CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY

KANPUR

SYLLABUS

(B.Tech.)

INFORMATION TECHNOLOGY

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

(SCHOOL OF ENGINEERING & TECHNOLOGY)

Vision

To achieve excellence in engineering education, empower students to be technically competent professionals and entrepreneurs with strong ethical values so as to significantly contribute as agents for universal development and societal transformation

Mission

To provide affordable quality education at par with global standards of academia and serve society with harmonious social diversity

To encourage new ideas and inculcate an entrepreneurial attitude amongst the students, and provide a robust research ecosystem

To practice and encourage high standards of professional ethics and accountability among students

Bachelor of Technology in Information Technology

Program Outcomes (POs)

PO1	**Engineering knowledge:** Acquire strong fundamental knowledge of computer science and engineering along with mathematics.
PO2	**Problem analysis:** Ability to identify, formulate &analyse requirements of a problem to provide sustainable solution which are in coherence with the local/regional/national or global needs and feasibility
PO3	**Design/development of solutions:** Design solution for complex problems, which incorporate components and processes, which are sustainable and reusable.
PO4	**Conduct investigation of complex problems:** Develop skills to synthesize research-based knowledge in the design, interpretation, analysis and synthesis of data for providing solutions to complex problems
PO5	**Modern tool usage:** Possess programming skills in different contemporary programming languages and use different development tools. Be able to select the appropriate tool/programing language/platform and understand the limitations of the same while implementing the solution.
PO6	**The Engineer and Society:** To apply skills for social causes at the local, regional, national and global level and work towards sustainable solutions. Apply reasoning informed by the contextual knowledge to access social, legal and cultural issues.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environment contexts
PO8	**Ethics:** To understand contemporary legal, social & ethical issues in computing.
PO9	**Individual and Teamwork:** PossesFlexibility to adapt to a team environment. To be able to work as an individual or as a member or a team leader in multidisciplinary team organizations.
PO10	**Communication:** To be able to present and communicate precisely and effectively. Be able to comprehend and write effective reports and design documents and presentations professionally and be able to perceive and give clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply to work in the capacity of a member/leader in the team to manage projects
PO12	**Life-long learning:** To have passion for acquiring technical advancements in the field of computer science and engineering and apply new technology for solving local/regional/national or global problems

Program Specific Outcomes (PSOs)

PSO-1	To be able to understand problem, think of best suitable approach to solve the problem, develop and evaluate effective solutions
PSO-2	To be able excel in contemporary technologies being adopted by the industry and academia
PSO-3	To be able to excel in various programming/project competitions and technological challenges laid by professional bodies

Program Educational Outcomes (PEOs)

1. To make the students ready for successful career leading to higher education and /or industry.
2. To empower students achieve personal and professional success with awareness and commitment to their ethical and social responsibilities, both as individuals and in team environments.
3. To encourage students maintain and improve their technical competence through lifelong learning.

Curricular Components

Category of courses	**Credits offered**
Basic Science Core	**27**
Engineering Science Core	**25**
Humanities and Social Science Core	**17**
Departmental Core	**68**
Departmental Electives	**16**
Open Electives	**20/25**
Projects and Seminars	**12**
Total	**198/206**

Semester-wise Course Structure

1st Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
MTH-S101	Mathematics–I	3	1	0	4
PHY-S101	Physics–I	3	1	3	5
ISC-S101	Programming and Computing (C &Unix)	3	0	3	5
TCA-S102	Workshop Concepts	0	2	4	5
HSS- S101	Professional Communication	3	1	0	4
	Total	**12**	**5**	**10**	**23**
2nd Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
MTH-S102	Mathematics II	3	1	0	4
PHY-S102	Physics II	3	1	3	5
CHM-S101	Chemistry I	3	0	3	5
TCA-S101	Engg. Drawing	0	2	4	5
ESC-S101	Basic Electrical &Electronics Engineering	3	1	3	5
	Total	**12**	**5**	**13**	**24**

3rd Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
DIT-S201	Object Oriented Programming	3	1	3	5
DIT-S203	Digital Electronics	3	0	2	5
MTH-S201	Mathematics III	3	2	0	4
---	Departmental Electives	3	1	0	4
EVS–S101	Environmental Science	2	0	0	2
UHV–S201	Universal Human Values	2	1	0	3
DIT-S205	Data Structures	3	1	3	5
GP-101	General Proficiency				1
	Total	**19**	**6**	**8**	**29**

4th Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
DIT-S202	Computer Organisation	3	1	0	4
---	Departmental Elective	0	0	3	4
DIT-S206	Software Engineering	3	0	3	5
HSS-S401	Industrial Economics	3	0	0	4
MTH-S301	Discrete Mathematics	3	1	0	4
GP-102	General Proficiency				1
	Total	**12**	**2**	**6**	**29**

5th Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
--	Departmental Elective	3	0	0	4
DIT-S303	Theory of computation	3	0	0	4
DIT-S305	Design & Analysis of Algorithm	3	0	0	4
DIT-S307	DBMS	3	1	3	5
DIT-S309	Operating System	3	0	3	4
GP-103	General Proficiency				1
	Total	**15**	**1**	**6**	**22**

6th Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
DIT-S302	Computer Networks	3	0	3	4
DIT-S308	Internet Technology	3	0	3	5
---	Departmental Elective				4 or 5
---	Departmental Elective				4 or 5
---	Mathematics Elective				4 or 5
SST-S301	Summer Training	0	0	1	2
HSS-S301	Professional Communication	1	1	1	2
GP-104	General Proficiency				1
	Total				**26 or 29**

7th Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
DIT-S401	Digital Image Processing	3	0	3	5
----	Departmental Elective				4 or 5
----	Departmental Elective				4 or 5
HSS-S201	Industrial Management	3	0	0	4
PRT-S401	BTech. Project I	0	0	6	4
SSM-S401	Student Seminar	0	0	2	2
GP-105	General Proficiency				1
	Total				**24 or 26**

8th Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
DIT-S402	Information Systems	3	1	0	4
---	Departmental Elective				4 or 5
---	Departmental Elective				4 or 5
---	Departmental Elective				4 or 5
PRT-S402	BTech. Project II	0	0	6	4
GP-106	General Proficiency				1
	Total				**21 or 24**
Note: Total No. of Lectures in each course should in the range 40 to 45 per semester if per week three lectures are allotted.					

Total Credits – 198 to 206

List of Electives

Course Code	Course Title	L	T	P	Cr
DIT-S208	Introduction to Linux and shell Programming	3	0	3	4
DIT-S311	Introduction to Compiler	3	0	0	4
DIT–S501	Software project management	3	0	0	4
DIT-S502	Mobile/Wireless Computing	3	0	0	4
DIT-S503	Information coding & techniques	3	0	0	4
DIT-S504	Advance Computer Architecture	3	0	0	4
DIT–S505	Computer Graphics	3	1	2	5
DIT-S506	Artificial Intelligence	3	0	0	4
DIT-S507	Advance JAVA	3	1	2	5
DIT-S508	Data Mining	3	0	0	4
DIT-S509	Dot NET	3	1	2	5
DIT-S510	VLSI	3	0	0	4
DIT-S511	Distributed Systems	3	0	0	4
DIT-S512	Network Security	3	0	0	4
DIT-S513	Multimedia Systems	3	0	0	4
DIT-S514	System Analysis and Design	3	0	0	4
DIT-S515	Embedded Systems	3	0	0	4
DIT-S516	Real Time Systems	3	0	0	4
DIT-S517	Geographic Information Systems	3	0	0	4
DIT-S518	E-Commerce	3	0	0	4
DIT-S519	Data Communication	3	0	0	4
DIT-S520	Analog Electronics Circuit	3	0	1	4
DIT-S521	Signal & Systems	3	0	0	4
DIT-S522	Modeling & Simulation	3	0	0	4
DIT-S523	Artificial Neural Networks	3	0	0	4
DIT-S524	Stochastic Models for Computer Application	3	0	0	4
DIT-S525	Telecommunication & Switching	3	0	0	4
DIT-S526	Information Security and Cyber Laws	3	0	0	4

DIT–S527	Digital Signal Processing	3	0	0	4
DIT-S528	Data Analysis	3	0	2	4
DIT-S529	Patten Recognition	3	0	2	4
DIT-S541	Introduction to Python Programming	3	0	3	4
DIT-S542	E-Business	3	0	0	4
DIT-S543	Digital Marketing	3	0	0	4
DIT-S544	Introduction to Game Programming	3	0	2	4
DIT-S545	Android Programming	3	0	2	4
DIT-S546	Introduction to IOS programming	3	0	2	4
DIT-S547	Human Computer Interface Programming	3	0	2	4
DIT-S548	Statistical Analysis System	3	0	2	4
DIT-S549	Block Chain and Crypto Currency	3	0	2	4
DIT-S550	Natural Language Processing	3	0	0	4
DIT-S551	Cloud Computing	3	0	2	4
DIT-S552	Big Data Technology	3	0	2	4
DIT-S553	Internet of Things	3	0	2	4
DIT-S554	ERP Systems	3	0	0	4
DIT-S555	Deep Learning	3	0	2	4
DIT-S556	Business Analytics and Text Mining Modeling using Python	3	0	2	4
DIT-S557	Innovation, Business Models and Entrepreneurship	3	0	0	4
DIT-S558	Entrepreneurship: do your venture	3	0	0	4
DIT-S559	Applied Multivariate Analysis	3	0	0	4
DIT-S560	Introduction to R Software	3	0	2	4
DIT-S562	Numerical Methods and Simulation Techniques for Scientist and Engineers	3	0	0	4
DIT-S563	Introduction to Machine Learning	3	0	2	4
MTH-S501	Operations Research	3	0	0	3
MTH-S503	Graph Theory	3	0	2	4
MTH-S504	Probability and Statistics	3	0	0	4
UHV-S101	Human Values and Professional Ethics	0	0	0	0

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Test the convergence & divergence of infinite series
CO2	Understand concepts of limit, continuity and differentiability of function of two variables
CO3	Find the maxima and minima of multivariable functions
CO4	Evaluate multiple integrals, concepts of beta & gamma functions
CO5	Apply the concepts of gradient, divergence and curl to formulate engineering problems

Course Details:

Unit-I- Sequences & Series: Definition, Monotonic sequences, Bounded sequences, Convergent and Divergent Sequences Infinite series, Oscillating and Geometric series and their Convergence, n^{th} Term test, Integral test, Comparison Test, Limit Comparison test, Ratio test, Root test, Alternating series, Absolute and Conditional convergence, Leibnitz test.

Unit II-Differential Calculus: Limit Continuity and differentiability of functions of two variables, Euler's theorem for homogeneous equations, Tangent plane and normal. Change of variables, chain rule, Jacobians, Taylor's Theorem for two variables, Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers**.**

Unit III-Integral Calculus: Review of curve tracing, Double and Triple integrals, Change of order of integration. Change of variables. Gamma and Beta functions, Dirichlet's integral; Applications of Multiple integrals such as surface area, volumes

Unit –IV Vector Calculus: Differentiation of vectors, gradient, divergence, curl and their physical meaning; Identities involving gradient, divergence and curl Line and surface integrals Green's, Gauss and Stroke's theorem and their applications

Unit–V Probability and Statistics: Concept of probability, random variable and distribution function: discrete and continuous, Binomial, Poisson and Normal Distributions.

Text and Reference Books:

1. C.L.Liu : Discrete Mathematics, , McGraw Hill, 2nd Edition, 1985.
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, 1985.
4. J.P.Trembley, R. Manohar, Discrete mathematical structures with applications to computer science, McGraw –Hill, Inc. New York, NY, 1975

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the behaviour of Physical bodies
CO2	Understand the basic concepts related to the motion of all the objects around us in our daily life
CO3	Gain the foundation for applications in various applied fields in science and technology
CO4	Understand the concepts of vectors, laws of motion, momentum, energy, rotational motion, central force field, gravitation, collision and special theory of relativity
CO5	Empower the students to develop the skill of organizing the theoretical knowledge and experimental observations into a coherent understanding

Course Details: (Theory)

Unit 1
Revision of vectors, vector differentiation, ordinary derivatives of vectors, space curves continuity and differentiability, partial derivatives of vectors, gradient, divergence, curl, vector differentiation and their geometrical interpretation, various coordinate systems: polar coordinate, orthogonal curvilinear coordinate system, unit vectors and tangent vectors in curvilinear systems, special orthogonal curvilinear coordinate system, cylindrical coordinate system and spherical polar coordinate systems.

Unit 2
Inertial and non-inertial frames, fictitious force, Coriolis force, Newton's laws of motion and its applications, friction, conservative and non-conservative force, work energy theorem, conservation of linear momentum and energy, variable mass system (Rocket motion), simple harmonic motion, small oscillation, equilibrium, condition for stability of equilibrium, energy diagram, small oscillation in a bound system, working of Teetertoy.

Unit 3
Concept of centre of mass and calculation of center of mass for different objects, system of particles and collision, conditions for elastic and inelastic collision, collision in center of mass frame, rigid body kinematics, rotational motion, moment of inertia, theorems on moment of inertia, calculation of moment of inertia of bodies of different shapes.

Unit 4
Central force field, properties of central force field, inverse square law force, gravitational field and potential; Kepler's laws of planetary motion and its application
Wave mechanics, wave particle duality, De-Broglie matter wave, Schrodinger wave equations (time dependent and time independent), uncertainty principle and its applications

Unit 5
Frame of reference, Galilean transformation, Michelson-Morley experiment, postulates of special theory of relativity, Lorentz transformations, Length contraction, time dilation, velocity addition

theorem, variation of mass with velocity, Einstein's mass energy relation, relativistic relation between energy and momentum, rest mass of photon.

Text and Reference Books:

1. Vector Analysis by M. R. Spiegel, Schaum's Outlines, 2021
2. Introduction to Mechanics: R. D. Kleppner and J. Kolenkow, Cambridge University Press, 2nd edition, 2014
3. A textbook of Mechanics by J. C. Upadhyay,Ram Prasas Publications; 1st edition, 2017
4. Mechanics by D. S. Mathur, S. Chand; New edition, 2000
5. Theory& ProblemsofTheoretical Mechanics by M. R. Spiegel, Schaum's Outline Series, 2017
6. Introduction to Special Theory of Relativity by Robert Resnick, Wiley, 1st edition 2007.
7. Concept of physics (Part-I) by H. C. Verma, BhartiBhawan Publisher, 2022.
8. Quantum Mechanics by L.I. Schiff, McGraw-Hill Education (India) Pvt Limited, 2017.
9. A Textbook of Quantum Mechanics by P.M. Mathews and K. Venkatesan, McGraw-Hill Education (India) Pvt Limited,2010.
10. Introduction to Quantum Mechanics by D.J.Griffiths, 3E, Cambridge University Press, 2018.

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Perform basic experiments related to mechanics
CO2	Be familiar with various measuring instruments and also would learn the importance of accuracy of measurements.

Course Details: (Practical)

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))
10. Moment of Inertia of Flywheel (Ref. Book by J. C. Upadhyay and UIET Laboratory Manual) Apparatus used (Fly wheel, weight hanger, slotted weights, stop watch, metre scale)

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Recollect various programming constructs and to develop C programs
CO2	Understand the fundamentals of C programming
CO3	Choose the right data representation formats based on the requirements of the problem
CO4	Implement different Operations on arrays, functions, pointers, structures, unions and files

Course Details:
Basic concepts of Computers, Basic UNIX Concepts and Vi - Editor
Introduction to C: Basic Programming concepts, Program structure in C, Variables andConstants, 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, 3rd edition, BPB Publication, Byron S. Gottfried
2. The 'C' Programming, Denis Ritchi, Second edition,PHI, 1988
3. Mastering C, Venugopal, Second edition, TMH, 2006
4. Let Us C, YashavantKanetkar, 18th Edition, BPB, 2021
5. Programming in ANSI C, Balaguruswami, Eighth Edition, TMH, 2019

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: 0 –2 – 4 – 5**
Course Name: Workshop Concepts

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the design and applications of different machine tools and their operations
CO2	Gain basic knowledge of casting processes and their applications
CO3	Recognize the different types metal forming process and their operations
CO4	Understand and appreciate the basic fabrication processes such as welding
CO5	Have knowledge about modern trends in manufacturing, unconventional machining processes and automation

Course Details: (Theory)

Historical perspectives and Classification of Manufacturing processes

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, presswork & 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 & basic 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

Course Name: Workshop Practice

Course Details: (Practical)

1. Foundry (1turn)

2. Welding (3 turns)
   (a) Gas Welding (1turn)
   (b) Arc Welding(2 urns)

i. Lap Joint (1 turn)
ii. Butt Joint (1 turn)

3. M/C Shop (4 Turns)
4. Fitting & Sheet Metal Work (1 turn+1turn)
5. Carpentry Shop (1turn)
6. Black-smithy shop (1turn)

Text and Reference Books:

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: HSS-S101 **Breakup: 3 –1 – 0 – 4**
Course Name: Professional Communication

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Enhance their communication skills for tackling the professional challenges of a diverse workplace
CO2	Learn effective writing skills and be able to write clear technical reports
CO3	Improve their verbal and non-verbal communication
CO4	Be fluent orally in the use of the nuances of the English language
CO5	Learn good interpersonal skills and be proficient with the soft skills required for national and global placements

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; Flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Importance of technical communication; Barriers to Communication)

Unit - II Constituents of Technical Written Communication Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods - Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation- various steps.

Unit - III Forms of Technical Communication Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports; Technical Proposal; Parts; Types; Writing of Proposal; Significance; Technical Paper, Project. Dissertation and Thesis Writing: Features, Methods & Writing.

Unit - IV 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 - V Value- Based Text Readings Following essays form the suggested text book with emphasis on Mechanics of writing, The Aims of Science and the Humanities by M.E. Prior. The Language of literature and Science by A.Huxley Man and Nature by J.Bronowski The Mother of the Sciences by A.J.Bahm
Science and Survival by Barry Commoner Humanistic and Scientific Approaches to Human Activity by Moody E. Prior The Effect of Scientific Temper on Man by Bertrand Russell.

Text and Reference Books:

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

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Solve the consistent system of linear equations
CO2	Determine the power series expansion of a given function
CO3	Solve arbitrary order linear differential equations with constant coefficients
CO4	Apply Laplace transforms to solve physical problems arising in engineering
CO5	Find eigen values, eigen vectors &diagonalize a matrix
CO6	Understand concept of vector space & linear transformation

Course Details:

Unit–I

Matrix Algebra: Elementary operations and their use in finding Rank, Inverse of a matrix and solution of system of linear equations. Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Normal & Unitary matrices and their elementary properties

Unit–II

Vector Space, Linear transformation, Linear dependent and linear independent, Eigen-values and Eigenvectors of a matrix, Cayley-Hamilton theorem, Diagonalization of a matrix

Unit-III

Ordinary Differential Equations of second order: Solution of linear differential equations with Constant coefficients. Euler-Cauchy equations, Solution of second order differential equations by changing dependent and independent variables; Method of variation of parameters, Introduction to series solution method, Frobenious Methods

Unit- IV

Ordinary differential equations of higher orders: Matrix method

Unit-V

Laplace Transform: Laplace and inverse Laplace transform of some standard functions, Shifting theorems, Laplace transform of derivatives and integrals. Convolution theorem, Initial and final value theorem; Laplace transform of periodic functions, error functions, Heaviside unit step function and Dirac delta function. Applications of Laplace transform.

