions , Sampling Distribution of Means and the Central Limit Theorem , Sampling Distribution of S2 , t-Distribution , F-Distribution.

One- and Two-Sample Estimation Problems: Introduction , Statistical Inference , Classical Methods of Estimation , Single Sample: Estimating the Mean , Standard Error of a Point Estimate , Prediction Intervals , Tolerance Limits , Single Sample: Estimating the Variance, One- and Two-Sample Tests of Hypotheses : Statistical Hypotheses: General Concepts , Testing a Statistical Hypothesis , The Use of P-Values for Decision Making in Testing Hypotheses , Single Sample: Tests Concerning a Single Mean.

TEXTBOOK: Probability and Statistics for Engineers and Scientists, 9/E, by Walpole, Myers, Myers, Ye, Pearson 2012, ISBN-13: 9780321629111.

Course Code: **CSE- S205** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Computer Organization**
Course Details:

Brief review of digital logic, Boolean algebra, flip flops, etc.

Data Representation: Integer representation-- number systems (binary, octal, Decimal, Hexadecimal), 1's and 2's Complements, Floating point numbers - - IE standard, normalization.

Computer Arithmetic: Half adder, Full adder, ripple carry and carry look-ahead adders, Multipliers - - Booth's algorithm. Processor Organization, Registers, Instruction cycle, ALU design, Instruction set of a processor, types of operands, types of operations, addressing modes, instruction formats.

Memory: RAM, ROM, DRAM Vs SRAM, Organization of memory cells inside a memory chip, Interfacing of memory with processor; Cache memory - mapping function emplacement algorithm, Write policy.
Input Output Organization: Program controlled, Interrupt driven (priority interrupts Daisy chaining), Direct memory access.

Control Unit: Micro–operations - - hardwired implementation, Micro -programming.

Computer Peripheral Organization: Keyboard, Monitor, Hard disk, CD-ROMs, Printers, etc.
Text Books and References :
V.C. Hamacher, Z.G. Vranesic and S.G.Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996. Patterson, Computer Organization & Design.
Stalling – Computer Organization & Architecture PHI
David A Paterson and John L. hennery – Computer Organization & Design Harcourt Asia.
Morris Meno – Computer System & Architecture (TMH)
Pal Chaudhari- Computer Organization & Design (PHI)

Course Code: **CSE-S301** **Breakup:** **3 – 0 – 3 – 5**
Course Name: **Database Management Systems**
Course Details:

Introduction:
- Database-System Applications
- Purpose of Database Systems
- File processing disadvantages
- View of Data
- Data Abstraction
- Data Models

The Relational Algebra
- The Tuple Relational Calculus
- The Domain Relational Calculus
- Functional Dependencies
  - Extraneous Attribute
  - Left irreducible FD
  - Prime/non-prime attributes

Database Languages
Relational Databases
DBMS Architecture

Introduction to the Relational Model
Structure of Relational Databases
Database Schema
Attributes and Keys
Schema Diagrams

Introduction to SQL
SQL Data Definition
Basic Structure of SQL Queries
Basic Operations
Set Operations
Null Values
Aggregate Functions
Nested Subqueries
Modification of the Database

Database Design and the E-R Model
Overview of the Design Process
The Entity-Relationship Model
Constraints
Removing Redundant Attributes in Entity Sets
Entity-Relationship Diagrams
Reduction to Relational Schemas
Entity-Relationship Design Issues

Logically Implied FD
Closure of a FD
Rules for logical inference of FD
Algorithm to determine closure of a FD set
Canonical Cover of a FD
Algorithm to determine Canonical Cover of a FD set
Algorithm to determine closure of an attribute set under FD set

Relational Database Design
Features of Good Relational Designs
Atomic Domains and First Normal Form
Decomposition Using Functional Dependencies
Lossless Join Decomposition
Dependency preserving Decomposition
Normalization

Introduction to Concurrency Control

Introduction to Transaction Management

Text Books and References:

1. A. Silberschatz, H.F. Korth and S. Sudarshan, Database System Concepts, Third Edition, McGraw Hill, 1996.
2. C. J. Date – Data base system Concepts Narosa Publication
3. Nawathe – Data base Management systems.
4. Thomas & Begg – Database System (Pearson)
5. Arun K. Majumdar – Database Management System (TMH)

Course Code: **CSE-S302** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Design and Analysis of Algorithms**
Course Details:

Notion of algorithm, Big Oh, Small–oh, Theta and Omega notations, Space and Time complexities of an algorithm
Sorting and Order Statistics: Revision of complexity analysis of different sorting algorithms and introduction to recurrence relations

Introduction: A first problem: Stable matching

Graph Algorithms: Breadth First search, Depth First search, single source shortest paths, minimum spanning trees, all pair shortest paths, Traveling sales person problem

Fundamental design paradigms:

Divide and Conquer: Mergesort, Binary search, Quick sort, Matrix multiplication,etc

Greedy methods: Shortest path algorithms, fractional knapsack problem, task scheduling problem,etc

Dynamic Programming: 0/1 knapsack problem, Longest common subsequence, Matrix chain multiplication, etc

Network Flow: The maximum flow problem and Ford Fulkerson algorithm, maximum flows and minimum cuts in a network

Theory of NP completeness: Polynomial time, NP complete problems, concept of reducibility.

Measure of approximation: ratio bound and relative error, Polynomial time approximation scheme.

Text Books and References:

1. E. Horowitz and S. Sahni, Fundamentals of Computer Algorithms, Galgotia, 1991
2. Jon Kleinberg and Eva Tardos, Algorithm Design
3. Charles . E. Ronald – Introduction to Algorithms (PHI)
4. Thomas H. Corman, Charles E. Uisenton Ronald L. Rivest. Introduction to Algorithms.
5. Sara Baase & Gelder – Computer Algorithms (Pearson)
6. Aho, Hoperoft, Wilman – Design & Analysis of Computer Algorithms (Pearson)

Course Code: **CSE-S303T** **Breakup:** **3 – 0 – 2 – 5**
Course Name: **Microprocessor.**
Course Details:

Introduction to microprocessor, Microprocessor Computer and assembly language, Microprocessor Architecture (8085) & Memory interfacing, Interfacing I/O Device, 8085 assemble language programming, Programming technique with 8085 Instruction set.

Counters & Delays, Stack & Subroutines, Code conversion, BCD Arithmetic & 16 bit data operations.

Interrupts, D/A & A/D converters, Programmable Interface Device (8155, 8355, 8279, 8255, 8254, 8259) DNA Controller, Serial I/O & Data Communication, Microprocessor application & future aspects of Microprocessor Technology.

Text Books and References:

1. Douglas V. Hall , Microprocessor & Interfacing Programming & Hardware.
2. B.Ram – Fundamentals & Microprocessors & Microcomputer (Dhanpat Rai Publication)
3. Ramesh S. Gaonkar – Microprocessor Architecture, Programming & Application with 8085 (peterson Publication)
4. Steven Holzner – 'C' with Assembly Language
5. Uffenback – Microcomputers & Microprocessors (8080, 8085 & Z-80) Interfacing & Troubleshooting

Microprocessor Lab

1. 8 bit Addition,16-bit addition
2. 8 bit Subtraction, 16 bit Subtraction
3. BCD Addition and Subtraction
4. Sorting the n numbers in ascending & descending order.
5. Sum of squares of n numbers, sum of cubes of n numbers
6. Arithmetic average of n numbers.
7. Programs using subroutines
8. 8 bit counter with 5ms Delay.
9. Interfacing of switch and display
10. Interfacing of A/D converter
11. Interfacing of D/A converter
12. Microprocessor based traffic controller

Course Code: **CSE-S304** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Theory of Computation**
Course Details:

Model of Computation
Classification, Properties and equivalence's

Regular languages models:
finite state machine (deterministic and non – deterministic). Regular grammars, regular

expression, Equivalence of deterministic and non – deterministic machines, Properties: closure, decidability, minimization of automata, iteration theorems.

Context – free languages models:
Context – free grammars, simplification if CFGs , Chomsky normal form , Greibach normal form. Pushdown Automata, and their equivalence with context free languages, Properties closure , iteration theorems, parsing.

Recursive and recursively innumerable sets models:
Turing machines, computable languages and function, Modification of Turning machines, Restricted Turning machines equivalents to the basic model, grammars recursive function , and their equivalence Church's thesis, Properties: closure, decidability, undecidability/ non – computability, notion of reductions.

Text Books and References:

1. J.E. Hopcroft and J.D.Ullman & Motwani Introduction to Automata Theory, Language and Computation, Narosa, 2001.
2. Peterlinz – An Introduction to formal Language & automata (Narosa Publication House)
3. Mishra & Chandrase – Theory of computer Science Automata Language & Computation (PHI)
4. Cohen – Intorduction to Computer Theory (Wiley)
5. Mortin – Theory of Computation (TMH)
6. Michael Sipsev, Introduction to Theory of Computation, 2nd Edition, Thomson/Congage

Course Code: **CSE- S308** **Breakup:** **3 – 1 – 2 – 4**
Course Name: **Introduction to Data Science**
Course Details:

Fundamentals of Data Manipulation with Python: Introduction to Specialization,Introduction to the Course, The Coursera Jupyter Notebook System, Python Functions, Python Types and Sequences, Python More on Strings, Python Demonstration: Reading and Writing CSV files, Python Dates and Times, Advanced Python Objects, map(), Advanced Python Lambda and List Comprehensions, Numerical Python Library (NumPy), Manipulating Text with Regular Expression

Basic Data Processing with Pandas:
Introduction to Pandas, The Series Data Structure, Querying a Series, DataFrame Data Structure, DataFrame Indexing and Loading, Querying a DataFrame, Indexing Dataframes, Missing Values

More Data Processing with Pandas:

In this week you'll deepen your understanding of the python pandas library by learning how to merge DataFrames, generate summary tables, group data into logical pieces, and manipulate dates. We'll also refresh your understanding of scales of data, and discuss issues with creating metrics for analysis. Merging Dataframes, Pandas Idioms, Group by, Scales, Pivot Table, Date/Time Functionality

Principles of Information Visualization:
Matplotlib Architecture, Basic Plotting with Matplotlib, Scatterplots, Line Plots, Bar Charts

Charting Fundamentals:
Subplots, Histograms, Box Plots, Heatmaps, Animation

Text books:

1. Practical Statistics for Data Scientists – By Peter Bruce and Andrew Bruce
2. Introduction to Probability – By Joseph K. Blitzstein and Jessica Hwang
3. Python for Data Analysis – By Wes McKinney
4. The Elements of Statistical Learning — Data Mining, Inference, and Prediction, by Trevor Hastie, Robert Tibshirani, Jerome Friedman
5. The Art of Data Science — A Guide for Anyone Who Works With Data, by Roger D. Peng and Elizabeth Matsui

Course Code: **CSE-S511** **Breakup:** **3 – 0 – 3 – 5**
Course Name: **Adv. Database Management System**
Course Details:

Design Theory for Relational Database:

Functional Dependencies, Decomposition of Relation schemes, Normal Forms for Relations. Schemes, Multivalued and other kinds of Dependencies.

Query Optimization:

Basic Optimization Strategies, Algebraic Manipulation, Optimization of Selections in System, Exact Optimization for a Subset of Relational Queries, Optimization under Weak Equivalence.

Database Protection: Integrity, Constraints in Query-by-Example, Security, Security in query-by-Example, Security in Statistical Databases.

Concurrent Operations on the Database:

Basic Concepts, A simple Transaction Model, Model with Read- and Write-Locks, Read-only, Write-only Model, Concurrency for Hierarchically Structured Items, Protection against Crashes, Optimistic Concurrency Control.

Principles of Distributed Data Bases:

Framework for distribution. Translation of global queries into fragment queries. Query optimization and management of distributed transaction. Concurrency control and reliability in distributed databases.