Text and Reference Books:

1. C.L.Liu : Discrete Mathematics, , McGraw Hill, 2nd Edition, 1985.
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, 1985.
4. J.P.Trembley, R. Manohar, Discrete mathematical structures with applications to computer science, McGraw –Hill, Inc. New York, NY, 1975.

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	understand the vector integration which they can apply in electricity and magnetism
CO2	Understand the concepts of wave optics such as the phenomena of interference, diffraction and polarization of light
CO3	Understand the concepts of electrostatics, magnetostatics, electromagnetic induction, Maxwell's equations and electromagnetic waves
CO4	Apply the concepts of physics in the engineering courses

Course Details: (Theory)

Unit 1
Vector integration, Stokes' theorem, divergence theorem, electrostatics: Coulomb's law, superposition of electric forces, electric flux, Gauss's law, electric field, potential, calculation of electric fields due to different charge distribution, gradient and curl of electric field, electric dipoles and multipoles, potential energy of a dipole placed in external electric field, Laplace's equation, Poisson's equation.

Unit 2
Magnetostatics, motion of charge in electric and magnetic field, Lorentz force, magnetic flux, torque on a current coil in uniform magnetic field, magnetic dipole, potential energy of a magnetic dipole, Biot-Savart law, Ampere's law, calculation of magnetic field due to different current distribution, divergence and curl of magnetic field.

Unit 3
Electromagnetic induction, Faraday's law, Lenz's law, self-induction, mutual induction, growth and decay of current in L-R circuit, electromagnetic waves, displacement current, Maxwell's equations in free space and matter, verification of Faraday's law of electromagnetic induction and Ampere's law in vacuum by using plane electromagnetic waves and derivation of velocity of light (c) in terms of permittivity and permeability of free space, Poynting vectors, Poynting theorem.

Unit 4
Coherent sources, Interference, Fresnel's biprism, interference in uniform and wedge shaped thin films, necessity of extended source, Newton's rings and its applications, Fresnel and Fraunhofer diffraction at single slit and double slits, absent spectra, diffraction grating, spectra with grating, dispersive power, resolving power of grating, Rayleigh's criterion of resolution

Unit 5

Dispersion of light, angular dispersion, dispersive power, irrational dispersion, angular and chromatic dispersion, deviation without dispersion, dispersion without deviation, polarization of light, Fresnel's theory of optical activity and polarimeter, fundamental idea of optical fiber, types of fibers.

Text and References Books:

1. Introduction to Electrodynamics by D.J. Griffiths, 3E, Prentice-Hall of India Private Limited, 2002.
2. Vector Analysis by M. R. Spiegel, Schaum's Outlines, 2021
3. Optics by AjoyGhatak, McGraw Hill Education (India) Private Limited,7th Edition,2020
4. A textbook of Optics by Subrahmanyam, Brijlal and Avadhanulu, Schand; 23rd Rev. Edition. 2006.
5. Classical electrodynamics by J. D. Jackson,Wiley, 3rd edition, 1998.
6. Concept of Modern Physics by AurthurBeiser, McGraw-Hill Education,6th Edition 2021.
7. Introduction to fiber optics by AjoyGhatak and K. Tyagrajan, 1E, Cambridge University Press, 2012

Course Name: Physics Lab-II

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Gain practical knowledge about electricity and magnetism and measurements such as resistance, voltage, current etc
CO2	Gain experimental knowledge of interference, diffraction and polarization of light and measurement of the wavelengths of the monochromatic light with the help of Newton's ring experiment, Fresnel's biprism experiment, etc.
CO3	Understand the concept of semiconductor physics through the four probe experiment
CO4	Gain knowledge about the various optical devices: prism, grating, spectrometer.
CO5	Understand the basic concept of modern physics through the determination of Planck's constant

Course Details: (Practical)

1. Newton's Ring (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Traveling Microscope, Support for Glass Plate inclined at 450 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)
9. Planck's Constant (Ref. Book by S.K. Gupta and UIET Laboratory Manual) Apparatus Used (Power supply, photocell, connecting wires)
10. Energy Band Gap by Four Probe Method (Ref. Book by S.K. Gupta and UIET Laboratory Manual) Apparatus Used (An experimental kit)

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the concept related to atoms and molecules, chemical bonding coordinate compounds and its applications
CO2	Concept of chemical kinetics, electrochemistry, photochemistry and their applications
CO3	Understand the concept of spectroscopy and its applications in various fields
CO4	Understand the basics of stereochemistry, organic reactions and its mechanism for various types of reactions
CO5	Various experiments helps the student to learn the basics of experiments to apply in day today life as well as in industry

Course Details: (Theory)

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 uni-dimensional 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- Application of Spectroscopic Techniques:
Basic working principle on measurement technique: IR, UV visible spectroscopy and NMR

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

UNIT-VII - Photochemistry:

Principles of photo chemistry, 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:

Structure of coordination compounds corresponding to coordination number up to 6, Types of ligands, chelation, Isomerism [geometrical, optical, ionization, linkage and coordination], Theories of bonding in coordination compounds- crystal field theory, Valence bond theory.

Text and Reference Books:

Physical Chemistry-

1. Physical Chemistry, P. Atkins and J De Paul, International student edition , 8th edition, Oxford University Press, (2006)
2. Principles of physical chemistry, B. R. Puri, L.R. Sharma and M.S. Pathania, Shoban Lal Nagin Chand and Co., Jalandhar, 43 edition, Vishal Publishing ***Co***. (2017)

Organic Chemistry-

1. Organic Chemistry, R. T. Morrison and R.N. Boyd, 6th edition, Prentice hall of India (P) Ltd. New Delhi (2016)
2. A Textbook of Organic Chemistry, ArunBahl and B.S. Bahl, S., 22th edition, S.Chand Publishers, New Delhi (2019)

Inorganic Chemistry-

1. Concise Inorganic chemistry, J.D. Lee, 5th edition, (1997).
2. Inorganic Chemistry, J.E. Huyee, E.A. Keiter and R.L. Keiter. 4th edition, Prentice Hall, Upper Saddle River,(2017)

Engineering Chemistry-

1. Engineering chemistry , Shashi Chawala, Dhanpat Rai & Co.(2013)
2. Engineering chemistry , P. C.Jain and Monika Jain. 16th edition,Dhanpat Rai Publishing Company (2015)

Course Name: Chemistry Lab- I

Course Details: (Practical)

1. To estimate the strength of the given unknown solution of Mohr's salt (Ferrous ammonium sulphate ($FeSO_4.(NH_4)SO_4.6H_2O$) using $KMnO_4$ solution as an intermediate.
2. To prepare a sample of p-nitroacetanilide.

3. To prepare a sample of Aspirin.
4. Preparation of Tris (Thiourea) Copper (I) sulphate.
5. Preparation of Hexaamine Nickel (II) chloride [Ni(NH3)6]Cl2.
6. Estimation of commercial caustic soda: Determination of the amounts of sodium carbonate and sodium hydroxide present together in the given commercial caustic soda.
7. Estimation of calcium ions present in tap water.
8. To determine the partition coefficient of acetic acid between n-butanol and water.
9. To study the photochemical reduction of a ferric salt (Blue printing).
10. To determine the viscosity of a given liquid room temperature using Ostwald's viscometer.
11. To separate Ag(I), Hg (I) and Pb(II) ions by paper chromatography and calculate their RF values.
12. Understanding reaction kinetics and calculating the rate and order of a reaction.
13. To study the kinetics of first order reaction (methyl acetate hydrolysis catalysed by o.5 N HCl solution).

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the basics of engineering graphics
CO2	Develop skills to prepare basic engineering drawings
CO3	Understand the concept of projection and acquire visualization skills
CO4	Gain imaginative skills to understand section of solids and developments of surfaces

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 and Reference Books:

1. Narayana,K.L. &Kannaiah,P. "Engg.Graphics". Tata McGraw Hill, New Delhi (2012).
2. Bhatt,N.D. (2014) "Elementary Engg. Drawing" Charotar Book stall. Anand.
3. Lakshminarayanan ,V and VaishWannar , R. S. "Engg.Graphics".Jain Brothers , New Delhi (2006).
4. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
5. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

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

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Predict the behaviour of any electrical and magnetic circuits
CO2	Formulate and solve complex AC, DC circuits
CO3	Realize the requirement of transformers in transmission and distribution of electric power and other applications
CO4	Have knowledge of some basic electronic components and circuits
CO5	Understand the basics of diode and transistor circuits
CO6	Understand the working of some I C based circuits
CO7	Study logic gates and their usage in digital circuits

Course Details: (Theory)

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 and Reference Books:

Text Books

1. Edward Hughe "Electrical and Electronic Technology", 10th Edition, Pearson Education Asia, 2019.
2. P. Kothari, I J Nagrath, "Electric Machines", 5th Edition, Tata McGraw Hill, 2017.
3. P. Malvino, "Electronic Principles", 7th Edition, Tata McGraw Hill, 2007.
4. A Textbook of Electrical Technology - Volume I (Basic Electrical Engineering) 23Rev Ed Edition, S. Chand Publishing.2020

Reference Books

1. S. K. Bhattcharya, “Basic Electrical and Electronics Engineering”, Pearson, 2012.
2. Vincent Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall of India Private Limited, 2nd Edition, 2003.
3. David Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2008.
4. Michael Tooley A., “Electronic circuits: Fundamentals and Applications”, 3rd Edition, Elsevier Limited, 2006.

Basic Electrical & Electronics Engineering Lab

Course Details: (Practical)

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: DIT-S201 **Breakup: 3 - 1 - 3 – 5**
Course Name: Object Oriented Programming Theory

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Able to Explain fundamental features of object oriented language
CO-2	Able to Explain Java Runtime Environment, Java Language building Blocks and illustrate to run simple Java programs
CO-3	Able to Construct Java programs by making use of 3 principles of OOPS with run time error handling mechanisms
CO-4	Able to Make Use of multithreading concepts, and event handling mechanism to build Java programs
CO-5	Able to Develop event driven Graphical User Interface (GUI) programming using applets and swings

Course Details:

Basic Concepts : Object, Class, Inheritance, Instant, Instant variable, Attribute, Encapsulation, Information hiding, Multiple Inheritance, Typing, Dynamic typing, Object analysis, Object oriented issues, Overview (Transition from C) Data types, Variables & Constants, Expression operators & statements. Control structures, Functions, Arrays, Pointers & Strings, Structures & Unions, Classes & Data Abstraction, Objects, Operation Overloading, Inheritance, Virtual Functions & Polymorphism, 1/0 Streams, Templates, Exception Handling, File Processing, Data Structures, Standard C++ and C Language additions, Pre Processors

Text Books and References:

1. Java: The Complete Reference,Herbert Schildt, McGraw Hill, Twelfth Edition, 2021
2. Java 2 Unleashed, Stephen Potts, Alex Pestrikov, Sams Publishing; 6th edition 2002

Object Oriented Programming Lab

1. Programming illustrating the use of classes and objects
2. Programming illustrating the use of functions and parameter passing
3. Programs illustrating overloading of various operators

Ex:Binary operators, Unary operators, New and delete operators etc.

3. Programs illustrating the use of following functions:
4. Programs to create singly and doubly linked lists and perform insertion and deletion
5. Programs illustrating various forms of inheritance: Ex. Single, Multiple, multilevel inheritance
6. Programs on abstract class and derived classes
7. Programs illustrating the use of virtual functions.
8. Write programs illustrating the console I/O operations.
9. Write Programs illustrating how exceptions are handled (cx: division-by-zero, overf1ow and Underflow in stacks etc.

Course Code: **DIT - S203** **Breakup: 3 – 0 – 2 – 5**
Course Name: **Digital Electronics**

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Understand the concepts of basic computer,number system.
CO-2	Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques.
CO-3	Construct Digital multiplexers, Adders and Subtractors, Binary Comparators, Latches and Master-Slave Flip-Flops.
CO-4	Analyze Synchronous and Asynchronous Sequential circuits.
CO-5	Understand registers and Counters, A/D and D/A converters.

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, 6th Edition
2) Morris Mano, Digital Logic and Computer Design, Prentice Hall of India, 1979
3) William I. Fletcher, An Engineering Approach to Digital Design, PHI, 1979
4) Alan B. Marcovitz, Introduction to Logic Design, McGraw Hill, 3rd edition 2009

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-S201 **Breakup: 3 –2 – 0 – 4**
Course Name: Mathematics - III

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Obtain the Fourier series expansion of a given function
CO2	Apply Fourier transform for solving Boundary Value Problems
CO3	Determine the solution of linear partial differential equations (PDE) by variable Lagrange's method & some nonlinear PDEs
CO4	Understand and use of complex variable & analyticity
CO5	Expand a function of Laurent series
CO6	Evaluation of real integrals using residues

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.

Unit-III: Fourier series: Trigonometric Fourier series and its convergence. Fourier series of even and odd functions, Fourier half-range series; Parseval`s identity, Complex form of Fourier series;
Unit-IV: Fourier Transforms: Fourier integrals, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their elementary properties, Convolution theorem, Application of Fourier transforms to BVP
Unit-V: Partial Differential Equations: Formation of first and second order partial differential equations. Solution of first order partial differential equations: Lagrange`s equation, Four standard forms of non-linear first order equations.

Text and Reference Books:

1. C.L.Liu : Discrete Mathematics, , McGraw Hill, 2nd Edition, 1985.
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, 1985.
4. J.P.Trembley, R. Manohar, Discrete mathematical structures with applications to computer science, McGraw –Hill, Inc. New York, NY, 1975.

Course Code: EVS-S101 **Breakup: 2 –0 – 0 – 2**
Course Name: Environmental Science

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the concepts and definitions associated with ecosystems, environmental pollution and its causes
CO2	Gain knowledge to analyse problems and suggest alternatives and new methods to manage natural resources
CO3	Understand how to Redesign, Recreate & Restore the ecosystems
CO4	Understand the legal aspects and the role of government in environment protection

Course Details:

UNIT-I
Scope and Importance of environmental studies, Need for public awareness, Segments of environment, biodiversities: Genetic diversity, Species diversity, Ecosystem diversity, Landscape diversity, Causes of pollution and detrimental effects.

UNIT-II
Eco systems- Types of systems, energy flow in an ecosystem, Balanced ecosystem,
Human activities- Food, shelter, economic and social security, Effects of human activities on environment- Agriculture, housing, Industry, mining and transportation activities, Basics of Environmental Impact Assessment, Sustainable Development.

UNIT-III
Types of natural resources: Water resources-Availability and quality aspects, Water borne diseases, Fluoride problems in portable water, Mineral resources, Food resources, Land resources, Forest Wealth, Material cycles- Carbon, Nitrogen and Sulphur cycle.

UNIT-IV
Energy- Different types of energy (Renewable and Non-renewable), Convectional and non-conventional energy-sources Electromagnetic radiation, Hydro Electric, Fossil fuel based, Nuclear, Solar, Biomass and Bio-gas, Hydrogen as an alternative future source of energy

UNIT-V
Environmental pollution and their effects, Water pollution, Land pollution, Noise pollution, public Health aspects, Air pollution. Current environmental issues of importance and their impact on environment: Population Growth, Climate change and global warming effect, Urbanization, Automobile pollution, Acid rain, Ozone layer depletion.

UNIT-VI
Preventive measures and control of pollution, Air and Water pollution control, Sold waste management, Case studies.

UNIT-VII

Role of Government in environment protection, Legal Aspects, Initiatives and protection Acts, public awareness, Initiatives by Non-governmental Organizations (NGOs), Role of IT services, Disaster management.

UNIT-VIII

Field work/ Activities/ Visit

Text and References Books:

1. Environmental Studies- Benny Joseph, TATA Mcgaw Hill publication,Third edition, 2017.
2. Environmental Studies- Dr. D.L. Manjunath, pearson Education, 2022.
3. Environmental Studies- R. Rajgopalan, Oxford publication.
4. Environmental Science and Technology- M. Anji Reddy, BS publication.
5. Principles of Environmental Science and Engineering- P. Venugopalan Rao, Prentice Hall of India, 2006.
6. Environmental Science and Engineering- Meenakshi, Prentice Hall of India, 2005.

Course Name: Universal Human Values – II

Course Code: UHV-S201 **Breakup: 2 –1 – 0 – 3**

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc
CO3	Understand the role of a human being in ensuring harmony in society and nature
CO4	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work

Course Details:

UNIT I: Introduction to Value Education

Value Education, Definition, Concept and Need for Value Education.
The Content and Process of Value Education
Basic Guidelines for Value Education
Self exploration as a means of Value Education
Happiness and Prosperity as parts of Value Education

UNIT II: Harmony in the Human Being

Human Being is more than just the Body
Harmony of the Self ('I') with the Body
Understanding Myself as Co-existence of the Self and the Body
Understanding Needs of the Self and the needs of the Body
Understanding the activities in the Self and the activities in the Body

UNIT III: Harmony in the Family and Society and Harmony in the Nature

Family as a basic unit of Human Interaction and Values in Relationships
The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love
Comprehensive Human Goal: The Five Dimensions of Human Endeavour.
Harmony in Nature: The Four Orders in Nature.
The Holistic Perception of Harmony in Existence

UNIT IV: Social Ethics

The Basics for Ethical Human Conduct
Defects in Ethical Human Conduct
Holistic Alternative and Universal Order
Universal Human Order and Ethical Conduct
Human Rights violation and Social Disparities

UNIT V: Professional Ethics

Value based Life and Profession.
Professional Ethics and Right Understanding
Competence in Professional Ethics
Issues in Professional Ethics – The Current Scenario
Vision for Holistic Technologies, Production System and Management Models

Text and Reference Books:

1. R.R. Gaur., R, Sangal. G.P Bagaria., A Foundation Course in Value Education, Excel Books, (2009).
2. R.R. Gaur., R, Sangal. G.P Bagaria, Teachers Manual for A Foundation Course in Human Values and Professional Ethics Excel Books, (2009).
3. A.N. Tripathy, Human Values, New Age International Publishers, (2003)
4. A. Nagaraj, JeevanVidya: EkParichaya, JeevanVidyaPrakashan, Amarkantak, (1999)
5. M.K. Gandhi, My Experiemnts with Truth, Maple Classics (2011)
6. I.C. Sharma, Ethical Philosophy of India, Nagin & Co Julundhar
7. Cecile Andrews, – Slow is Beautiful (2006)

Course Code: **DIT - S205** **Breakup: 3 – 1 – 3 – 5**
Course Name: **Data Structure**

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Understand basics knowledge of data structure operations like insertion, deletion etc for various data structure and their application.
CO-2	Analyze the problem and create appropriate algorithm.
CO-3	Develop and implement various programs using C for non linear data structure.
CO-4	Investigate and solve difficulties in the implementation of searching techniques.
CO-5	Know application file and graphs in real world.

Course Details:

Basic concepts and notations, Mathematical background, Revision of arrays and pointers, Recursion and implementation of Recursion

Stacks and Queues: Sequential representation of stacks and queues

Lists: List representation techniques, Dynamics Storage allocation, Representation of stacks and queues using linked list, operations on linked list, Introduction to Doubly linked list.