Administration of Distributed Data Bases. Example Systems.

Text Books and References:

1. J.D.Ullman, Principles of Database Systems, Galgotia, New Delhi.
2. S.Ceri, G. Relagatti, Distributed Databases, McGraw-Hill.

3. C. Papadimitriou, The Theory of Database concurrency Control, Computer Science Press.
4. T. Ozsu, P. Valduriez, Principles of Distributed Database Systems, Prentice-Hall.

Course Code: **CSE-S306** **Breakup:** **3 – 0 – 4 – 5**
Course name: **Computer Networks**
Course Details:

Introduction: history and development of computer networks, Local area networks, Metropolitan area networks, wide area networks, networks topology ISO/OSI seven layer architecture, connectionless versus connection oriented.

Data Communication: Data encoding and transmission ,data link control, Multiplexing, packet switching, LAN Architecture, LAN Systems(Ethernet, Token Ring), Network devices switches, Gateways , Routers

Physical Layer: transmission media, analog transmission, digital transmission.

Data link layer: framing error detection and correction, stop-and wait protocol, sliding window protocols, HSLC protocol.

MAC Layer: Aloha protocols, CSMA/CD: Ethernet, token ring, token bus Logical link control, Bridges and switches, FDDI, fast Ethernet, FDM, TDM.

Network layer: Virtual circuit, datagrams, Routing Algorithms shortest path, distance vector, link state routing, flooding, hierarchical routing, congestion control algorithms. Internetworking tunneling, Encapsulation , Fragmentation. Multicasting, Inter network protocols (IP) – header structure, addresses, option, etc. Routing protocols, (Example : RIP,HELLO,OSPF,BGP)classless Inter- domain routi9ng other protocols, ICMP,ARP, RARP,BOOTP,DHCP.

Asynchronous Transfer mode (ATM); cell format, connection setup, switching, quality –of – services, ATM adaptation layers.

Text Book and References:

1. A.S. tannenbaum, Computer network, Third Edition, PHI 1996.
2. Shallings– Data Communication and Networks.
3. Behronz A. Forouran – Data Communication and Networks. (TMH)
4. Black – Computer Network (PHI)
5. Nance – Network Programming in C (PHI)

Course Code: **CSE-S307** **Breakup:** **3 – 1 – 0 – 4**
Course name: **Software Engineering.**
Course Details:

Software and Software Engineering

1. Software Process a Generic View
2. Software Process Models
3. Requirements Engineering
4. Project management Concepts
5. Software Process, Project and Product Metrics
6. Metrics for Design Model
7. Estimation for Software Projects
8. Analysis Concepts and Modeling
9. Software Testing

Reference Books

1. Software Engineering, Roger S Pressman, TMH
2. Integrated approach to software engineering, Pankaj Jalote, Springer
3. Software Engineering: A Precise Approach, Pankaj Jalote, Wiley
4. Fundamentals of Software Engineering, Rajib Mall, PHI
5. Sommerville – S/W Engineering (Pearson),8th edition

Course Code: **CSE-S520** **Breakup:** **3 – 0 – 2 – 5**
Course Name: **Foundation of Machine Learning**
Course Details:

1. Introduction
   Definition of learning systems, Goals and applications of machine learning, Aspects of developing a learning system: training data, concept representation, function approximation.
2. Inductive Classification
   The concept learning task, Concept learning as search through a hypothesis space, General-to-specific ordering of hypotheses, Finding maximally specific hypotheses, Version spaces and the candidate elimination algorithm, Learning conjunctive concepts, The importance of inductive bias.
3. Decision Tree Learning
   Representing concepts as decision trees, Recursive induction of decision trees, Picking the best splitting attribute: entropy and information gain, Searching for simple trees and computational complexity, Occam's razor, Over fitting, noisy data, and pruning.
4. Experimental Evaluation of Learning Algorithms
   Measuring the accuracy of learned hypotheses, Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.
5. Computational Learning Theory
   Models of learnability, Sample complexity, Computational complexity of training, Sample complexity for finite hypothesis spaces.