Sorting Algorithms: Insertion sort, Bubble sort, Quick sort, Merge sort, Heap sort, Shell sort, Time and Space complexity of sorting algorithms

Tables: Searching sequential tables, Index sequential searching, Hash tables, Heaps.

Trees: Definition and basic concepts, Linked tree representations, Binary tree traversal algorithms,(Preorder, Inorder, Postorder), Binary search tree, Insertion and Deletion in Binary search tree, Multiway search trees, B trees, B+ tree and their applications, Digital search trees and Trie structure.

Graphs: Introduction to Graphs, Implementation of Graphs, Depth first search, Breadth first search.
Introduction to External Sorting

Text Books and References:

1. Data Structure Using C and C++, Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, ,Second Edition, Pearson education, 2002.
2. Data Structures with C (Schaum's Outline Series), Seymour Lipschutz, McGraw Hill, first edition, 2017
3. Data Structures Using C, Aaron M. Tenenbaum, McGraw Hill, first edition, 1989

Data Structures Lab

Write Program in C / C++ 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: **DIT-S202** **Breakup:** **3 – 1 – 0 – 4**
Course Name: **Computer Organization**

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Explain the basics of organizational and architectural issues of a digital computer and Classify and compute the performance of machines, Machine Instructions.
CO2	Describe various data transfer techniques in digital computer and the I/O interfaces.
CO3	Analyze the performance of various classes of Memories, build large memories using small memories for better performance and analyse arithmetic for ALU implementation
CO4	Describe the basics of hardwired and micro-programmed control of the CPU, pipelined architectures, Hazards and Superscalar Operations

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 :

1. V.C. Hamacher, Z.G. Vranesic and S.G.Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996.
2. Computer Organization & Architecture, Stallings, Eleventh Edition, Pearson, 2022
3. Computer Organization & Design, David A Paterson and John L. hennery, fifth edition, Morgan Kaufmann,
4. Computer System & Architecture, Morris Mano, TMH,,Third edition, 2007

Course Code: DIT-S206 **Breakup: 3 - 0 - 3 - 5**

Course Name: SOFTWARE ENGINEERING

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Learn the concepts of software crisis, issues, characteristics, evolution and application with respect to software engineering.
CO-2	Know the fundamental aspects of software development with respect to requirement engineering, requirement analysis, design, coding, testing and maintenance
CO-3	Elaborate the implementation of life cycle and models used in software development.
CO-4	Gain practical knowledge of software designing along with object oriented design approach and its methodology
CO-5	Find the practical implementation of software coding style and software testing strategies for software development
CO-6	Know the practical knowledge in software development in terms of maintenance of software after software implementation
CO-7	Enhance the knowledge of management of software project from initial stage to final stage for software development.
CO-8	Access the practical knowledge for ensuring the quality and reliability of software during software development using models.

Course Details:

Unit-I: Introduction
Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

Unit-II: Software Requirement Specifications (SRS)
Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

Unit-Ill: Software Design
Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

Unit-IV: Software Testing

Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom- Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

Unit-V: Software Maintenance and Software Project Management

Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

Text and References Books:

1. Software Engineering: A Practitioner's Approach, Bruce R. Maxim (Author), Roger S. Pressman, McGraw Hill Education; Eighth edition,2019
2. Integrated approach to software engineering, Pankaj Jalote, Narosa, 2005
3. Software Engineering: A Precise Approach, Pankaj Jalote, Wiley,2010
4. Fundamentals of Software Engineering, Rajib Mall, PHI Learning; 5th edition, 2018
5. Sommerville – S/W Engineering, Pearson Education; First edition,2020

Course Code: HSS-S401 **Breakup: 3 –0 – 0 – 4**
Course Name: Industrial Economics

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Have sufficient knowledge about demand and supply problems
CO2	Understand concepts of production and cost analysis
CO3	Use of microeconomic tools in problem solving
CO4	Utilisation of limited resources in meeting the rising demand in the market

Course Details:

UNIT-1
Meaning, definition and scope of economics, Basic concepts of demand and supply, Market equilibrium, Ceiling price and floor price.

UNIT-2
Price elasticity of demand: Factors affecting price elasticity of demand, Calculation, Relation between marginal revenue, demand and price elasticity, Income elasticity of demand and Cross elasticity of demand, Indifference curves, Budget Line

UNIT-3
Production and Cost analysis: Basic concepts, Production in the short- run and long-run, cost analysis
Finding the optimal combination of inputs, Returns to scale

UNIT-4
Market: Characteristics of perfect completion, Profit maximisation in short-run and long-run
Firms with market power: Measurement and determinants of market power, Profit maximisation under monopoly: output and pricing decisions, Price discrimination, capturing consumer surplus, Strategic decision making in oligopoly markets

UNIT-5
National income: Concepts, Sources, Measurement, Difficulties, circular flow of income
Inflation: Cost-push and Demand-pull inflation, Effects and control of inflation, Business cycle, Functions of RBI, GST

Text and References Books:

1. Economics by Paul. A. Samuelson, McGraw-Hill; Twentieth edition, 2019
2. Managerial Economics by Christopher R. Thomas, S. Charles Maurice, Sumit Sarkar, McGraw Hill Education; 9th edition, 2010
3. Financial Management by J. V. Vaishampayan, New Royal Book Company; 1st edition, 2015
4. Micro Economics by A. Koutsoyannis, Palgrave Macmillan; 2nd edition, 1979

Course Code: MTH-S301 **Breakup: 3 – 1 – 0 – 4**
Course Name: Discrete Mathematics
Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Analyze logical propositions via truth tables.
CO2	Prove mathematical theorems using mathematical induction.
CO3	Understand sets and perform operations and algebra on sets
CO4	Determine properties of relations, identify equivalence and partial order relations, sketch relations
CO5	Identify functions and determine their properties
CO6	Define graphs, digraphs and trees, and identify their main properties
CO7	Evaluate combinations and permutations on sets

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, Recursive definitions, Relations and Functions, Equivalence relations, Composition of relations, Closures, Partially ordered sets, Hasse Diagram's, Lattices (Definition and some properties).

Unit-III: Algebraic Structures : Definition, Semi groups, Groups, Subgroups, Abelian groups, Cyclic groups.

Unit-IV: Graph Theory: Incidence, Degrees, Walks, Paths, Circuits, Charactarization theorems, Connectedness, Euler graphs, Hamiltonian graphs, Travelling salesman problem, Shortest distance algorithm (Djkstra's), Trees, Binary trees, Spanning trees, Spanning tree algorithms Kruksal's and Prim's .

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. Elements of Discrete Mathematics: A Computer Oriented Approach, C Liu (Author), D. Mohapatra, McGraw Hill Education, 4th edition 2017
2. B.Kolman, R.C.Busby, and S.C.Ross, Discrete mathematical structures, 5/e, Prentice Hall, 2004
3. Discrete mathematical structures For computer scientists &Mathematicians ,J.L.Mott, A.Kandel and T.P.Baker, Pearson Education India, 2nd edition, 2015
4. J.P.Trembley, R. Manohar, Discrete mathematical structures with applications to computer science, McGraw –Hill, Inc. New York, NY,1975

Course Code: DIT – S303 **Breakup: 3 – 0 – 0 – 4**
Course Name: Theory of Computation

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Describe the concept of abstract machines and their power to recognize the languages.
CO-2	Apply finite state machines for modeling and solving computing problems
CO-3	Design context free grammars for formal languages.
CO-4	Distinguish between decidability and undesirability
CO-5	Solve mathematical tools and formal methods

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 Turing 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,3rd edition Addisionwesley, 2007.
2. Peterlinz – An Introduction to formal Language & automata (Narosa Publication House), 6th edition, Jones & Bartlett, 2016
3. Theory of Computer Science: Automata, Languages and Computation, Mishra K.L.P, Prentice Hall India Learning Private Limited, 3rd edition,2006
4. Introduction to Computer Theory, Daniel I.A. Cohen, Wiley; Second edition 2007
5. Theory of Computation (TMH),John Martin, McGraw Hill Education; 3rd edition 2007
6. Introduction to Theory of Computation, Michael Sipser,2nd Edition, Thomson course technology, 2014

Course Code: **DIT-S305** **Breakup:** **3 – 0 – 0 – 4**
Course Name: **Design and Analysis of Algorithms**

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Understand the algorithms and notation, including order notation, and how to analyze the complexity of the algorithms.
CO-2	Understand the concept of Hashing, tree .
CO-3	Compare, contrast, and apply the key algorithmic design paradigms: divide and conquer, greedy method, dynamic programming techniques.
CO-4	Understand the concepts of Graph algorithms to solve problem using Greedy method as well as dynamic programming techniques.
CO-5	To understand the concepts of Randomized, and exact vs. approximate. Implement, empirically compare, and apply fundamental algorithms and string matching, P, NP and NP complete real-world problems.

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 shortestpaths, 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, 2011
2. Algorithm Desig, Jon Kleinberg,Pearson Education India; 1st edition,2013
3.Introduction to Algorithms, Charles E. Leiserson, Thomas H. Cormen, MIT Press; 4th edition 2022
4. Computer Algorithms: Introduction To Design And Analysis, Sara Baase and Van Gelder, Pearson Education,2000
5. Design & Analysis of Computer Algorithms, AHO, Pearson Education India; 1st edition 2002

Course Code: **DIT-S307** **Breakup:** **3 –1–3– 5**

Course Name: **Database Management Systems**

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Able to understand the basic concepts of DBMS and ER Model and How to draw ER Diagrams.
CO-2	Ability to define constraints, writing queries using SQL syntax and Applying the Relational algebra and Calculus to define expressions for queries in Databases.
CO-3	Able to understand the purpose of Normalization and defining various Normal forms.
CO-4	Able to understand the basic issues while implementing the concept of Transaction and recovery.
CO-5	Able to understand the various Concurrency Control techniques and concepts of Object Oriented databases.

Course Details:

Introduction: Database-System Applications, Purpose of Database Systems, File processing disadvantages, View of Data, Data Abstraction, Data Models, 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 Sub queries, 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, The Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus

Functional Dependencies

Extraneous Attribute, Left irreducible FD, Prime/non-prime attributes, 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. Database System Concepts, Abraham Silberschatz), Henry F. Korth, S. Sudarshanl, McGraw Hill; 7th edition, 2021
2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education; Third edition 2014

3. Fundamentals of Database Systems, ElmasriRamez,NavatheShamkant, Pearson Education; Seventh edition 2017

DBMS Lab

1) Creating tables for various relations (in SQL)
2) Implementing the queries in SQL for
    a) Insertion
    b) Retrival (Implement all the operation like Union, Intersect, Minus, in, exist, aggregate functions (Min.,Max…) etc…
    c) Updation d) Deletion
3) Creating Views
4) Writing Assertions
5) Writing Triggers
6) Implementing Operations on relations (tables) using PI/SQL
7) Creating FORMS
8) Generating REPORTS.

Course Code: DIT-S309 **Breakup:** 3 – 0 – 3 – 4
Course Name: Operating System

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Explain the types of operating system and ability to create threads and perform interposes communication.
CO-2	Understand CPU scheduling and able to solve process synchronization problems.
CO-3	Understand issues surrounding deadlock handling and memory management.
CO-4	Explain paging and segmentation methods suitable for virtual memory. Ability to manage files and directory.
CO-5	Be able to recovery and manage disk spaces. Knowledge of files systems and Android OS.

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.

Inter process 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. Operating system concepts, A.Silberschatz and P.B. Galvin, , Wiley, 8th edition, 2017
2. Schaum's Outline of Operating Systems, J. Archer Harris, McGraw-Hill Education, 2001
3. Modern Operating Systems, Andrew Tanenbaum, Pearson; 4th edition 2014
4. Operating Systems Concepts And Design, Milan Milenkovic, McGraw Hill Education; 2nd edition 2001
5. Operating Systems: Internals and Design Principles, William Stallings, Pearson, 9th edition, 2018
6. Operating Systems : A Design-Oriented Approach, Charles Crowley, McGraw Hill Education, 2017

Course Code: DIT-S302 **Breakup:** 3 – 0 – 3 – 4
Course Name: Computer Networks

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	With a new approach of communication, a student shall be able to transfer data through respective medium; also he can opt various ways of networking using topologies. A student can also understand the difference between the time and frequency domain transmission in order to analyze various switching modes
CO-2	For new IEEE standard, a student should overcome the previous phenomena for networking using different domains. He/ she should know the conditions regarding the channel allocations, collision detection and its avoidance.
CO-3	For a particular data transfer system, student shall be able to analyze which router is good for networking using different algorithms. A student shall able to differ between the approaches used in congestion control and protocols in network layer
CO-4	He/she should be able to know the duties regarding respective layer. A student should be aware of the fact when to use TCP and when to use UDP for synchronization between hop points so that a student can analyze encryption and decryption techniques for proper data transfer CO5 For securing data and a system, a student can evaluation
CO-5	For securing data and a system, a student can evaluate different procedures and algorithms based on network security and he/she should learn about the protocols to used according to the format of data transfer

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. Computer Networks, S. Tanenbaum, Pearson Education India; Sixth edition,2022
2. Data and Computer Communication, Stallings William,Pearson Education; Tenth edition, 2017
3. Data Communications and Networking with TCPIP ProtocolSuite, Behrouz A. Forouzan, 6/e, McGraw Hill Education (India) Private Limited, 2022
4. Unix Network Programming Volume 1, Steavens/ Bill Fenner / Rudoff, Vol. 1, Pearson Education India; 3rd edition,2015
5. Computer Networks: A Systems Approach,Peterson, Elsevier, Fifth edition 2011

Course Code: DIT-S308 **Breakup: 3 -0 - 3 - 5**
Course Name: INTERNET TECHNOLOGY

CO-1	Able to understand the basic terminology of web and concepts of web projects.
CO-2	Hands on practice on HTML and learn to implement HTML in web development.
CO-3	Hands on practice on CSS and learn to implement CSS in web development.
CO-4	Understand the concepts and use of JavaScript in web applications.
CO-5	Understand the use of PHP as server side language.

Course Details:

UNIT I
Introduction and Web Development Strategies History of Web, Protocols governing Web, Creating Websites for individual and Corporate World, Cyber Laws Web Applications, Writing Web Projects, Identification of Objects, Target Users, Web Team, Planning and Process Development.

UNIT II
HTML, XML and Scripting List, Tables, Images, Forms, Frames, CSS Document type definition, XML schemes, Object Models, Presenting XML, Using XML Processors: DOM and SAX Introduction to JavaScript, Object in Java Script, Dynamic HTML with Java Script.

UNIT Ill
Java Beans and Web Servers Introduction to Java Beans, Advantage, Properties, BOK, Introduction to EJB, Java Beans API Introduction to Servelets, Lifecycle, JSDK, Servlet API, Servlet Packages: HTTP package, Working with Http request and response, Security Issues.

UNIT IV
JSP Introduction to JSP, JSP processing, JSP Application Design, Tomcat Server, Implicit JSP objects, Conditional Processing, Declaring variables and methods, Error Handling and Debugging, Sharing data between JSP pages- Sharing Session and Application Data.

UNIT V
Database Connectivity Database Programming using JDBC, Studying Javax.sql. *package, accessing a database from a JSP page, Application-specific Database Action, Developing Java Beans in a JSP page, introduction to Struts framework.

Text Book and References:

1. Collaborative Web Development: Strategies and Best Practices for Web Teams, Jessica Burdman, Addison Wesley 1999
2. Chris Bates, “Web Programing Building Internet Applications”, John Wiley & Sons Inc; 3rd edition 2006
3. Joel Sklar , “Principal of web Design” Cengage; 5th edition 2012
4. Core Java: An Integrated Approach, R. Nageswara Rao, Dreamtech Press 2016
5. Herbert Schieldt, The Complete Reference:Java, McGraw Hill; Standard Edition 2022
6. Hans Bergsten, “Java Server Pages”, O′Reilly; 1st edition 2001

Course Code: **HSS-S301** **Breakup:** **1 – 1 – 1 – 2**
Course Name: **Professional Communication**

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Plan, draft, revise, and edit documents for use in professional settings
CO2	Adapt writing to different audiences, purposes, and contexts
CO3	Synthesize and report on the professional and technical literature in the field
CO4	Write in a clear, coherent, and direct style appropriate for engineering communication
CO5	Understand and employ common documents in engineering writing, including proposals, failure
CO6	Analyses technical descriptions, research reports, and professional correspondence
CO7	Avoid plagiarism search, evaluate, and cite primary and secondary sources
CO8	Format documents in IEEE, the formatting style used in engineering communication

Course Details:

Unit 1- Presentation Techniques

- Meaning and importance of presentation technique
- Use of presentation techniques in everyday life
- Presentation skills required for business organization
- Types of business presentations-meetings, seminars, Conferences

Unit 2-Oral presentations

- Effective oral presentation techniques
- Tips for good oral delivery; debates, elocution, impromptu speeches
- Levels and models of organizational Communication
- Interviews-types of interviews
- Group discussions

Unit 3- Written communication

- Style and tone of writing business messages and Documents.
- Writing for websites, internet e-mails and short messages
- Applications, letters, memos
- Proposals and report writing

Unit 4 - Nonverbal presentations

- Nonverbal communication techniques
- Business manners, ethics and personality development
- Audio/visual presentations, power point presentations
- Art of delivery

Unit 5- Literary concepts

- Stories, essays, comprehension
- Reading techniques-skimming and scanning methods
- Listening skills

Text Book and References:

1) “Business Communication Today”, Bove’e, Thill and Schatzman: Pearson Education(Singapore),2003
2) “Business Communication-a framework of success”, H.Dan O’Hair, James S.O’Rourke and Mary John O’ Hair: South Western College Publishing 2001.
3) “Basic Business Communication”, Raymond V.Lesikar, Marie E.Flatley: Tata McGraw Hill Publishing Company Ltd., 2002.

Course Code: **DIT-S401** **Breakup: 3– 0 – 3 – 5**
Course Name: **Digital Image Processing**

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Review the fundamental concepts of a digital image processing system
CO2	Analyse images in the frequency domain using various transforms
CO3	Evaluate the techniques for image enhancement and image restoration.
CO4	Categorize various compression techniques
CO5	Interpret Image compression standards
CO6	Interpret image segmentation and representation techniques

Course Details:

UNIT-I

The image model and image acquisition image shape, sampling, intensify images, color images, range images, image capture, scanners.

UNIT-II

Statistical and spatial operations Grey Level transformations, histogram equilization, multi image operations. Spatially dependent transformations, templates and convolution window operations, Directional smoothing, other smoothing techniques.

UNIT-III

Segmentation and Edge detection region operations, Basic edge detection, second order detection, crack edge detection edge following, gradient operators, compass &laplace operators.

UNIT-IV

Morphological and other area operations, basic morphological operations, opening and closing operations, area operations morphological transforms.

UNIT-V

Image compression: Types and requirements, statistical compression, spatial compression, contour coding, quantizing compression.

Text Books and References:

1. Andrion Low-Introductory computer Vision and Image Processing MCGraw Hill International Edition, 1991
2. Digital Image Processing, Rafael Gonzalez ,Richard Woods,Pearson; 4th edition 2017)

Course Code: **HSS-S201** **Breakup:** **3 – 0 – 0 – 4**
Course Name: **Industrial Management**

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Choose, prepare, interpret and use cost estimates as a basis for the different situations in an industrial company
CO2	Interpret financial statements and other financial reports of industrial companies, including the income statement, the balance sheet, the cash flow statement, key measures, budget and sustainalbility analysis in these
CO3	Explain how the industrial company can be organised and managed
CO4	Explain the industrial company's value creating processes, how the company can price it's products and how the company works in it's environment.

Course Details:

Introduction to Industrial management, Brief history of industries in India, Brief definition of management, organization and administration. Characteristics of management, Principle of management, Function of management like, planning, organization, direction, co-ordination etc.

Level of management, skills of management, inter relation between skills and levels of management, scientific management, Introduction to Schools of Management thoughts, introduction to organization, study of basic type of organization for ex. Line and staff organization, project organization, metrics organization, Informal organization, Introduction to industrial Psychology, Motivation theory and study of Maxlow, Need, Hierarchy Theory, Planned Location, Planned Layout. Study of different forms of layout like line layout, process layout, product layout, combinational layout, sixth position layout etc.

Objective of planned layout, introduction to material management, scope of material management, study of inventory control method, introduction to different types of inventory control techniques, introduction to work study, motion study etc, introduction to conflict management.

Text Book and References:

1. Khanna O.P. : Industrial Engineering, Dhanpat Rai Publications 2018
2. Industrial Engineering and Management, DivyaZindani Kaushik Kumar, Dreamtech Press 2020
3. Mahajan : Industrial and Process Management, Dhanpat Rai & Co. (P) Limited 2015

Course Code: DIT-S402 **Breakup: 3 - 1 - 0 - 4**
Course Name: INFORMATION SYSTEMS

Course outcomes (CO): At the end of the course, the student will be able to:

CO-1	Able to understand basic concepts Information System, and different types of Information Systems.
CO-2	Able to understand the Information System for Business Operations, Managerial Decision Support and Strategic Advantage.
CO-3	Able to design and develop various, Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management.
CO-4	Able to approach Modern System Analysis and Design, Improving is Development Productivity, Identifying and Selecting System Development.
CO-5	Able to understand Process Modeling, Logic Modeling, Structured English, Decision Tables, Decision Trees, Organizational.

Course Details:

Introduction to Information system, Understanding system from business view point, Business processes Types & Levels of Information Systems.

An overview of SCM, KM, CRM, ERP. Technology support for IS: Data warehousing concepts Data pre-processing Concept of data cube.

Comparison of OLAP with OLTP systems Overview data mining for knowledge discovery Mini project or by means of programming

Text & References:

Text:

1. Management Information Systems, Effy OZ, Thomson Leaning/Vikas Publications
2. Management Information Systems, James A. O'Brein, Tata McGraw-Hill

References:

1. Rober G . Mudrick , Joel E . Ross And James R . ClAGGET , Information Systems For Modern Management , 33rd Edition , 1992 , Prentice Hall Of India (P) Ltd ., Eastern Economy Edition .
2. Jerome Kanter Management Information Systems, 3rd Edition , 1990 . Prentice Hall Of India Ltd. , Eastern Economy Edition

Departmental Electives

Detailed Syllabus

Course Code: DIT-S208 **Breakup: 3 -0 -3 -4**

Course Name: INTRODUCTION TO LINUX AND SHELL PROGRAMMING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Understand Linux Architecture and Effectively use Linux Environment using shell, filters and program development tools.
CO2	Perform file I/O management through commands and perform package management, storage management and failure recovery.
CO3	Automate tasks and write simple programs using scripts.
CO4	Configure important services like FTP, DNS,Squid and WEB

Course Details:

UNIT- I A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, Is, cp, mv, rm, cat, more, wc, Ip, od, tar, gzip, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities, tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio

UNIT - II Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization. Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT - III Grep: Operation, grep Family, Searching for File Content. Sed :Scripts, Operation, Addresses, commands, Applications, grep and sed. UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors, system calls and device drivers. File Management :File Structures, System Calls for File Management- create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API - opendir, readdir, closedir, mkdir, rmdir, umask.

UNIT - IV PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets. File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.

UNIT - V INTER PROCESS COMMUNICATION: Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands. INTRODUCTION TO SOCKETS: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.

Text Books and Reference:

1. W. Richard. Stevens (2005), Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India.

2. Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg.Thomson, Paperback 2003

3. Linux System Programming, Robert Love, O'Reilly, SPD, 2013.

4. Advanced Programming in the UNIX environment, 2nd Edition, W.R.Stevens, Pearson Education, 2005

5. UNIX for Programmers and Users, 3rd Edition, Graham Glass, King Ables, Pearson Education, 2003

Course Code: DIT-S311 **Breakup: 3 -0 -0 -4**

Course Name: INTRODUCTION TO COMPILERS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO-1	Students will acquire knowledge about phases of compilation. Students will be able to understand the role of Lexical Analyzer in Compilation Process.
CO-2	Studies about the various parsing techniques helps the students to understand about Parsing Process. Students will learn the difference between top down and bottom up parser.
CO-3	Knowledge of Ambiguities in the context free Grammar helps students in problem analysis. Students will be able to analyze different parsing techniques used for Compilation
CO-4	Students gain the ability to learn about the Intermediate code generation in compilation process. Information acquired from the fundamentals of intermediate representation leads to implementation of target code.
CO-5	Understanding the various storage al location strategies helps in organization of information in the Run Time Environment of Compilation. Students will be acquiring knowledge about Instruction Level Optimization.

Course Details:

UNIT – I: INTRODUCTION TO COMPILERS: Definition of compiler, interpreter and its differences, the phases of a compiler, role of lexical analyzer, regular expressions, finite automata, from regular expressions to finite automata, pass and phases of translation, bootstrapping, LEX-lexical analyzer generator. PARSING: Parsing, role of parser, context free grammar, derivations, parse trees, ambiguity, elimination of left recursion, left factoring, eliminating ambiguity from dangling-else grammar, classes of parsing, top down parsing - backtracking, recursive descent parsing, predictive parsers, LL(l) grammars.

UNIT – II: BOTTOM UP PARSING: Definition of bottom up parsing, handles, handle pruning, stack implementation of shift-reduce parsing, conflicts during shift-reduce parsing, LR grammars, LR parsers-simple LR, canonical LR(CLR) and Look Ahead LR (LALR) parsers, error recovery in parsing, parsing ambiguous grammars, YACC-automatic parser generator.

UNIT- III: SYNTAX DIRECTED TRANSLATION: Syntax directed definition, construction of syntax trees, Sattributed and L-attributed definitions, translation schemes, emitting a translation. INTERMEDIATE CODE GENERATION: intermediate forms of source programs- abstract syntax tree, polish notation and three address code, types of three address statements and its implementation, syntax directed translation into three-address code, translation of simple statements, Boolean expressions and flow-of-control statements.

UNIT – IV: TYPE CHECKING: Definition of type checking, type expressions, type systems, static and dynamic checking of types, specification of a simple type checker, equivalence of type expressions, type conversions, overloading of functions and operators. RUN TIME ENVIRONMENTS: Source language issues, Storage organization, storage-allocation strategies, access to non-local names, parameter passing, symbol tables and language facilities for dynamic storage allocation.

UNIT – V: CODE OPTIMIZATION: Organization of code optimizer, basic blocks and flow graphs, optimization of basic blocks, the principal sources of optimization, the directed acyclic graph (DAG) representation of basic block, global data flow analysis. CODE GENERATION: Machine dependent code generation, object code forms, the target machine, a simple code generator, register allocation and assignment, peephole optimization.

Text Books and Reference:

1. A.V. Aho, R. Sethi and J.D. Ullman, Compilers: Principle Techniques and Tools, Addition- Wesley 2007, 2nd edition.
2. Steven Muchnick – Advance Compiler Design Implementation (Elsevier India), 2008
3. Theory and Practice of Compiler Writing, Jean Paul Trembla, Paul Gordon Sorenson, McGraw-Hill Inc.,US, 1985
4. Compiler Design in C, Holub (Author), Allen, Prentice Hall India Learning Private Limited, 1992

Course Code: DIT-S501 **Breakup: 3 - 0 - 0 - 4**

Course Name: SOFTWARE PROJECT MANAGEMENT

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Gains knowledge of software economics, phases in the life cycle of software development.
CO2	Describes the purpose and importance of project management and analyze the artifacts and metrics from the perspective of planning, tracking and completion of the project
CO3	Analyzes the major and minor milestones in technical perspective.
CO4	Gains knowledge of Project organization, process instrumentation and differentiate Organization structures and Project Structures.
CO5	Implements a Project to manage project schedule, expenses and resources with the application of suitable project management tools.
CO6	Designs and develops a software product using conventional and modern principles of software project management.

Course Details:

UNIT-I: Introduction and Software Project Planning

Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.

UNIT-II: Project Organization and Scheduling

Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions,Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.

UNIT-Ill: Project Monitoring and Control

Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.

UNIT-IV: Software Quality Assurance and Testing

Testing Objectives, Testing Principles, Test Plans, Test Cases, Types ofTesting, Levels ofTesting, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.

UNIT-V: Project Management and Project Management Tools

Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and

risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

Text Books and Reference:

Text Books:

1. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", Fifth Edition, Tata McGraw Hill, 2011.

2. "Accounting for Management" JawaharLal, 5th Edition, Wheeler Publications, Delhi

Reference Books:

1. JackMarchewka," Information Technology-Project Management", Wiley Student Version, 4th Edition, 2013.

2. James P Lewis,"Project Planning, Scheduling & Control", McGraw Hill, 5th Edition, 2011.

3. PankajJalote," Software Project Management in Practise", Pearson Education, 2002

Course Code: DIT-S502 **Breakup: 3 -0 - 0 - 4**

Course Name: MOBILE COMPUTING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Understand and identify the GSM, GPRS and Bluetooth software model for mobile computing
CO2	The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
CO3	Understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
CO4	Analyze QoS over wire and wireless channels
CO5	Able to promote the awareness of the life-long learning, business ethics, professional ethics and current marketing scenarios.

Course Details:

Unit-I: Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air- interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit – II: Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit- III: Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Unit- IV: Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Unit-V: Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

Text Books and Reference:

1. Wireless Communication –Theodore . S. Rappaport, (PHI 2002),2nd edition
2. Mobile Communication - Jochen Schiller, Adison Wisley, 2nd Edition 2003

Course Code: DIT-S503 **Breakup: 3 - 0 - 0 - 4**
Course Name: INFORMATION CODING TECHNIQUES

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Define the amount of information per symbol and information rate of a discrete memory less source
CO2	Apply lossless source codes for discrete memoryless source to improve the efficiency of information.
CO3	Explain the Galois field and the related properties and operations.
CO4	Apply different channel coding techniques for error detection and correction schemes.
CO5	Analyze the coded word for error detection and correction due to channel noise

Course Details:

Information Entropy Fundamentals, Data and Voice Coding, Error Control Coding, Comprehension Techniques, Audio and Video Coding.

Text Books and Reference:

1. Simon Haykin, "Communication Systems", John Wiley and Sons, 4th Edition, 2001.
2. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002; Chapters: 3,4,5.
3. Mark Nelson, "Data Compression Book", BPB Publication 1992.
4. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.

Course Code: DIT-S504 **Breakup: 3 - 0 - 0 - 4**

Course Name: ADVANCE COMPUTER ARCHITECTURE

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO-1	For a microprocessor system, student should be able to deal with the internal architecture of 8 bits, to analyze the working operation and to know the pin configuration for the respective microprocessor. A student shall be having an idea of machine cycle for the good operation and results for other basic properties
CO-2	For a 16 bit microprocessor, a student should overcome the working of 8 bit to 16 bit. He/she should be clear about the facts related to above said microprocessors. A student should be good enough to deal with interrupts internally or externally
CO-3	For a particular data instruction set, student should be having a clear idea of solving machine language programs using kit. He/she shall be having an idea to tackle with counter delays and subroutines
CO-4	He/she should be able to know the concept of pipelining and parallelism in uniprocessor system for hazard detection. A student should have a basic idea of job levels that are governed by an organization on priority basis. He/she should know the classifications of Instruction and Arithmetic Pipelines
CO-5	For good networking, a student should be able to draw SIMD interconnections and FFT or a butterfly method system for collision prevention and vector dispatching. He/she should be able to make Cube Interconnection Network, Shuffle-Exchange and Omega Network.

Course Details:

Unit - I: Introduction

Parallel Computing, Parallel Computer Model, Program and Network Properties, Parallel Architectural Classification Schemes, Flynn's & Feng's Classification, Performance Metrics and Measures, SpeedupPerformance Laws: Multiprocessor System and Interconnection Networks; IEEE POSIX Threads: Creating and Exiting Threads, Simultaneous Execution of Threads, Thread Synchronization using Semaphore and Mutex, Canceling the Threads.

Unit- II: Pipelining and Memory Hierarchy

Basic and Intermediate Concepts, Instruction Set Principle; ILP: Basics, Exploiting ILP, Limits on ILP; Linear and Nonlinear Pipeline Processors; Super Scalar and Super Pipeline Design; Memory Hierarchy Design: Advanced Optimization of Cache Performance, Memory Technology and Optimization, Cache Coherence and Synchronization Mechanisms.

Unit - III: Thread and Process Level Parallel Architecture

Introduction to MIMD Architecture, Multithreaded Architectures, Distributed Memory MIMD Architectures, Shared Memory MIMD Architecture, Clustering, Instruction Level Data Parallel Architecture, SIMD Architecture, Fine Grained and Coarse Grained SIMD Architecture, Associative and Neural Architecture, Data Parallel Pipelined and Systolic Architectures, Vector Architectures.

Unit - IV: Parallel Algorithms

PRAM Algorithms: Parallel Reduction, Prefix Sums, Preorder Tree Traversal, Merging two Sorted lists; Matrix Multiplication: Row Column Oriented Algorithms, Block Oriented Algorithms; Parallel Quicksort, Hyper Quicksort; Solving Linear Systems: Gaussian Elimination, Jacobi Algorithm; Parallel Algorithm Design Strategies.

Unit -V: Developing Parallel Computing Applications

OpenMP Implementation in 'C': Execution Model, Memory Model; Directives: Conditional Compilation, Internal Control Variables, Parallel Construct, Work Sharing Constructs, Combined Parallel Work-Sharing Constructs, Master and Synchronization Constructs; Run-Time Library Routines:Execution Environment Routines, Lock Routines, Timing Routines; Simple Examples in 'C'. Basics of MPI.

Text Books and Reference:

1. Kai. Hwang, Advance computer architecture, MacGraw Hill, 1993.
2. Schaum's Outline of Computer Architecture, Nick Carter, McGraw-Hill Education 2002
3. Structured Computer Organization, Tanenbaum, Pearson Education India; Sixth edition 2016
4. Parallel Computer Architecture: A Hardware/Software Approach (The Morgan Kaufmann Series in Computer Architecture and Design), Anoop Gupta (Author), David Culler (Author), J.P. Singh, Morgan Kaufmann Publishers In 1998
5. Advance computer architecture, Amit Mishra, S.K. Kataria& Sons; 2012th edition 2012

Course Code: DIT-S505 **Breakup: 3 - 1 - 2 - 5**

Course Name: COMPUTER GRAPHICS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Explain the basics of computer graphics, different graphics systems and applications of computer graphics.
CO2	Explore the background and standard line and circle drawing algorithms.
CO3	Exposure of various transformation approaches and its comparative analysis.
CO4	Illustrate Projection and clipping with explore different techniques.
CO5	Outline the concepts of parametric conditions and properties of beizer curves, beizer surfaces.
CO6	Apply design principles to create different curves and explore hidden lines and surface techniques.

Course Details:

Unit-I: Line generation: Points lines, Planes, Pixels and Frame buffers, vector and character generation. Graphics Primitives: Display devices, Primitive devices, Display File Structure, Display control text.

Unit-II: Polygon: Polygon Representation, Entering polygons, Filling polygons. Segments: Segments table, creating deleting and renaming segments, visibility, image transformations.

Unit-III: Transformations: Matrices transformation, transformation routines, displays procedure. Windowing and Clipping: Viewing transformation and clipping, generalize clipping, multiple windowing.

Unit-IV: Three Dimension: 3-D geometry primitives, transformations, projection clipping. Interaction: Hardware input devices handling algorithms, Event handling echoing, Interactive techniques.

Unit-V: Hidden Line and Surface: Back face removal algorithms, hidden line methods. Rendering and Illumination: Introduction to curve generation, Bezier, Hermite and B-spline algorithms and their comparisons.

Text Books and Reference:

1. Hill – Computer Graphics using openGL, Pearson; 3rd edition 2007
2. Foley, Feiner& Hughes – Computer Graphics Principles & Practices in C (Addisionwesley)
3. Computer Graphics C Version, Hearn, Pearson Education India; 2nd edition 2002
4. Procedural Elements of Computer Graphics, David Rogers, McGraw Hill Education; 2nd edition 2017
5. YashwantKanetkar – Computer Graphics Programming in C, BPB, 1998

Course Code: DIT-S506 **Breakup: 3 - 0 - 0 - 4**

Course Name: ARTIFICIAL INTELLIGENCE

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO4	Demonstrate proficiency-developing applications in an 'AI language', expert system shell, or data-mining tool.
CO5	Demonstrate proficiency in applying scientific method to models of machine learning

Course Details:

UNIT-I: Introduction to Artificial Intelligence, Simulation of sophisticated & Intelligent Behavior in different area problem 301ving in games, natural language, automated reasoning, visual perception, heuristic algorithm versus solution guaranteed algorithms.

UNIT- II: Understanding Natural Languages. Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammars, Shanks Conceptual Dependency, grammar free analyzers, sentence generation, and translation.

UNIT III: Knowledge Representation First order predicate calculus, Horn Clauses, Introduction to PROLOG, Semantic Nets, Partitioned Nets, Minskey frames, Case Grammar Theory, Production Rules KnowledgeBase, The Interface System, Forward & Backward Deduction.

UNIT- IV: Expert System Existing Systems (DENDRAL, MYCIN) domain exploration Meta Knowledge, Expertise Transfer, Self Explaining System

UNIT-V: Pattern Recognition Introduction to Pattern Recognition, Structured Description, Symbolic Description, Machine perception, Line Finding, Interception Semantic & Model, Object Identification, Speech Recognition. Programming LanguageIntroduction to programming Language, LISP, PROLOG.

Text Books and References:

1. S.J. Russell and P. Norvig , Artificial intelligence : A Modern Approach , Pearson; 3rd edition 2010
2. Elaine Rich and Kaven Knight – Artificial IntellegenceMcGraw Hill Education; 3rd edition, 2017
3. Introduction to Artificial Intelligence, MariuszFlasiński, Springer, 1st ed. 2016
4. Introduction to Artificial Intelligence, Patterson, Pearson, 2015

Course Code: DIT-S507 **Breakup: 3 -1 - 2 - 5**

Course Name: ADVANCE JAVA

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO-1	Able to Explain fundamental features of object oriented language
CO-2	Able to Explain Java Runtime Environment, Java Language building Blocks and illustrate to run simple Java programs
CO-3	Able to Construct Java programs by making use of 3 principles of OOPS with run time error handling mechanisms
CO-4	Able to Make Use of multithreading concepts, and event handling mechanism to build Java programs
CO-5	Able to Develop event driven Graphical User Interface (GUI) programming using applets and swings

Course Details:

Review of Java Fundamentals, Multi-threaded programming Java EE Servlets Java Server Pages

JDBC, SQL etc Data and Transaction Management Distributed Computing

Web-tier Security Struts.