6. Rule Learning: Propositional and First-Order
   Translating decision trees into rules, Heuristic rule induction using separate and conquer and information gain, First-order Horn-clause induction (Inductive Logic Programming) and Foil, Learning recursive rules, Inverse resolution, Golem, and Progol.
7. Bayesian Learning
   Probability theory and Bayes rule, Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training, Logisitic regression, Bayes nets and Markov nets for representing dependencies.
8. Instance-Based Learning
   Constructing explicit generalizations versus comparing to past specific examples. k-Nearest-neighbor algorithm. Case-based learning.
9. Language Learning
   Classification problems in language: word-sense disambiguation, Sequence labeling, Hidden Markov models (HMM's). Veterbi algorithm for determining most-probable state sequences. Forward-backward EM algorithm for training the parameters of HMM's.

Text Books and References

Bishop, "Neural Networks for Pattern Recognition", 1995
Hastie, Tibshirani and Friedman, "Elements of Statistical Learning: Data Mining, Inference and Prediction", 2001
MacKay, "Information Theory, Inference, and Learning Algorithms", 2003.

Course Code: **CSE-S513** **Breakup:** **3 – 1 – 3 – 5**
Course Name: **Computer Vision**
Course Details:

Image Formation Models
Monocular imaging system, Orthographic & Perspective Projection , Camera model and Camera calibration. Binocular imaging systems.

Image Processing and Feature Extraction
Image representations (continuous and discrete), Edge detection.

Motion Estimation
Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Shape Representation and Segmentation
Deformable curves and surfaces, Snakes and active contours, Level set representations Fourier and wavelet descriptors, Medial representations, Multiresolution analysis.

Object recognition
Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition.

Text Books and Refrences:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall

2. Robot Vision, by B. K. P. Horn, McGraw-Hill.
3. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

Computer Vision Lab

1. Implementation of line generation using slope's method, DDA and Bresenham's algorithms.
2. Implementation of circle generation using Mid-point method and Bresenham's algorithms.
3. Implementation of ellipse generation using Mid-point method.
4. Implementation of polygon filling using Flood-fill, Boundary –fill and scan line algorithms.
5. Implementation of 2-D transformation: Translation, Scaling, rotation, Mirror Reflection and sharing (write a menu driven program).
6. Implementation of line clipping using Cohen-Sutherland algorithm and Bisection Method.
7. Implementation of Polygon clipping using Sutherland-Hodgeman algorithms.
8. Implementation of 3-D geometric transformations: Translation, Scaling and rotation.
9. Implementation of curve generation using Interpolation methods.
10. Implementation of Curve generation using B-spline and Bezier curves.
11. Implementation of any one of back face removal algorithm (such that depth-buffer algorithm, Painter's algorithm, Warnock's algorithm, Scan line algorithm)

Course Code: **CSE-S526** **Breakup:** **3 – 1 – 4 – 5**
Course Name: **Deep Learning**
Course Details:

Introduction to TensorFlow : Computational Graph, Key highlights, Creating a Graph, Regression example, Gradient Descent, TensorBoard, Modularity, Sharing Variables,Keras Perceptrons: What is a Perceptron, XOR Gate

Activation Functions : Sigmoid,ReLU, Hyperbolic Fns, Softmax Artificial Neural Networks : Introduction, Perceptron Training Rule, Gradient Descent Rule

Gradient Descent and Backpropagation: Gradient Descent, Stochastic Gradient Descent, Backpropagation, Some problems in ANN

Optimization and Regularization : Overfitting and Capacity, Cross Validation, Feature Selection, Regularization, Hyperparameters

Introduction to Convolutional Neural Networks: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications Introduction to Recurrent Neural Networks: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications

Deep Learning applications: Image Processing, Natural Language Processing, Speech Recognition, Video Analytics

Text Book

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Course Code: **CSE-S518** **Breakup:** **3 – 1 – 0– 4**
Course Name: **Artificial Intelligence**
Course Details:

Introduction:
Introduction to AI, Foundations of AI, History of AI, Concept of AI techniques, the underlying assumptions, the state of art
Intelligent agents:
Agents and Behavior, The concept of rationality, Agent Architecture

Problem solving:
Problems, problem space and search – Formulating problems, Designing the problems as state space search, Issues in the design of search programs

Uninformed Search Techniques: Breadth first, Depth first, Depth limited, Iterative deepening, bidirectional, etc
Heuristic/Informed Search Techniques:
Generate and test, Best first search, A* search, Memory bounded heuristic search, Hill climbing search, Simulated annealing search, local beam search, genetic algorithms

Constraint Satisfaction Problem, Means End Analysis Adversial Search: Optimal decitions in games, Minmax algorithm, Alpha Beta Pruning

Knowledge Representation – knowledge representation issues, the predicate calculus representing knowledge using rules, symbolic reasoning, uncertainty, Probabilistic reasoning.

Languages and programming technique for AI:
An Introduction to PROLOG or LISP

Text Books and References:

1. S.J. Russell and P. Norvig , Artificial intelligence : A Modern Approach , PHI
2. Elaine Rich and Kaven Knight – Artificial Intellegence 2nd Ed. TMH
3. Nils J. Nilsson – Artificial Intelligence (Harcourt India Pub.Ltd.)
4. Charnick Mc Dermott – Introduction to Artificial Intelligence (Pearson)
5. Turban Aronson – Decision Support System & Intelligent System (Pearson)

List of Departmental Elective

Course Code: **CSE-S516** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Bioinformatics Concepts: A computer Science Perspective**
Course Details:

Unit 1: Cell Structure and function of cell, Introduction of DNA, RNA, Protein, Carbohydrate and Lipids, Structure of Protein (primary, secondary Tertiary and quaternary), Gene and non coding RNA. Protein folding and function, Nucleic acid-Protein interaction. Enzymes: details of enzyme nomenclature and classification; units of enzyme activity; coenzymes and metal cofactors; temperature and pH effects; Michaelis-Menten kinetics; Inhibitors and activators; active site and catalytic mechanisms; covalent and non-covalent regulations; isoenzymes; osmolytes and intracellular modulation of enzymes.

Unit 2: Biological Databases both protein and Nucleotide, Sequence similarity search program and Algorithm , Pairwise and Multiple sequence Alignment program, Shannon Entropy, BLAST Algorithm , FASTA Algorithm, Protein Substitution Matrix (BLOSUM and PAM), Nucleotide Substitution Matrix, Profile, Heuristic based approach
Unit 3: Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses.
Unit 4: Hidden Markov Model and their application for profile analysis, Genetic Algorithm and its use in Structure Prediction of biomolecules , Nussinov algorithm for RNA secondary structure prediction, SOM, Cluster Analysis :Nearest neighbour search ,Search using stem numbers ,Search using text signatures, Phylogenetic Analysis Tools: Maximum Likelihood, Parsimony methods, Distance methods, Model Comparison.

Text Books and References:

1. Fundamentals of Biochemistry, D., Voet, Voet, J.G. & Pratt, C. W. (John Wiley & Sons, 2nd edition, 2006)
2. Computational Molecular Biology: An Algorithmic Approach, Pavel Pevzner (MIT Press, 2000)
3. An Introduction to Bioinformatics Algorithms, Neil C. Jones (The MIT Press 2004)
4. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids**,** Richard Durbin, Sean R. Eddy , Anders Krogh, Graeme Mitchison (Cambridge University Press 1998)
5. Bioinformatics: Sequence and Genome Analysis, David W. Mount **(**Cold Spring Harbor Laboratory Press 2001
6. Statistical methods in bioinformatics: an introduction, Ewens, W. J. & Grant, G. R., (New York. Springer, 2001)

Course Code: **CSE-S521** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Data Mining and Data Warehousing**
Course Details:

Unit I: Data Warehousing: Need for data warehousing , Basic elements of data warehousing, Data Mart, Data Warehouse Architecture, extract and load Process, Clean and Transform data, Star ,Snowflake and Galaxy Schemas for Multidimensional databases, Fact and dimension data, Partitioning Strategy-Horizontal and Vertical Partitioning.