Java Server Faces Java Design Patterns AJAX Portlets Hibernate

Java Archives and JNLP Methods of Logging Methods of Profiling

Text Books and References:

1. The complete Reference – Java 2 (Latest Edition) by Patrick Naughton& Herbert Schildt, McGraw Hill; 12th edition 2021
2. Java 2 Plateform Unleashed,Jamie Jaworski, Sams; Book and CD-ROM edition 1999
3. Java Collection – John Zukowski (Apress), 2001
4. Java Swing – Loy & Cole, O'Reilly Media; 2nd edition, 2002
5. Mastering Enterprise JavaBeans and the Java 2 Platform, Enterprise Edition, wiley, 1999
6. Advanced Programming for Java 2, Calvin Austin (Author), Monica Pawlan Addison Wesley 2000

ADVANCE JAVA LAB

1. Programming illustrating the use of classes and objects
2. Programming illustrating the use of functions and parameter passing
3. Programs illustrating overloading of various operators

Ex:Binary operators, Unary operators, New and delete operators etc.

3. Programs illustrating the use of following functions:
4. Programs to create singly and doubly linked lists and perform insertion and deletion
5. Programs illustrating various forms of inheritance: Ex. Single, Multiple, multilevel inheritance etc.
6. Programs on abstract class and derived classes
7. Programs illustrating the use of virtual functions.
8. Write programs illustrating the console I/O operations.
9. Write Programs illustrating how exceptions are handled (cx: division-by-zero, overf1ow and Underflow in stacks etc.

Course Code: DIT-S508 **Breakup: 3 - 0 - 0 - 4**

Course Name: DATA MINING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Learn data Warehouse principle , Data mining concepts and working
CO2	Understand various data processing preprocessing and their application scenarios.
CO3	Discuss The data mining task like classification, regression, clustering. Association mining.
CO4	Understand the impact of machine learning solution on the society and also the contemporary issues.
CO5	Explore a suitable data mining task to the problem.

Course Details:

Review of basic concepts of data warehousing and data mining, reasons for their use, benefits and problems arising. Data warehouse logical design: star schemas, fact tables, dimensions, other schemas, materialized, views, Data warehouse physical design: hardware and i/o considerations, parallelism, indexes. Data warehousing technologies and implementations: data extraction, transportation, transformation, loading and refreshing. Data warehouse support in SQL Server 2000 and Oracle 9i. Data warehousing to data mining, OLAP architectures, design and query processing. SQL, Extensions for OLAP. Data mining approaches and methods: concept description, classification, association rules, clustering, Mining complex types of data, Research trends in data warehousing and data mining.

Text Books and Reference:

1. Data Mining - Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann2006.
2. Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations by Ian H.Witten and Eibe Frank, Morgan Kaufmann 2000.
3. Data Mining: Introductory and Advanced Topics by Margaret Dunham, Prentice Hall 2003.
4. Data Mining with Microsoft SQL Server 2000 Technical Reference Microsoft Press 2005.

Course Code: DIT-S509 **Breakup: 3 - 1 - 2 - 5**

Course Name: DOT NET

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Learn basic of oops programming with principles.
CO2	Understand various predefined and user defined data types likes class, struct, enumeration and keywords.
CO3	Discuss the data-hiding tasks like abstraction and encapsulation with some new features like property, getter and setters.
CO4	Understand the impact of access modifiers in data security from unauthorized access.
CO5	Understanding the impact of Dot Net Framework on various types of application.

Course Details:

UNIT 1: The .NET Framework: Introduction, Common Language Runtime, Common Type System,Common Language Specification, The base class library, The .Net Class Library Intermediate Language, Just In Time Compiler, Garbage Collection, Assemblies

UNIT 2: C# Basics: Introduction., .Data Type, Identifiers, Variabes & Constants, C# Statements, Object Oriented Concepts, Object & Classes, Arrays and Strings, System Collections, Delegates

UNIT 3: Developing ASP.NET Applications: Namespace System, Window Forms, C# in Web Application, Web Form Fundamentals, Validation andRich Controls, Master Pages and Themes

UNIT 4: Working With Data: ADO.NET Fundamentals, Reflection, State Management, Website Navigation

UNIT 5: Advanced ASP.NET: Error Handling, Security Fundamentals, Web Services, Unsafe Mode

Text Books and Reference:

1. John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016

2. Christian Nagel, “C# 6 and .NET Core 1.0”, 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, “Head First C#”, 3rd Edition, O’Reilly Publications, 2013.

3. Mark Michaelis, “Essential C# 6.0”, 5th Edition, Pearson Education India, 2016.

4. Andrew Troelsen, “Prof C# 5.0 and the .NET 4.5 Framework”, 6th Edition, Apress and Dreamtech Press, 2012.

List of Projects:

1. Shopping cart project using ADO.NET: This sample project has all basic features required for a shopping cart web site including Login, Registration, Add to Cart, Checkout etc. A good ASP.NET learning project using C#, ASP.NET, SQL Server.
2. Personal Assistant: This is a small project for managing personal details. Current version of this project support AddressBook feature - Add, Edit and Manage contacts and addresses using VB.NET.
3. Address Book: This is a small project for managing contact details. This is a C# version of the'Personal Assistant' project.
4. School Management System: This is a project for managing education institutes using C#.
5. Library Management System: This is an academic project for students using Java.
6. Alerts & Web services: This project communicates with web services and downloads Alerts from the web server using Java & XML.

Course Code: DIT-S510 **Breakup: 3 - 0 - 0 - 4**

Course Name: VLSI

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
CO2	Draw the layout of any logic circuit which helps to understand and estimate parasitic of logic circuit.
CO3	Design different types of logic gates using CMOS inverter and analyze their transfer characteristics
CO4	Provide Design concepts required to building blocks of data path using gates and simple memories using CMOS.
CO5	Design simple logic circuits using PLA,PAL,FPGA and CPLD.

Course Details:

- Introduction to VLSI; CMOS; design metrics
- Combinational logic, layout, design rules
- Manufacturing process;
- CMOS Transistor; Inverter;
- Low Power design strategies
- Circuit families; Static and Dynamic
- Sequential Circuits
- Clocking and Synchronization
- Deep sub-micron designs; design for performance
- Wires
- Adders, Multipliers, data paths
- Memory
- Emerging topics; Variability and Design for Manufacturing
- CMOS system design, Floor plan, Placement and routing, Project design

Text Books and Reference:

1. CMOS VLSI Design: Circuits and Systems Perspective, by N Weste and D. Harris, Fourth edition, Addison Wesley (Pearson), 2010
2. Digital VLSI Chip Design with Cadence and Synopsys CAD Tools by Erik Brunvand 2009 (Paperback)
3. Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic'. Second Edition, A Prentice-Hall, 2003

Course Code: DIT-S511 **Breakup: 3 -0 - 0 - 4**

Course Name: DISTRIBUTED SYSTEMS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO-1	Students will attain knowledge with distributed system architecture, design and its implementation
CO-2	Learn mutual exclusion and Deadlock management in distributed system.
CO-3	Learn use of agreement protocols in distributed system and distributed file system management.
CO-4	Learn different resource management techniques like distributed shared memory and scheduling for distributed systems.
CO-5	Learn routing algorithms and their applicability in distributed system.

Course Details:

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Resource sharing and the Web Challenges. System Models: Architectural models, Fundamental Models Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection.

Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms.

Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.

Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to ByzantineAgreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system.

Distributed Objects and Remote Invocation: Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI case study.

Security: Overview of security techniques, Cryptographic algorithms, Digital signatures Cryptographypragmatics, Case studies: Needham Schroeder, Kerberos, SSL & Millicent.

Distributed File Systems: File service architecture, Sun Network File System, The Andrew File System, Recent advances.

Transactions and Concurrency Control: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

Distributed Algorithms: Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching, Introduction to Wave & traversal algorithms, Election algorithm.

CORBA Case Study: CORSA RMI, CORSA services.

Text Books and Reference:

1. Mukesh Singhal & Niranjan Shivaratri "Advanced Concepts in Operating System" McGraw Hill Education, 2017
2. Tel , Gerald, "Introduction to Distributed Algorithm" Cambridge University Press; 2nd edition 2000
3. Distributed Systems: Concepts and Design, Coulouris, Pearson Education India; 4th edition 2008
4. Distributed Systems, Andrew S Tanenbaum (Author), Maarten Van Steen, Maarten Van Steen 2023

Course Code: DIT-S512 **Breakup: 3 - 0- 0 - 4**

Course Name: NETWORK SECURITY

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO-1	Illustrate the concepts of Network Security and Compare Various Symmetric and Asymmetric Cryptographic methods used for Network Security
CO-2	Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath
CO-3	Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
CO-4	Summarize different Authentication Techniques & Describe programs like PGP & S/MIME
CO-5	Determine appropriate mechanisms for protecting information systems ranging from operating systems to database management systems and to applications

Course Details:

Unit-I

Introduction to security attacks, services and mechanism, Classical encryption techniques substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard (DES}, Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES 27

Unit-II

Introduction to group, field, finite field of the form GF(p}, modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm,

Advanced Encryption Standard (AES} encryption and decryption Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, Discrete

Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, security of RSA

Unit-Ill

Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA} Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS}, proof of digital signature algorithm,

Unit-IV

Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange,

Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos Electronic mail security: pretty good privacy (PGP), S/MIME.

Unit-V

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction (SET}. System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls

Text Books and Reference:

1. William Stallings, "Cryptography and Network Security: Priciples and Practice", Prentice Hall, New Jersey,5th edition 2010
2. Johannes A. Buchmann, Introduction to Cryptography", Springer- Verlag,2nd edition 2004.
3. Bruce Schneier, Practical Cryptography, Pearson Education India

Course Code: DIT-S513 **Breakup: 3 -0 - 0 - 4**

Course Name: MULTMEDIA SYSTEMS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Write action script for a particular problem.
CO2	Design and Draw customized GUI components.
CO3	Apply Transformations on Components
CO4	To make use of fundamental concepts and formulate best practices
CO5	Apply technical concepts and practices in specialized areas

Course Details:

Unit-I: Introduction

Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment products Stages of Multimedia Projects Multimedia hardware, Memory & storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Unit-II:

Multimedia Building Blocks Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

Unit-Ill:

Data Compression Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modelling. Finite Context Modelling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.

Unit-IV:

Speech Compression & Synthesis Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.

Unit-V:

Images Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file

formatic animations Images standards, JPEG Compression, Zig Zag Coding, Multimedia Database. Content based retrieval for text and images, Video: Video representation, Colors, Video Compression, MPEG standards, MHEG Standard Video Streaming on net, Video Conferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database, recent development in Multimedia.

Text Books and Reference:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia (2nd ed.)", 2014, Springer International Publishing.

2. Tay Vaughan, "Multimedia making it work", 2014, McGraw-Hill Education; 9 edition.

3. An Introduction to Digital Multimedia 2nd Edition, 2013, Jones & Bartlett Learning; 2 edition, ISBN 144968839X-978-1449688394.

4. Vic Costello, "Multimedia Foundations: Core Concepts for Digital Design, 2nd Edition", 2017, T&F/FOCAL PRESS.

5. Tim Morris, "Multimedia Systems Delivering, Generating and Interacting with Multimedia", 2012, Springer London.

Course Code: DIT-S514 **Breakup: 3 - 0 - 0 - 4**

Course Name: SYSTEM ANALYSIS AND DESIGN

CO1	A firm basis for understanding the life cycle of a systems development project
CO2	Anunderstandingoftheanalysisanddevelopmenttechniquesrequiredasateammemberofamedium-scaleinformationsystemsdevelopmentproject
CO3	An understanding of the ways in which an analyst's interaction with system sponsors and users play a part in information systems development
CO4	Experience in developing information systems models
CO5	Experience in developing systems project documentation

Course Details:

Introduction to system analysis and design: Typical information system; typical cases for analysis; problem-solving steps; gathering information; starting a project. Requirements specifications: Feasibility analysis; Data flow diagrams; describing data; Entity relationship analysis; data dictionary; physical and logical model of data; logical database design; and the importance of normalization; consider stations infile design ; role of database management system. Examples. Process Specifications: Structured English;decision tables and decision trees; input forms and output report design; validation of data; program design; control, audit, security and recovery considerations. Case study. Software design alternatives. System Implementation: Testing and quality assurance. Software maintenance. Role of project management in the system development cycle. Complete example. Production planning and control, Accounting principles : information flow; role of CAD/CAM; aggregate planning and master scheduling
; preparation of the master schedule, journalizing transactions; ledger posting and trail balance ; matching concept; capital and revenue; final accounts. Forecasting: Qualitative forecasting: time-seriespredication using regression;
seasonal and cyclic forecasting.

Text Books and Reference:

1. Igor Hawryszkiewycz, Introduction to System Analysis and Design Prentice Hall of India,2000.

2. S.N.Maheshwari, An introduction to Accounting Vani Educational Books,2003

3. D D Bedworth and J E Bailey Integrated Production Control Systems Wiley international Edition, 1991

List of practical:

1. Introducing the fundamentals of Visual Basic programming and its Environment to the user.
2. To study about the properties of command button, label and text box.
3. To study about different kinds of datatypes, operators and array used in visual basic programming. Also study about the variables and constants used in visual basic.
4. To study about different conditional statement and different loop structures used in visual basic program.
5. To study about Checkbox and Option button.
6. To study the properties of Combo Box and List Box.
7. To study about the properties of Scroll Bar and Timer Control.
8. To study about how to create Menu, Sub Menu and Pop-up Menu.
9. To study about the database connectivity with visual basic project.
10. To study about generating data report in visual basic

Course Code: DIT-S515 **Breakup: 3 - 0 - 0 - 4**

Course Name: EMBEDDED SYSTEM

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Acquire a basic knowledge about fundamentals of microcontrollers
CO2	Acquire a basic knowledge about programming and system control specific task.
CO3	Acquire knowledge about devices and buses used in embedded networking
CO4	Develop programming skills in embedded systems for various applications.
CO5	Acquire knowledge about Life cycle of embedded design and its testing.

Course Details:

Current topics in the design, specifications and analysis of embedded systems. The course will have the contemporary coverage of topics such as specifications of embedded systems, analysis of embedded systems, interface to the real-time operating systems, design case studies, design methodologies, etc. Other topics may include verification of embedded systems like formal verification, co-simulation, etc., estimation of hardware and software costs, partitioning, synthesis (hardware, software, memory, bus), retarget able usage of the software, specification and verification of the OS schedules, hard and soft real- time operating systems, and fault tolerant systems.

Text Books and Reference:

1. Wayne Wolf, (2001). “Computer as Components – Principles of Embedded Computing System Design”, Harcourt India Pvt Ltd.,
2. David E Simon, (2004) “An Embedded Software Primer”, Pearson Education,
3. Raj Kamal, (2003) “Embedded Systems – Architecture, Programming and Design”, Tata McGraw Hill,.
4. Sriram V Iyer, Pankaj Gupta, (2004) “Embedded Realtime Systems Programming”, Tata McGraw Hill,
5. K.V.K.K. Prasad, (2004) “Embedded/Realtime Systems: Concepts, Design and Programming”, Dreamtech Press,.

Course Code: DIT-S516 **Breakup: 3 -0 - 0 - 4**

Course Name: REAL TIME SYSTEMS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Be able to explain real-time concepts such as preemptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt latency and response time, and semaphores.
CO2	Able describe how a real-time operating system kernel is implemented.
CO3	Explain how the real-time operating system implements time management.
CO4	Discusshowtaskscancommunicateusingsemaphores,mailboxes,andqueues.
CO5	Be able to implement a real-time system on an embedded processor.

Course Details:

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency. Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective- Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems. Effect of Resource Contention and Resource Access Control (RAC), Nonpreemptive Critical Sections, Basic Priority- Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority- Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects. Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints. Model of

Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real ime Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.

Text Books and Reference:

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication,2000.

2. Real-Time Systems: Scheduling, Analysis, and Verification, Albert M. K. Cheng, Wiley-Interscience; 1st edition (19 August 2002)

3. M. K.Cheng, John Wiley and Sons Publications, 2006.

Course Code: DIT-S517 **Breakup: 3 - 0 - 0 - 4**

Course Name: Geographic Information Systems (GIS)

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Describe what GIS is; name the major GIS software available; know where to find more information;
CO2	Explain the components and functionality of a GIS and the differences between GIS and other information systems;
CO3	Understand the nature of geographic information and explain how it is stored in computer (including map projection) and the two types of GIS data structure;
CO4	Conduct simple spatial analysis using GIS software;
CO5	design and complete a GIS project from start to finish (data capture, data storage and management, analysis, and presentation).

Course Details:

- A gentle introduction to GIS
- Geographical information and spatial data types
- Hardware and software, GIS, steps in spatial data handling
- Database management systems
- Spatial referencing
- Data quality, measures of location errors on maps
- Satellite-based positioning
- Spatial data input, data preparation
- Point data transformation
- Advanced operations on continuous field rasters
- Analytical GIS capabilities, retrieval and classification, overlay functions
- Neighborhood operations, network analysis, error propagation
- Data visualization.

Text Books and Reference:

1. "Getting to Know ArcGIS Pro" by Michael Law and Amy Collins. Publisher: Esri Press. Edition: 2nd Edition. Year: 2020.
2. "Mastering ArcGIS" by Maribeth Price. Publisher: McGraw-Hill Education. Edition: 8th Edition. Year: 2021.
3. "Geographic Information Science and Systems" by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind. Publisher: Wiley. Edition: 4th Edition. Year: 2015.
4. "Introduction to Geographic Information Systems" by Kang-tsung Chang. Publisher: McGraw-Hill Education. Edition: 9th Edition. Year: 2021.
5. "GIS Fundamentals: A First Text on Geographic Information Systems" by Paul Bolstad. Publisher: Eider Press. Edition: 6th Edition. Year: 2021.

Course Code: DIT-S518 **Breakup: 3 - 0 - 0 - 4**

Course Name: E-COMMERCE

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Understand the framework and anatomy of ecommerce applications and analyze ecommerce consumer, organizational applications.
CO2	Infer mercantile process models from both merchant‟s and consumer‟s view point.
CO3	Understand the implementation of Electronic Data Interchange (EDI) in day to day life.
CO4	Study all the aspects of Intra-Organizational electronic commerce including supply chain management.
CO5	Analyze different consumer, information searching methods and resource discovery and information retrieval techniques

Course Details:

UNIT-I: Introduction:

What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of ECommerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework Network Infrastructure for E-commerce Network Infrastructure for E-commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

UNIT-II: Mobile Commerce:

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

UNIT-III: Encryption

World Wide Web & Security, Encryption, Transaction security, Secret Key Encryption, Public Key Encryption, Virtual Private Network {VPM), Implementation Management Issues.

UNIT- IV: Electronic Payments

Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

UNIT-V: Net Commerce

EDA, EDI Application in Business, Legal requirement in E -Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

Text Books and Reference:

1. Greenstein and Feinman, "E-commerce", TMH, 2002

2. Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", AddisionWesley, 1997

3. Denieal Amor, "The E-Business Revolution", Addision Wesley, 2013

4. Diwan, Sharma, "E-commerce" Excel, 2018

5. Bajaj & Nag, "E-Commerce: The Cutting Edge of Business", TMH, 2018

Course Code: DIT-S519 **Breakup: 3 - 0 - 0 - 4**

Course Name: Data Communication

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Students will be able to understand network communication using the layered concept, Open System Interconnect (OSI) and the Internet Model.
CO2	Students will be able to understand various types of transmission media, network devices; and parameters of evaluation of performance for each media and device.
CO3	Students will be able to understand the concept of flow control, error control and LAN protocols; to explain the design of, and algorithms used in, the physical, data link layers.
CO4	Students will understand the working principles of LAN and the concepts behind physical and logical addressing, subnetting and supernetting.
CO5	Students shall understand the functions performed by a Network Management System and to analyze connection establishment and congestion control with respect to TCP Protocol.
CO6	Students shall understand the principles and operations behind various application layer protocols like HTTP, SMTP, FTP.

Course Details:

UNIT 1: Introduction to Data Communication:

UNIT 2: Signals : Analog and Digital, periodic and aperiodic signals, analog signals, time and frequency domains, composite signals, digital signals.

UNIT 3: Data Transmission : Data transmission basics, asynchronous and synchronous transmission, error detection methods, data compression, transmission control circuits, communication control devices.

UNIT 4: Encoding and Decoding : Digital to digital conversion, analog to digital, digital to analog, analog to analog conversions.

UNIT 5: Modulation & Demodulation of Digital Signal: Interfaces and modems, digital data transmission, DTE - DCE interface, other interface standards, Modems: 56k modem, cable modem

UNIT 6: Multiplexing:-

Many to one/one to many, FDM, WDM, TOM, multiplexing application telephone system,

DSL,FTTC.

UNIT 7: Introduction to Mobile Communication:

Text Books and Reference:

1) Data communication, computer networks and open systems, Fred Halsall. PEA, Addison-Wesley in 1996.

2) Data communication, Stalling, PHI, 2013

3) Data communication and networking, Behrouz A Forouzan, TMHComputer network, A. Tannenbaum, PHI, 2006

Course Code: DIT-S520 **Breakup: 3 - 0 - 1 - 4**

Course Name: Analog Electronics Circuit

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1:	Design and analysis of CE, CB, CC amplifiers using small signal h-model and pi-model and derivation of voltage gain, current gain, input impedance and output impedance.
CO2:	Design and analysis of RC coupled single stage and multistage amplifiers and their frequency responses; and the effects of coupling and bypass capacitors in amplifiers.
CO3:	Design and analysis of common source FET amplifier and its frequency response.
CO4:	Design and analysis of negative feedback amplifiers and oscillators.
CO5:	Design and analysis of different types of power amplifiers and tuned amplifiers.
CO6:	Behavior of noise in an amplifier.

Course Details:

UNIT 1:

Diodes as circuit element, ideal diode model, The piecewise linear diode model, clamping circuits, clipping (Limiting) circuits, clipping at two independent levels, Rectifiers, Half wave, full wave, Bridge rectifiers, filter circuits.

UNIT 2:

The junction transistor, transistor current components, transistor as an amplifier, The CB, CE and CC configuration, typical transistor junction voltage values. Transistor Biasing and thermal stabilization: The operating point, Biasing Circuits, fixed bias, bias stability, self bias or emitter bias, fixing of Q- point using graphically & analytical methods, stabilization against variation in lea, Vbc, B; Bias compensation Diode.

UNIT 3:

The Transistor at low frequencies: Two port devices and the hybrid model, The h-parameter, determination of h-parameters from input and output characteristics, Analysis of a transistor amplifier circuit using h-parameters, the emitter follower (its modeling), miller's theorem and its dual, cascading transistor amplifier (up to 2 stages), simplified hybrid model, high input resistance transistor ckts-e.g. darling ton, emitter follower.

UNIT 4:

Field effect transistors: General description on FET, JFET operation, and its characteristic, MOSFET, The FET small signal model, The low frequency CS and CD amplifiers at high frequencies.

UNIT 5:

Power amplifiers: Class A, class B, class C, class AB & push-pull amp. Oscillators: sinusoidal, phase shift, resonant-circuit, wein bridge, crystal oscillators.

Text Books and Reference:

1) Integrated Electronics Analog and Digital circuits and systems. J mil Iman/ Halkias, McGraw-Hill Education, 2001

2) Electronic Devices And Circuit Theory: Robert Boylestad & Nash Lsky (PHI), 3th edition, 2018.

3) Electronic Devices & Circuits: David A. Bell (TMH), 5th edition, Oxford University Press 2015

Course Code: DIT-S521 **Breakup: 3 - 0 - 0 - 4**

Course Name: Signal & Systems

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Understand mathematical description and representation of continuous and discrete time signals and systems
CO2	Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
CO3	Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.
CO4	Understand the basic concept of probability, random variables & random signals
CO5	Develop the ability to find correlation, CDF, PDF and probability of a given event.

Course Details:

UNIT l: Fourier analysis of signals, Amplitude, Phase & Power spectrum, Orthogonality of functions, Types of signals, Fourier Transform of some useful functions, Singularity functions & its properties, Dirac delta function & its properties, Sampling function, Laplace Transform of some useful functions.

UNIT 2: Convolution of signals, Graphical & analytical methods of convolution, sampling theorem (time domain & frequency domain), Nyquist rate & Nyquist interval, Aliasing, Aperture effect, Recovery from sampled signal, Natural sampling, Flat top sampling, Time convolution theorem, Frequency convolution theorem.

UNIT 3: Power & Energy signals, Energy & Power spectral densities of signals, Cross correlation, Auto correlation.

UNIT 4: Systems & Filters: Linear system, Time invariant & LTI system, Impulse response, Causal systems, Filter characteristics of linear systems, Low pass filter High pass filters, Band pass filters, Band stop filters.

Text Books and Reference:

1. John G.Proakis and Dimitris G.Manolakis, "Digital Signal Processing Principles Algorithms and Applications, 4th edition, Prentice Hall of India Pvt.Ltd. 2007.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer based Approach", Tata McGraw Hill 4th Edition, 2010.
3. Alan Oppenheim V., Ronald Schafer W., "Discrete Time Signal Processing", Pearson Education India Pvt Ltd., New Delhi, 2002.
4. Anil K. Jain – Fundamental of Digital image Processing, Pearson, 1988

Course Code: DIT-S522 **Breakup: 3 - 0 - 0 - 4**

Course Name: Modeling & Simulation

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Understand the techniques of modeling in the context of hierarchy of knowledge about a system and develop the capability to apply the same to study systems through available software
CO2	Learn different types of simulation techniques.
CO3	Learn to simulate the models for the purpose of optimum control by using software.
CO4	Optimum design of the modeling and simulation approaches with emphasis on applications using MATLAB.

Course Details:

UNIT l: System definition and components, stochastic activities, continuous and discrete systems, System modeling, Types of models, static and dynamic

physical models, static and dynamic mathematical models, full corporate model, types of system study.

UNIT 2: System simulation, Need of simulation, Basic nature of simulation, techniques of simulation, comparison of simulation and analytical methods, types of system Simulation, real time simulation, hybrid simulation, simulation of pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag model, Cobweb model.

UNIT 3: Simulation of continuous Systems, analog vs digital simulation, simulation of water reservoir system, simulation of a servo system, simulation of an Auto-pilot. Discrete system simulation, fixed time-step vs event-to-event model, generation of random numbers, test of randomness, Monte-Carlo computation vs stochastic simulation.

UNIT 4: System dynamics, exponential growth models, exponential decay models, logistic curves, system dynamics diagrams, world model.

UNIT 5: Simulation of PERT networks, critical path computation, uncertaintities in activity duration, resource allocation and consideration, Simulation languages, object oriented simulation.

Text Books and Reference:

1. "Modeling and Simulation Fundamentals: Theoretical Underpinnings and Practical Domains" by John A. Sokolowski and Catherine M. Banks. Published by John Wiley & Sons, 2014.

2. "Simulation Modeling and Analysis" by Averill M. Law and David Kelton. Published by McGraw-Hill Education, 2015.
3. "Introduction to Modeling and Simulation with MATLAB® and Python" by Steven I. Gordon and Brian Guilfoos. Published by CRC Press, 2017.
4. "Modeling and Simulation in Python" by Jose M. Garrido. Published by Chapman and Hall/CRC, 2021

Course Code: DIT-S523 **Breakup: 3 - 0 - 0 - 4**

Course Name: Artificial Neural Networks

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Model Neuron and Neural Network, and to analyze ANN learning, and its applications.
CO2	Perform Pattern Recognition, Linear classification
CO3	Develop different single layer/multiple layer Perceptron learning algorithms
CO4	Learn the concepts of principal components and SOM.
CO5	Design of another class of layered networks using deep learning principle

Course Details:

UNIT l: Introduction to neural nets, Perceptrons and the LMS Algorithm. Back propagation Learning, Visually-Guided Robot Control.

UNIT 2: Optimization Techniques, Over fitting, Cross-Validation, and Early Stopping, Simple Recurrent Networks, Pattern Classification, Language Processing Models.

UNIT 3: Radial Basis Functions, The EM {Expectation-Maximization) Algorithm, Neural Networks for Control, Support Vector Machines, Time Series Prediction.

UNIT 4: Shared Weight Networks, Competitive Learning and Kohonen Nets, Hebbian Learning and Principal Components Analysis, Hopfield Nets and Boltzmann Machines.

UNIT 5: Mean Field Approximation, Helmholtz Machines; Minimum Description Length, Bayesian Networks, Computational Learning Theory, onnectionist Symbol Processing, Reinforcement Learning, Neurophysiology for Computer Scientists.

Text Books and Reference:

1) "Neural Networks and Learning Machines" by Simon Haykin, Pearson Education, 3rd Edition, 2009
2) "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 1st Edition, 2016
3) "Artificial Neural Networks" by B. Yegnanarayana, Prentice Hall India Learning, 1st Edition, 2004
4) "Neural Networks: A Comprehensive Foundation" by Simon Haykin, Prentice Hall, 2nd Edition, 1999

Course Code: DIT-S524 **Breakup: 3 - 0 - 0 - 4**

Course Name: Stochastic Models for Computer Applications

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	To be able to apply previous knowledge of probability theory to construct stochastic models of random systems
CO2	To be able to model time dependent random phenomena as a Markov chain
CO3	To be able to model birth-death queuing systems in steady state
CO4	To be able to model decisions with uncertain outcomes
CO5	To be able to deal effectively with stochastic elements in a wide variety of systems

Course Details:

UNIT 1: Bavariate Distribution, One function of two Random variables, two functions of twoRandom variables, Problems.
UNIT 2: Expectation: Introduction, Moments, Expectation of function of more than one random variable, Transform Methods, Moments & Transforms of some important distributions, Computation of mean time to failure, Inequalities & Limit Theorems
UNIT 3: Conditional Expectation: Introduction, Mixture distribution, Conditional Expectation, Imperfect Fault Coverage & Reliability,Random Sums.
UNIT 4: STOCHASTIC Process: Introduction, Classification of Stochastic Process, the Bernoulli Process, the Poisson Process, Renewal Processes, Availability Analysis, Random Incidence, Renewal model of Program Behavior
UNIT 5: Discrete Parameter Markov Chains: Introduction, Computation of n-step transition Probabilities, State Classification & Limiting Distributions, Distribution between State Changes, Irreducible Finite Chains & A periodic States, The Queuing System, Finite Markov Chains with Absorbing States.
UNIT 6: Continuous Parameter Markov Chains: Introduction, The Birth & Death Process, Non Birth & Death Processes, Markov Chains withAbsorbing States.

Text Books and Reference:

1) "Introduction to Stochastic Processes with R" by Robert Dobrow, John Wiley & Sons, 2nd Edition, 2019.
2) "Stochastic Modeling and Mathematical Statistics: A Text for Statisticians and Quantitative Scientists" by Francisco J. Samaniego, CRC Press, 2nd Edition, 2019.
3) "Stochastic Modeling: Analysis and Simulation" by Barry L. Nelson, Dover Publications, 2nd Edition, 2013.
4) "An Introduction to Stochastic Modeling" by Howard M. Taylor and Samuel Karlin, Academic Press, 3rd Edition, 2015.
5) "Applied Stochastic Models and Control for Finance and Insurance" by Charles S. Tapiero, Springer, 2nd Edition, 2015.

Course Code: DIT-S525 **Breakup: 3 - 0 - 0 - 4**

Course Name: TELECOMMUNICATION SWITCHING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Understand and think to develop the new mobile computing based application.
CO2	Capable to discuss on some new methodological dispute associated to this new paradigm and can conclude with some good facts.
CO3	Understand the database issues in mobile environments and data delivery models in mobile computing.
CO4	Clever to improve mobile ad-hoc network (MANET) applications and/or procedures/protocols.
CO5	Able to develop and describe various existing or new mobile environment related protocols.

Course Details:

UNIT I

TELECOMMUNICATION SWITCHING SYSTEMS: Introduction, Elements of switching systems, switching network configuration, principles of cross bar switching.

UNIT II

Electronic space division switching, Time division switching, Combination switching.

UNIT III

TELEPHONE NETWORKS: Subscriber loop systems, switching hierarchy and routing, transmission plan, numbering plan, charging plans.

UNIT IV

SIGNALING TECHNIQUES: In channel signaling, common channel signaling. Network traffic load and parameters, grade of service and blocking probability.

UNIT V

DATA COMMUNICATION NETWORKS: Introduction, network architecture, layered network architecture, protocols, data communications hardware, data communication circuits.

UNIT VI

Public switched data networks, connection oriented & connection less service, Circuit Switching, packet switching and virtual circuit switching concepts, OSI reference model, LAN, WAN, MAN & Internet. Repeaters, Bridges, Routers and gate ways.

UNIT VII

INTEGRATED SERVICES DIGITAL NETWORK (ISDN) : Introduction, motivation, ISDN

architecture, ISDN interfaces, functional grouping, reference points, protocol architecture, signaling, numbering, addressing, BISON.

UNIT VIII

DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM& CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries and Higher rate of service.

Text Books and Reference:

Text Books

1. Tele communication switching system and networks - Thyagarajan Viswanath, PHI, 2000.

2. Advanced electronic communications systems - Wayne Tomasi, PHI, 2004.

References

1. Digital telephony - J. Bellamy, John Wiley, 2nd edition, 2001.

2. Data Communications & Networks - Achyut. S.Godbole, TMH, 2004.

3. Principles of Communication Systems- H. Taub & D. Schilling, TMH, 2nd Edition, 2003.

4. Data Communication & Networking - B.A. Forouzan, TMH, 3rd Edition, 2004.

5. Telecommunication switching, Traffic and Networks - J E Flood, Pearson Education, 2002

Course Code: DIT-S526 **Breakup: 3 -0 - 0 - 4**

Course Name: Information Security and Cyber Laws

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization
CO2	Practice with an expertise in academics to design and implement security solutions.
CO3	Understand key terms and concepts in Cryptography, Governance and Compliance
CO4	Develop cyber security strategies and policies
CO5	Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

Course Details:

UNIT-I

History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Concepts in Internet and World Wide Web: Brief review of Internet Protocols-TCP/IP, IPV4, IPV6. Functions of various networking components-routers, bridges, switches, hub, gateway and Modulation Techniques

UNIT-II

Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles. 11 Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards.

UNIT-III

Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges Framework for Information Security, ISO 27001, SEE-CMM, Security Metrics, Information Security Vs Privacy

UNIT-IV

Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN

UNIT-V

Laws, Investigation and Ethics: Cyber Crime, Information Security and Law, Types & overview of Cyber Crimes, Cyber Law Issues in E-Business Management Overview of Indian IT Act, Ethical Issues in Intellectual property rights, Copy Right, Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.

Text Books and Reference:

1) "Information Security: Principles and Practice" by Mark Stamp. Publisher: Wiley, 3rd Edition (2011).
2) "Principles of Information Security" by Michael E. Whitman and Herbert J. Mattord. Publisher: Cengage Learning, 6th Edition (2018).
3) "Cyberlaw: The Law of the Internet and Information Technology" by Brian Craig. Publisher: Pearson, 2nd Edition (2017).
4) "Computer Security and the Internet: Tools and Jewels" by Michael A. Caloyannides. Publisher: CRC Press, 2nd Edition (2003).

Course Code: DIT-S527 **Breakup: 3 - 0 - 0 - 4**

Course Name: Digital Signal Processing

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	To describe signals mathematically and understand how to perform mathematical operations on signals.
CO2	It will provide knowledge of Digital filter
CO3	To discuss word length issues,multi rate signal processing and application.
CO4	Develop different signal processing applications using DSP processor.
CO5	Design and implement LTI filters for filtering different real world signals.

Course Details:

1) Discrete Fourier Transform:

Frequency Domain Sampling: The Discrete Fourier Transform Frequency- Domain Sampling and Reconstruction of Discrete-Time Signals. The Discrete Fourier Transform {DFT). The OFT as a linear Transformation. Relationship of the OFT to Other Transforms. Properties of the OFT. Periodicity, Linearity, and Symmetry Properties. Multiplication of two DFTs and Circular Convolution. Additional OFT Properties. Frequency analysis of signals using the OFT.

2) Efficient Computation of OFT Efficient Computation of the OFT: FFT Algorithms, Direct Computation of the OFT. Radix-2 FFT algorithms. Efficient computation of the OFT of two real sequences, computations, Efficient computation of the OFT of a 2NPoint real sequences, Gortezel Algorithm, Chirp Z-transform algorithm.

3) Basic IIR Filter Structures:

Direct forms {I & II), cascade and parallel realizations. Signal flow graph, Transposed structure, Basic FIR filter structures-. Direct form structure, frequency sampling structure, Lattice structure, Linear phase FIR structure. FIR structures.

4) Symmetric and Anti-symmetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows,Design of Linear-Phase FIR Filters by the

Frequency Sampling Method, Design of FIR, Equiripple filter design Differentiators. Design of Hilbert Transformers.

5) Design of IIR Filters From Analog Filters: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance. IIR
Filter Design by the Bilinear Transformation. The Matched-z Transformation, Characteristics of Commonly Used Analog Filters. Application of above technique to the design of Butterworth & Chebyshev filters.