Unit II: Data Warehouse and OLAP technology, Multidimensional data models and different OLAP Operations, OLAP Server: ROLAP, MOLAP, Data Warehouse implementation ,Efficient Computation of Data Cubes, Processing of OLAP queries, Indexing data.

Unit III: Data Mining: Data Preprocessing ,Data Integration and Transformation, Data Reduction, Discretizaion and Concept Hierarchy Generation , Basics of data mining, Data mining techniques, KDP (Knowledge Discovery Process), Application and Challenges of Data Mining, Introduction of Web Structure Mining, Web Usage Mining, Spatial Mining, Text Mining, Security Issue, Privacy Issue, Ethical Issue.

Unit IV: Mining Association Rules in Large Databases: Association Rule Mining, Single-Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, Fp-Growth Algorithm, Time series mining association rules, latest trends in association rules mining.

Unit V: Classification and Clustering Distance Measures, Types of Clustering, K-Means Algorithm,Decision Tree Induction, Bayesian Classification, Association Rule Based, Other Classification Methods, Prediction, Classifier Accuracy, Categorization of methods, Partitioning methods, Outlier Analysis.

Text Books and References:

J. Han, M. Kamber, "Data Mining: Concepts and Techniques", Harcourt India / Morgan Kauffman
P.Ponnian, "Data Warehousing Fundamentals", John Weliey.
M.H.Dunham, "Data Mining Introductory & Advanced Topics", Pearson Education.
Ralph Kimball, "The Data Warehouse Lifecycle Tool Kit", John Wiley.
M.Berry , G.Linoff, "Master in Data Mining", John Wiley.
W.H.Inmon, "Building the Data Ware houses", Wiely Dreamtech.
E.G. Mallach , "The Decision Support & Data Warehouse Systems", TMH
Sam Anahory, Dennis Murry, "Data Warehousing in the real world", Pearson Education 2003.
David Hand, Heikki Manila, Padhraic Symth, "Principles of Data Mining", PHI 2004..
Alex Bezon, Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", MeGraw-Hill Edition

Course Code: **CSE-S523** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Cloud Computing**
Course Details:

Introduction introduction to cloud computing – definition of cloud – evolution of cloud computing – underlying principles of parallel and distributed computing – cloud characteristics – elasticity in cloud – on-demand provisioning.

cloud enabling technologies service oriented architecture – rest and systems of systems – web services – publish-subscribe model – basics of virtualization – types of virtualization – implementation levels of virtualization – virtualization structures – tools and mechanisms – virtualization of cpu – memory – i/o devices – virtualization support and disaster recovery.

cloud architecture, services and storage layered cloud architecture design – nist cloud computing reference architecture – public, private and hybrid clouds – laas – paas – saas – architectural design challenges – cloud storage – storageas-a-service – advantages of cloud storage – cloud storage providers – s3.

resource management and security in cloud inter cloud resource management – resource provisioning and resource provisioning methods – global exchange of cloud resources – security overview – cloud security challenges – software-as-aservice security – security governance – virtual machine security – iam – security standards.

Cloud technologies and advancements hadoop – mapreduce – virtual box — google app engine – programming environment for google app engine — open stack – federation in the cloud – four levels of federation – federated services and applications – future of federation.

Text books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

Course Code: **CSE-S530** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Internet of Things**
Course Details:

Module I: IOT - What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.

Module II:IOT PROTOCOLS - Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

Module III: IOT ARCHITECTURE - IoT Open source architecture (OIC) - OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

Module IV: WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

Module V: IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

Text books:

- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition,• VPT, 2014
- Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to• ConnectingEverything", 1st Edition, Apress Publications, 2013
- CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011

Course Code: **CSE-S525** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Text Analytics**
Course Details:

INTRODUCTION TO TEXT MINING: Roots of text mining - Information extraction and text mining - Development of enabling technology in text mining - Sentiment analysis and opinion mining. Definition - Business challenges addressed: information organization and access - Discovery of patterns.

MODULE II TEXT ANALYTICS: Text analytics and text mining - Future of text mining - Practice areas of text analytics - Finding the appropriate solution to a problem - Visualizing the domains of text analytics.

MODULE III CLUSTERING: Text Capturing, sorting, sifting, stemming and matching – word cloud, wordless and beyond –Clustering document using words – sentiment and counting

MODULE IV PREDICTIVE MODEL: Word regression – Classification that grow on trees: CHAID and CART applications – Bayes Nets.

MODULE V APPLICATIONS AND TOOLS: Application of text mining - Case study – Limitations of Google analytics.

Text Books:

1. Gary Miner John Elder IV, Robert Nisbet, DursunDelen, Thomas Hill, Andrew Fast, "Practical Text Mining and Statistical Analysis for Non structured Text Data Applications",1st Edition, Academic Press, ISBN9780123869791,2012.
2. Steven Struhl,"Practical Text Analytics: Interpreting text and unstructured data for business intelligence", ISBN : 0749474025, 2015.

Course Code: **CSE-S509** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **SOFT COMPUTING**
Course Details:

Neural Networks (Introduction & Architecture), Neuron, Nerve structure and synapse, artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications. Fuzzy Logic-I (Introduction):Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations,Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.
Fuzzy Logic –II (Fuzzy Membership, Rules) Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.
Genetic Algorithm(GA) : Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and GeneticAlgorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.
Reference Books:
3. Siman Haykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Application

Course Code: **CSE-S527** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Speech Recognition and hidden Markov model**
Course Details:

Basic Concepts: Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Speech Analysis, Speech Modeling, Speech Recognition and Speech Synthesis

Linguistic Background, Knowledge Representation and Reasoning
Grammars and Parsing, Features and Augmented Grammars, Grammars for Natural Language, Encoding Uncertainty, Ambiguity Resolution and Semantics and Logical form

TEXT BOOKS

1. Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003. 2.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education. REFERENCES
3. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
4. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.
5. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
6. Ben gold and Nelson Morgan, "Speech and audio signal processing", processing and perception of speech and music, Wiley- India Edition, 2006 Edition.
7. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press.
8. James Allen, Natural Language Understanding
9. Jurafsky & Martin – Speech & Language Processors (Pearson)

Course Code: **CSE-S507** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Advanced Computer Networks**
Course Details:

Revision of Computer Networks, Seven Layer Architecture, TCP/IP Suite of protocols etc.
Transport Layer: Flow and error control, multiplexing, establishing and releasing a connection, Transmission control protocol – header, services, connection management, convention control, sliding window and timers. User datagram protocol, Domain name services.

Unix network programming, socket abstraction client – server architecture.

Session presentation, application layers, Example protocols: Email (SMTP) Telnet, FTP, etc.

Internet security: firewalls. Network managements: SNMP.

IPV6: IPV6 Versus IPV4, Structure of IPV6 Protocol : general header structure , extension headers , IPV6 addressing : Types , notation, prefix notation , unicast, anycast , multicast addresses etc.

Security in IPV6: Basic Security Requirement and techniques, open security issues in current internet, IPSec frame work Quality of service in IPV6

ICMPV6: error messages, neighbor discovery, Auto configuration, path MTU discovery.

Wireless networks: Overview of 802.11 networks, 802.11 MAC, wired Equivalent privacy, Wireless communication technology: FHSS, DSSS, CDMA etc.

Mobility networks: Mobile IP, security related issues

Text Books and References:

1. 802.11 wireless networks : The definitive guide, Mathew S. Gast, O'relly
2. Wireless communication & networks: William Stallings
3. IPV6 Essentials , Silvia Hagen O'relly
4. IPV6 Clearly Explained , Peter Morgan , Kauffman
5. Mobile IP design , Principle & Practices , Perkin Woolf, Alpert Addison Wesley