Text Books and Reference:

1. John G.Proakis and Dimitris G.Manolakis, "Digital Signal Processing Principles Algorithms and Applications, 4th edition, Prentice Hall of India Pvt.Ltd. 2007.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer based Approach", Tata McGraw Hill 4th Edition, 2010.
3. Alan Oppenheim V., Ronald Schafer W., "Discrete Time Signal Processing", Pearson Education India Pvt Ltd., New Delhi, 2002.
4. Anil K. Jain – Fundamental of Digital image Processing, Pearson, 1988

Course Code: DIT-S528 **Breakup: 3 -0 -2 -4**

Course Name: DATA ANALYSIS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Apply explorative data analysis for solving real world business problems, and effectively present results using data visualization techniques
CO2	Apply social network analysis techniques and financial modelling techniques for the given problem.
CO3	Apply principles of Data Science for the analysis of the given business problem and build recommendation engine.
CO4	Apply classification and regression algorithms to build machine intelligence

Course Details:

Unit 1 :Data Definitions and Analysis Techniques, Elements, Variables, and Data categorization Levels of Measurement, Data management and indexing, Introduction to statistical learning and R-Programming.
Unit 2 :Descriptive Statistics, Measures of central tendency Measures of location of dispersions Practice and analysis with R.
Unit 3 :Basic Analysis Techniques, Basic analysis techniques, Statistical hypothesis generation and testing Chi-Square test, t-Test, Analysis of variance Correlation analysis Maximum likelihood test Practice and analysis with R.
Unit 4: Data analysis techniques, Regression analysis Classification techniques Clustering, Association rules analysis Practice and analysis with R.
Unit 5: Case studies and projects, Understanding business scenarios Feature engineering and visualization, Scalable and parallel computing with Hadoop and Map-Reduce Sensitivity Analysis.

Text Books and Reference:

1) "Python for Data Analysis" by Wes McKinney. Publisher: O'Reilly Media. Edition: 2nd. Year: 2017.
2) "Data Analysis with Open Source Tools" by Philipp K. Janert. Publisher: O'Reilly Media. Edition: 1st. Year: 2010.
3) "Data Smart: Using Data Science to Transform Information into Insight" by John W. Foreman. Publisher: Wiley. Edition: 1st. Year: 2013.
4) "R Graphics Cookbook" by Winston Chang. Publisher: O'Reilly Media. Edition: 2nd. Year: 2018.
5) "Applied Predictive Modeling" by Max Kuhn and Kjell Johnson. Publisher: Springer. Edition: 1st. Year: 2013.

Course Code: DIT-S529 **Breakup: 3 -0 -2 -4**
Course Name: PATTERN RECOGNITION

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
CO2	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
CO3	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
CO4	Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
CO5	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

Course Details:

Basics of Probability, Random Processes and Linear Algebra: Probability: independence of events, conditional and joint probability, Bayes' theorem; Random Processes: Stationary and nonstationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors; Bayes Decision Theory

Bayes Decision Theory: Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features

Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case; Maximum a Posteriori estimation; Bayesian estimation: Gaussian case

Unsupervised learning and clustering: Criterion functions for clustering; Algorithms for clustering: K-Means, Hierarchical and other methods; Cluster validation; Gaussian mixture models; Expectation-Maximization method for parameter estimation; Maximum entropy estimation

Sequential Pattern Recognition: Hidden Markov Models (HMMs); Discrete HMMs; Continuous HMMs Nonparametric techniques for density estimation: Parzen-window method; K-Nearest Neighbour method

Dimensionality reduction: Fisher discriminant analysis; Principal component analysis; Factor Analysis

Linear discriminant functions: Gradient descent procedures; Perceptron; Support vector machines

Non-metric methods for pattern classification: Non-numeric data or nominal data; Decision trees: CART

Text Books and Reference:

1. RO.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

Course Code: DIT-S541 **Breakup: 3 -0 -3 -4**

Course Name: INTRODUCTION TO PYTHON PROGRAMMING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO-1	Understand the basic building blocks in python programming language to construct different applications.
CO-2	Apply the necessary data structures to solve a given problem.
CO-3	Extract and import packages for developing different solutions for real time problems.
CO-4	Implement the problems in terms of real-world objects using concept of OOPS.

Course Details:

UNIT I: Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT II: Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful •functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear sear h, binary search.

UNIT III: Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing -list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT IV: Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

UNIT V: Concept of class, object, and instances, constructor, class attributes and destructors, Real-time use of class in live projects, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support.

Text Books and Reference:

1) "Python Crash Course: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes, published by No Starch Press, 2nd edition (2019)
2) "Automate the Boring Stuff with Python: Practical Programming for Total Beginners" by Al Sweigart, published by No Starch Press, 2nd edition (2019)
3) "Learning Python: Powerful Object-Oriented Programming" by Mark Lutz, published by O'Reilly Media, 5th edition (2021)
4) "Python for Everybody: Exploring Data in Python 3" by Charles Severance, published by Charles Severance, 2nd edition (2018)
5) "Head First Python: A Brain-Friendly Guide" by Paul Barry, published by O'Reilly Media, 2nd edition (2016)

Course Code: DIT-S542 **Breakup: 3 -0 -0 -4**

Course Name: E-Business

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Gain knowledge of e-business with its technology, need, pros & cons, model, impacts, sales life cycle along with its implementation in India.
CO2	Understand practical knowledge of infrastructure and technologies used in e-business and mobile commerce.
CO3	Learn about the knowledge of security aspects used in e-business and mobile commerce.
CO4	Apply knowledge for ensuring the implementation of secure information using encryption techniques and digital signature in e-business and mobile commerce.
CO5	Understand the concept of the process of electronic payment e-business along with different technologies, policies and governments law.

Course Details:

UNIT I: Introduction to E-Business, Making Functional Areas E-Business Enabled, Value chain and supply chain, inter and intra organizational business processes, ERP, Making Functional Areas E-Business Enabled : E-Procurement.

UNIT II: Making Functional Areas E-Business Enabled, E-marketing, E-Selling, E-Supply Chain Management, Technologies for E-Business: Internet and Web based system, Technologies for E-Business: Security and payment systems.

UNIT III: Technologies for E-Business: Supply chain integration technologies (EDI, RFID, Sensors, IoT, GPS, GIS), Technologies for E-Business: Supply chain integration technologies (Web services and cloud), Decision Support in E-Business: Web analytics

UNIT IV: Decision Support in E-Business: Customer behavior modeling, Decision Support in E-Business: Auctions, Decision Support in E-Business: Recommender systems

Text Books and Reference:

1) Management Information Systems: Managing the Digital Firm, Laudon and Laudon, Pearson, 2014

2) Scaling for E-Business, Menasce & Almeida, PHI, 2012

3) eBusiness & eCommerce – Managing the Digital Value Chain, Meier & Stormer, Springer, 2017

Course Code: DIT-S543 **Breakup: 3 -0 -0 -4**

Course Name: Digital Marketing

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand digital marketing platform
CO2	Understand the key goals and stages of digital campaigns
CO3	Understand the of use key digital marketing tools
CO4	Learn to develop digital marketing plans
CO5	Translate some of the key marketing and business models that will help to shape your digital marketing strategy

Course Details:

UNIT I: Introduction to Digital Marketing and its Significance, Traditional Marketing Vs Digital Marketing, Digital Marketing Process, Website Planning and Development : Types of websites Website Planning and Development, Keywords, Understanding Domain and Webhosting Building Website/Blog using CMS WordPress, Using WordPress Plug-ins.

UNIT II: Introduction to Search Engine Optimization, Keyword P lanner Tools, On Page SEO Techniques-Indexing and Key Word Placement, On Page SEO Techniques- Content Optimization, On Page SEO : Yoast SEO Plug-in, Off –Page SEO Techniques, Email Marketing-Introduction and Significance, Designing e-mail marketing campaigns using Mail Chimp.

UNIT III: Building E-mail List and Signup Forms, Email Marketing Strategy and Monitoring, Email –Automization, Pay Per Click Advertising Introduction, Pay Per Click Advertising: Google Adword Type of Bidding strategies, Designing and Monitoring search campaigns, Designin g and Monitoring Display campaigns.

UNIT IV: Designing and Monitoring Video campaigns, Designing and Monitoring Universal App Campaigns, Google Analytics Introduction and Significance, Google Analytics Interface and Setup, Understanding Goals and Conversions, Monitoring Traffic Behavior and preparing Reports, Social Media Marketing, Introduction and Significance, Facebook Marketing Introduction Types of Various Ad Formats.

UNIT V: Setting up Facebook Advertising Account, Understanding Facebook Audience and its

Types, Designing Facebook Advertising Campaigns, Working with Facebook Pixel, Twitter Marketing Basics, Designing Twitter Advertising Campaigns, Introduction to LinkedIn Marketing, Developing digital marketing strategy in Integration form.

Text Books and Reference:

1) The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns by Ian Dodson, Wiley; 1st edition (2016)

2) Digital Marketing For Dummies by Ryan Deiss and Russ Henneberry, For Dummies, 2019.

Course Code: DIT-S544 **Breakup: 3 -0 -2 -4**

Course Name: Introduction to Game Programming

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Deal with the practicalities of writing a computer game.
CO2	Explain the mathematics involved in computer games.
CO3	Explain the AI algorithms and Physical Laws involved in generating computer games.
CO4	Implement computer games for various platforms.
CO5	Describe how Computer Graphics, AI, Physics and Networks are combined in developing computer games.

Course Details:

UNIT I: 3D GRAPHICS FOR GAME PROGRAMMING 9 3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.

UNIT II: GAME ENGINE DESIGN 9 Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.

UNIT III: GAME PROGRAMMING 9 Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.

UNIT IV: GAMING PLATFORMS AND FRAMEWORKS 9 2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - DX Studio, Unity.

UNIT V: GAME DEVELOPMENT 9 Developing 2D and 3D interactive games using DirectX or Python - Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

Text Books and Reference:

1. Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, (engage Learning, PTR, 2012.

2. Jason Gregory, "Game Engine Architecture", CRC Press/ AK Peters, 2009.

3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2 nd Editions, Morgan Kaufmann, 2006.

Course Code: DIT-S545 **Breakup: 3 -0 -2 -4**

Course Name: ANDROID PROGRAMMING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Demonstrate the Understanding of fundamental of Android Programming. (Understand)
CO2	Build their ability to develop software with reasonable complexity on mobile platform. (Apply)
CO3	Discover the life cycles of Activities, Applications, intents and fragments. (Evaluate)
CO4	Design the Android apps by using Java Concepts. (Create)

Course Details:

JAVA Concepts: OOPs Concepts, Inheritance in detail, Exception handling, Packages & interfaces, JVM & .jar file extension, ulti threading (Thread class & Runnable Interface)

SQL: DML & DDL Queries in brief.

Introduction to Android: Introduction to Android, Setting up development environment, Dalvik Virtual Machine & .apk file extension, Fundamentals: Basic Building blocks - Activities, Services, Broadcast Receivers & Content providers, UI Components - Views & notifications, Components for communication -Intents & Intent Filters o Android API levels (versions & version names)

Application Structure (in detail): AndroidManifest.xml, uses-permission & uses-sdk, Resources & R.java o Assets, Layouts & Drawable Resources, Activities and Activity lifecycle, First sample Application

Emulator-Android Virtual Device: Launching emulator, Editing emulator settings, Emulator shortcuts, Logcat usage, Introduction to DDMS, Second App:- (switching between activities) - Develop an app for demonstrating the communication between Intents

Basic UI design: Form widgets, Text Fields, Layouts, [dip, dp, sip, sp] versus px Examples

Preferences: Shared Preferences, Preferences from xml, Examples, Menu: Option menu, Context menu, Sub menu, menu from xml, menu via code Examples

Intents: Explicit Intents, Implicit intents, Examples, UI design: Time and Date, Images and

media, Composite, Alert Dialogs & Toast, Popup Examples, Tabs and Tab Activity, Styles & Themes: styles.xml, drawable resources for shapes, gradients (selectors), style attribute in layout file, Applying themes via code and manifest file, Content Providers: SQLite Programming, SQLite Open Helper, SQLite Databse, Cursor, Reading and updating Contacts

Notifications: Broadcast Receivers, Services and notifications, Toast, Alarms Examples. Custom components: Custom Tabs, Custom animated popup panels, Other components, Threads: Threads running on UI thread (run On UiThread), Worker thread, Handlers & Runnable, AsynTask. , Live Folders, Using sdcards, XML Parsing, JSON Parsing, Maps, GPS, Location based Services, Accessing Phone services (Call, SMS, MMS), Network connectivity services.

Text Books and Reference:

1) "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips, Chris Stewart, and Kristin Marsicano. Publisher: Big Nerd Ranch Guides; 4th edition (2019).
2) "Head First Android Development: A Brain-Friendly Guide" by Dawn Griffiths and David Griffiths. Publisher: O'Reilly Media; 1st edition (2017).
3) "Android Studio 3.6 Development Essentials: Kotlin Edition" by Neil Smyth. Publisher: Payload Media; 1st edition (2020).
4) "Android Programming for Beginners" by John Horton. Publisher: Packt Publishing; 3rd edition (2019).
5) "Mastering Android Development with Kotlin" by Milos Vasic. Publisher: Packt Publishing; 1st edition (2019).

Course Code: DIT-S546 **Breakup: 3 -0 -2 -4**

Course Name: Introduction to IOS Programming

CO1	To be able to design iOS application. (Apply)
CO2	To be able to develop an application using Swift Programming language (Create)
CO3	To be able to develop multi-screen application using XCode (Create)
CO4	To understand the need and be able to use Different UI Controllers. (Understand)
CO5	To be able to debug an application using XCode debugger. (Analyse)

Course Details:

Overview of iOS and X-CODE: Installation, Create and manage project using XCode, Introduction to iPhone Architecture, Introduction to SWIFT, Developer Technology Overview: The Apple Developer Tool, Swift, Cocoa Touch, Model-View-Controller, Interface Builder, Overview of latest iOS features.

Swift Basics: Object oriented programming with swift, File structure in Swift, Swift Programming Basics: Data types, Constants, Variables, Operators, Decision making and Branching, Arrays, Functions, Enumerations. Introduction to iOS Playground.

iPhone Application Development: Exploring the iOS Framework with XCode, Cocoa Fundamentals, Tracking the iOS Application Life cycle, Understanding Interface Builder, Creating User Interface, Customizing the Interface Appearance using Layout, Views, Outlets and Actions, View Controllers and UI Controllers like Labels, Buttons, Sliders, Different Views, Gestures, etc. Connecting the code with Accelerometer, Location service, 3D touch, Push notifications Understand the MVC Design pattern, MVC in XCode, Using Application Templates, User Input and Output: Handling Keyboard Input, Implementing Alert, Sounds and Vibrations, Using XCode debugger, Database Management and Web Services: Parsing JSON data, Parsing XML data, Sqlite databases, Web Service APIs calls.

Text Books and Reference:

1) iOS 10 Programming Fundamentals with Swift by Matt Neuburg - O'Reilly Media Pub

2) Building iPhone and iPad Electronic Projects - MikeWesterfield - O'Reilly Media Pub.

3) Head First iPhone and iPad Development, 2nd Edition - Dan Pilone, Tracey Pilone - O'Reilly Media

4) Beginning iPhone and iPad Web Apps - ChrisApers, Daniel Paterson - Apress Pub

Course Code: DIT-S547 **Breakup: 3 -0 -2 -4**

Course Name: HUMAN COMPUTER INTERFACE PROGRAMMING

Course Details:

UNIT I: The Human: I/O channels - Memory - Reasoning and problem solving; The Computer: Devices – Memory, processing and networks; Interaction: Models - frameworks - Ergonomics - styles - elements - interactivity- Paradigms. - Case Studies

UNIT II: Interactive Design: Basics - process - scenarios - navigation - screen design - Iteration and prototyping. HCI in software process: Software life cycle - usability engineering - Prototyping in practice - design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques - Universal Design

UNIT III: HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements - Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies

UNIT V: Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

Text Books and Reference:

1) Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, -Human Computer Interactionll, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)

2) Brian Fling, -Mobile Design and Developmentll, First Edition, O'Reilly Media Inc., 2009 (UNIT - IV)

3) Bill Scott and Theresa Neil, -Designing Web Interfacesll, First Edition, O'Reilly, 2009. (UNIT-V)

Course Code: DIT-S548 **Breakup: 3 -0 -2 -4**

Course Name: STATISCAL ANALYSIS SYSTEM

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Manipulate data sets including inputting raw data from external files, Create data subsets.
CO2	Implement if...then...else structures, and loops, Write SAS numeric, character, and probability functions.
CO3	Produce descriptive statistics with graphics.
CO4	Conduct basic statistical estimation and testing using SAS.
CO5	Employ statistical modeling on both qualitative and quantitative data in the SAS environment.

Course Details:

Unit – I: Definition - Scope and limitations of Statistics - Collection of data - Census. Sampling surveys - Classification and tabulation - diagrammatic and graphical representation of data - Nominal, ordinal and interval scaling.

Unit – 2: Measures of central tendency - Measures of dispersion and Coefficient of variation - Problems based on raw data and grouped data - Moments - raw and central - Measures of skewness - Measures of Kurtosis and their applications.

Unit – 3: Curve fitting - Principle of least squares - linear, nonlinear, exponential and growth curves.

Unit – 4: Correlation - Rank Correlation - Regression analysis - Problems based on raw data and grouped data.

Unit – 5: Association of attributes - Notations - Classes and class frequencies - Consistency of data - Independence of attributes - Yule's coefficient of association - coefficient of colligation.

Text Books and Reference:

1. Bansilal and Arora (1989). New Mathematical Statistics, Satya Prakashan, New Delhi.

2. Gupta. S.C. & Kapoor,V.K. (2002). Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd. New Delhi.

3. Goon A.M. Gupta. A.K. & Das Gupta, B (1987) . Fundamentals of Statistics, Vol.2, World Press Pvt. Ltd., Calcutta.

4. Kapoor, J.N. & Saxena, H.C. (1976). Mathematical Statistics, Sultan Chand and Sons Pvt. Ltd

Course Code: DIT-S549 **Breakup: 3 -0 -2 -4**

Course Name: BLOCKCHAIN & CRYPTOCURRENCY

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Describe the basic concepts and technology used for blockchain.
CO2	Describe the primitives of the distributed computing and cryptography related to blockchain.
CO3	Illustrate the concepts of Bitcoin and their usage.
CO4	Implement Ethereum block chain contract.
CO5	Apply security features in blockchain technologies.
CO6	Use smart contract in real world applications.

Course Details:

UNIT I: Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT II: Blockchain: Introduction, Advantage over the conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limjt, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT III: Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Bum, Difficulty Level, Sybil Attack, Energy utilization, and alternate._

UNIT IV: Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

UNITV: Cryptocurrency Regulation: Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market, and Global Economy. Blockchain AppJications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Text Books and Reference:

1) Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

2) Wattenhofer, The Science of the Blockchain

3) Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

4) Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System

5) DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.

Course Code: DIT-S550 **Breakup: 3 -0 -0 -4**

Course Name: NATURAL LANGUAGE PROCESSING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Extract information from text automatically using concepts and methods from natural language processing (NLP) including stemming, n-grams, POS tagging, and parsing.
CO2	Develop speech-based applications that use speech analysis (phonetics, speech recognition, and synthesis).
CO3	Analyse the syntax, semantics, and pragmatics of a statement written in a natural language.
CO4	Develop a conversational agent that uses natural language understanding and generation.
CO5	Apply machine learning algorithms to natural language processing.
CO6	Design NLP-based AI systems for question answering, text summarization, and machine translation.

Course Details:

UNIT I: Overview: Origins and cbalJenges ofNLP- Theory of Language -Features ofindian Languages Issues in Font -Models and Algorithms- NLP Applications.

UNIT II: Phonology - Computational Phonology - Words and Morphemes - Segmentation - Categorization and ½emmatisation - Word Form Recognition - Valency - Agreement - Regular Expressions - Finite State Automata - Morphology- Morphological issues oflndian Languages - Transliteration.

UNIT III: Probabilistic Models of Pronunciation and Spelling - Weighted Auto111ata - N-Grams – Corpus, Analysis _: Smoothing - Entropy - Parts-of-Speech - Taggers - Rule-based - Hidden Markov, Models - Speech Recognition.

UNIT IV: Basic Concepts of Syntax - Parsing Techniques - Genera] Grammar rules for Indian Languages, Context Free Grammar - Parsing with Context-Free Grammars - Top Down Parser - Ear1ey Algorithm - Features and Unification - Lexicalised and Probabilistic Parsing.

UNIT V: Representing Meaning - Computational Representation - Meaning Structure of Language - Semantic Analysis - Lexical Semantics - WordNet - Pragmatics - Discourse - Reference Resolution - Text Coherence- Dialogue Conversational Agents.

Text Books and Reference:

1) Daniel Jurafskey and James H. Marrin "Speech and Language Processing", Prentice Hal I, 2009.

2) Christopher D.Manning and Hinrich Schutze, "Foundation of Statistical Natural Language Processing ', MIT Press, 1999) .

3) Ronald Hausser, "Foundations of Computational Linguistics", Springer-Verleg, 1999.

4) James Allen, "Natural Language Understanding", Benjamin/Cummings Publishing Co. 1995.

5) Steve Young and Gerrit Bloothooft, "Corpus-Based Methods in Language and Speech Processing", Kluwer Academic Publishers, 1997.

Course Code: DIT-S551 **Breakup: 3 -0 -2 -4**

Course Name: CLOUD COMPUTING

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Describe the principles of Parallel and Distributed Computing and evolution of cloud computing from existing technologies
CO2	Implement different types of Virtualization technologies and Service Oriented Architecture systems
CO3	Elucidate the concepts of NIST Cloud Computing architecture and its design challenges
CO4	Analyse the issues in Resource provisioning and Security governance in clouds
CO5	Choose among various cloud technologies for implementing applications
CO6	Install and use current cloud technologies

Course Details:

UNIT I: Overview of Computing Paradigm Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evol,ution of cloud computing Business driver for adopting cloud computing, Introduction to Cloud Computing Cloud Computing (NIST Model) Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties, Characteristics & Disadvanta,ges Pros' and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing Role of Open Standards

UNIT II: Cloud Computing Architecture Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS) Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS) Deployment Models Public cloud, Private cloud, Hybrid cloud, Community cloud

UNIT III: Infrastructure as a Service(IaaS) . Introduction to IaaS IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) Resource Virtualization Server, Storage, Network Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as

a service) Examples Amazon EC2 Renting, EC2 Compute Unit, Platform and Storage, pricing, customers Eucalyptus, Platform as a Service(PaaS) Introduction to PaaS What is PaaS, Service Oriented Architecture, (SOA) Cloud Platform ..and Management Computation Storage Examples Google App Engine Microsoft Azure, Software as a Service (PaaS) Introduction to Saas, Web services, Web 2.0, Web OS, Case, Study on SaaS.

UNIT IV: Service Management in Cloud Computing Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously Managing Data Looking at Data, Scalability & Cloud Services Dat_abase & Data Stores in Cloud Large Scale Data Processing '

UNIT V: Cloud Security Infrastructure Security Network level security, Host level security, Application level security Data security and Storage Data privacy and security Issu6 Jurisdictional issues raised by Data location Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in loud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

Text Books and Reference:

1) Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw Hill Edition, Fourth Reprint, 2010.

2) Kris Jamsa, "Cloud Computing: SaaS, PaaS, /aaS, Virtualization, Business Models, Mobile. Security and more", Jones & Bartlett Learning Company LLC, 2013.

3) Ronald L.Krutz, Russell vines,"Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing Inc., 2010.

4) Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

5) Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, Wile, 2011

6) Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

7) Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronatd L. Krutz, Russell Dean Vines, Wiley-India,

Course Code: DIT-S552 **Breakup: 3 -0 -2 -4**

Course Name: BIG DATA TECHNOLOGY

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Discuss the challenges and their solutions in Big Data
CO2	Understand and work on Hadoop Framework and eco systems.
CO3	Explain and Analyse the Big Data using Map-reduce programming in Both Hadoop and Spark framework.
CO4	Demonstrate spark programming with different programming languages.
CO5	Demonstrate the graph algorithms and live streaming data in Spark.
CO6	Analyse file systems such as GFS and HDFS.

Course Details:

UNIT I: Big Data and its Importance, Four V's of Big Data, Drivers, for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications.

UNIT II: Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics, Information Management.

UNIT III: Integrating disparate data stores, Mapping data to the programming framework, Connecting and extracting data from storage, Transforming data for processing, subdividing data in preparation for Hadoop Map Reduce.

UNIT IV: Employing Hadoop Map Reduce, Creating the components of Hadoop Map Reduce jobs, Distributing data processing across server farms, Executing Hadoop Map Reduce jobs, monitoring the progress of job flows, The Building Blocks of Hadoop Map Reduce Distinguishing Hadoop daemons, Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

UNIT V: Installing and Running Pig, Comparison with Databases, Pig Latin, User- Define Functions, Data Processing Operators, Installing and Running Hive, Hive QL, Querying Data, User-Defined Functions, Oracle Big Data.

Text Books and Reference:

1) Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", I st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.

2) Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", lst Edition, IBM Corporation, 2012.

3) Rajaraman, A., Ullman, J. D., Mining of Massive Datasets, Cambridge University Press, United Kingdom, 2012

4) Berman, ;J.J., Principles of Big Data: Preparing, Sharing and Analyzipg1Complex Information, Morgan Kaufmann, 2014

5) Tom White, "HADOOP: The definitive Guide", 0 Reilly 2012.

6) Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packet Publishing 2013.

Course Code: DIT-S553 **Breakup: 3 -0 -2 -4**

Course Name: INTERNET OF THINGS (loTs)

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Explain the definition and usage of the term “Internet of Things” in different contexts.
CO2	Understand the key components that make up an IoT system.
CO3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.
CO4	Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming, and data analysis.
CO5	Understand where the IoT concept fits within the broader ICT industry and possible future trends.
CO6	Appreciate the role of big data, cloud computing and data analytics in a typical IoT system

Course Details:

UNIT I: What is JoT, Genesis of JoT, loT and Digitization, IoT Impact, Convergence of IT and foT, loT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing JoT Architectures, A Simplified IoT Architecture, The Core loT Functional Stack, IoT Data Management and Compute Stack.

UNIT II: Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT III: IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for loT, Profiles, and Compliances, Application Protocols for IoT, The Transport Layer, loT Application Transport Methods.

UNIT IV: Data and Analytics for IoT, An Introduction to Data Analytics for loT, Machine Leaming, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures:

OCTAVE and FAIR, The Phased Application of Security in an Operational Environment

UNIT V: loT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Conneoting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Text Books and Reference:

1) David Han,es, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"l_oT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", lstEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743).

2) Srinivasa KG, "Internet ofThings",CENGAGE Leaning India, 2017.

3) Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands.on-A proach)", ls1Edition, VPT, 2014. (ISBN: 978-8173719547).

4) Raj Kamal, "ln met of Things: Architecture and Design Principles", !s1Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).

Course Code: DIT-S554 **Breakup: 3 -0 -0 -4**

Course Name: ERP SYSTEMS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Demonstrate a good understanding of basic issues in Enterprise Systems.
CO2	Explain the scope of common Enterprise Systems (e.g., MM, SCM, CRM, HRM, procurement)
CO3	Explain the challenges associated with implementing enterprise systems and their impacts on organisations.
CO4	Describe the selection, acquisition, and implementation of enterprise systems.
CO5	Use a leading Enterprise Systems package (SAP) to support business operations and decision-making.
CO6	Communicate and assess an organisation's readiness for enterprise system implementation with a professional approach in written form.

Course Details:

UNIT I : Enterprise-wide information system, Custom built and packaged approaches, Needs and Evolution of ERP Systems, Common myths and evolving realities, ERP and Related Technologies, Business Process Reengineering and Information Technology, Supply Chain Management, Relevance to Data Warehousing, Data Mining and OLAP, ERP Drivers, Decision support system.

UNIT II: ERP Domain, ERP Benefits classification, Present global and Indian market scenario, milestones and pitfalls, Forecast, Market players and profiles, Evaluation criterion for ERP product, ERP Life Cycle: Adoption decision, Acquisition, Implementation, Use & Maintenance, Evolution and Retirement phases, ERP Modules.

UNIT III: Framework for evaluating ERP acquisition, Analytical Hierarchy Processes (AHP), Applications of AHP in evaluating ERP, Selection of Weights, Role of consultants, vendors and users in ERP implementation; Implementation vendors evaluation criterion, ERP Implementation approaches and methodology, ERP implementation strategies, ERP Customization, ERP-A manufacturing Perspective.

UNIT IV: Critical success and failure factors for implementation, Model for improving ERP effectiveness, ROI of ERP implementation, Hidden costs, ERP success inhibitors and accelerators, Management concern for ERP success, Strategic Grid: Useful guidelines for ERP

Implementations.

UNIT V: Technologies in ERP Systems anq Extended ERP, Case Studies Development and Analysis ERP Implementations in focusing the various issues discussed in above units through Soft System approaches or qualitative Analysis tools, Leaming and Emerging Issues, ERP and E-Cornmerce.

Text Books and Reference:

1) "Enterprise Resource Planning Concepts and Practice" by Vinod Kumar Garg and N.K. Venkitakrishnan, PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2) "Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce, and Risk" by Daniel E. O'Leary, Cambridge University Press, 3rd Edition, 2018.
3) "ERP Demystified" by Alexis Leon, Tata McGraw-Hill Education, 3rd Edition, 2010.
4) "Implementing SAP ERP Sales & Distribution" by Glynn C. Williams, McGraw-Hill Education, 1st Edition, 2010.

Course Code: DIT-S555 **Breakup: 3 -0 -2 -4**

Course Name: Deep Learning

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains
CO2	To make students comfortable with tools and techniques required in handling large amounts of datasets
CO3	Uncover various deep learning methods in NLP, Neural Networks etc.
CO4	Several libraries and datasets publicly available to illustrate the application of these algorithms
CO5	Help students in developing skills required to gain experience of doing independent research and study

Course Details:

UNIT I: Introduction to Deep Learning, Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization.

UNIT II: Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning, Revisiting Gradient Descent, Momentum Optimizer, RMSProp.

UNIT III: Adam, Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization.

UNIT IV: Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc., Classical Supervised Tasks with Deep Learning, Image Denoising, Semanticd Segmentation, Object Detection etc.

UNIT V :LSTM Networks, Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

Text Books and Reference:

1) "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Publisher: MIT Press, 1st edition (2016).
2) "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" by Aurélien Géron. Publisher: O'Reilly Media, 2nd edition (2019).
3) "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow" by Sebastian Raschka and Vahid Mirjalili. Publisher: Packt Publishing, 3rd edition (2019).
4) "Deep Learning with Python" by Francois Chollet. Publisher: Manning Publications, 1st edition (2017).

Course Code: DIT-S556 **Breakup: 3 -0 -2 -4**

Course Name: Business Analytics & Text Mining Modeling Using Python

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Enable all participants to recognize, understand and apply the language, theory and models of the field of business analytics and text mining using Python
CO2	Foster an ability to critically analyze, synthesize and solve complex unstructured business problems and text mining using Python
CO3	Encourage an aptitude for business improvement, innovation and entrepreneurial action through Python
CO4	Encourage the sharing of experiences to enhance the benefits of collaborative learning using Python
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve

Course Details:

UNIT I: Introductory overview of Text Mining, Introductory Thoughts, Data Mining vs. Text Mining, Text Mining and Text Characteristics, Predictive Text Analytics, Text Mining Problems, Prediction & Evaluation, Python as a Data Science Platform Python for Analytics, Introduction to Python Installation, Jupyter Notebook Introduction, Python Basics, Python Programming Features, Commands for common tasks and control, Essential Python programming concepts & language mechanics Built in Capabilities of Python, Data structures: tuples, lists, dicts, and sets.

UNIT II: Built in Capabilities of Python, Functions, Namespaces, Scope, Local functions, Writing more reusable generic functions, Built in Capabilities of Python, Generators, Errors & Exception Handling, Working with files Numerical Python, N-dimensional array objects

UNIT III: Numerical Python, Vectorized array operations, File management using arrays, Linear algebra operations, Pseudo-random number generation, Random walks Python pandas, Data structures: Series and DataFrame, Python pandas, Applying functions and methods, Descriptive Statistics, Correlation and Covariance Working with Data in Python, Working with CSV, EXCEL files, Working with Web APIs.

UNIT IV: Working with Data in Python, Filtering out missing data, Filling in the missing data, removing duplicates, Perform transformations based on mappings, Binning continuous variables, Random sampling and random reordering of rows, Dummy variables, String and text processing,

Regular expressions, Categorical type, Data Visualization using Python, Matplotlib Library, Plots & Subplots

UNIT V: Text mining modeling using NLTK, Text Corpus, Sentence Tokenization, Word Tokenization, Removing special Characters, Expanding contractions, Removing Stopwords, Correcting words: repeated characters, Stemming & lemmatization, Part of Speech Tagging, Feature Extraction, Bag of words model, TF-IDF model, Text classification problem, Building a classifier using support vector machine

Text Books and Reference:

1) Fundamentals of Predictive Text Mining by Sholom M. Weiss, Nitin Indurkhya, & Tong Zhang (2010/2015)

2) Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython by Wes McKinney (2017)

3) Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from Your Data by Dipanjan Sarkar (2016)

Course Code: DIT-S557 **Breakup: 3 -0 -0 -4**

Course Name: Innovation, Business Models and Entrepreneurship

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Identify qualities of entrepreneurs
CO2	Write project proposal
CO3	Use various entrepreneurship models
CO4	Understand various schemes supporting entrepreneurship
CO5	Think creative and innovative

Course Details:

UNIT I : Analyzing the Current Business Scenario, Innovation and Creativity- An Introduction, Innovation in Current Environment, Types of Innovation, School of Innovation, Challenges of Innovation,Steps of Innovation Management,Idea Management System,Divergent V/s Convergent Thinking,Design Thinking and Entrepreneurship.

UNIT II: Experimentation in Innovation Management, Idea Championship,Participation for Innovation, Co-creation for Innovation, Proto typing to Incubation, What is a Business Model,Who is an Entrepreneur,Social Entrepreneurship,Blue Ocean Strategy-I,Blue Ocean Strategy-II.

UNIT III: Marketing of Innovation, Technology Innovation Process, Technological Innovation Management Planning, Technological Innovation Management Strategies, Technology Forecasting, Sustainability Innovation and Entrepreneurship,Innovation Sustainable Conditions,Innovation: Context and Pattern,SME'S strategic involvement in sustainable development,Exploration of business models for material efficiency services.

UNIT IV: Management of Innovation, creation of IPR,Management of Innovation, creation of IPR,Types of IPR,Patents and Copyrights, Patents in India, Business Models and value proposition, Business Model Failure: Reasons and Remedies, Incubators : Business Vs Technology, Managing Investor for Innovation, Future markets and Innovation needs for India.

Text Books and Reference:

1) "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries. Publisher: Crown Business, 1st edition (2011).
2) "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur. Publisher: John Wiley & Sons, 1st edition (2010).
3) "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail" by Clayton M. Christensen. Publisher: Harvard Business Review Press, 1st edition (1997).
4) "Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant" by W. Chan Kim and Renée Mauborgne. Publisher: Harvard Business Review Press, Expanded edition (2015).

Course Code: DIT-S558 **Breakup: 3 -0 -0 -4**

Course Name: Entrepreneurship: Do your venture

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Students will pick up about Foundation of Entrepreneurship Development and its theories
CO2	Students will explore entrepreneurial skills and management function of a company with special reference to SME sector
CO3	Students will identify the type of entrepreneur and the steps involved in an entrepreneurial venture
CO4	Students will understand various steps involved in starting a venture and to explore marketing methods & new trends in entrepreneurship
CO5	Steps in venture development and new trends in entrepreneurship

Course Details:

UNIT I: Entrepreneurial Journey, Entrepreneurial Discovery, Ideation and Prototyping.

UNIT II: Testing, Validation and Commercialisation, Disruption as a Success Driver, Technological Innovation and Entrepreneurship – 1.

UNIT III: Technological Innovation and Entrepreneurship – 2, Raising Financial Resources, Education and Entrepreneurship.

UNIT IV: Beyond Founders and Founder-Families, India as a Start-up Nation, National Entrepreneurial Culture.

UNIT V: Entrepreneurial Thermodynamics, Entrepreneurship and Employment, Start-up Case Studies.

Text Books and Reference:

1) "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries. Publisher: Crown Business, 1st edition (2011).
2) "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company" by Steve Blank and Bob Dorf. Publisher: K&S Ranch, 1st edition (2012).
3) "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur. Publisher: John Wiley & Sons, 1st edition (2010).

Course Code: DIT-S559 **Breakup: 3 -0 -0 -4**
Course Name: Applied Multivariate Analysis

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Introduce the language of multivariate data analysis
CO2	Understand the characteristics of multivariate quantitative research, including strengths and weaknesses
CO3	Understand the principles and characteristics of the multivariate data analysis techniques
CO4	Distinguish between dependence and interdependence methods in multivariate data analysis
CO5	Identify the most appropriate statistical techniques for a multivariate dataset

Course Details:

UNIT I: Introduction to Multivariate Analysis, Multivariate Distributions.

UNIT II: Classification of Individuals, Cluster Analysis, Discriminant Analysis and Classification.

UNIT III: Principal Components Analysis, Factor Analysis.

UNIT IV: Canonical Multidimensional Scaling.

UNIT V: Correspondance Analysis, Multivariate Linear Models.

Text Books and Reference:

1) "Applied Multivariate Statistical Analysis" by Richard A. Johnson and Dean W. Wichern. Publisher: Pearson, 6th edition (2007).
2) "Multivariate Data Analysis" by Joseph F. Hair Jr., William C. Black, Barry J. Babin, and Rolph E. Anderson. Publisher: Pearson, 7th edition (2019).
3) "Applied Multivariate Techniques" by Subhash Sharma. Publisher: John Wiley & Sons, 1st edition (1996).
4) "Discovering Statistics Using R" by Andy Field, Jeremy Miles, and Zoe Field. Publisher: Sage Publications, 1st edition (2012).
5) "Modern Multivariate Statistical Techniques: Regression, Classification, and Manifold Learning" by Alan J. Izenman. Publisher: Springer, 1st edition (2008).

Course Code: DIT-S560 **Breakup: 3 -0 -2 -4**
Course Name: Introduction to R Software

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	To make students exercise the fundamentals of statistical analysis in R environment
CO2	They would be able to analysis data for the purpose of exploration using Descriptive and Inferential Statistics
CO3	Students will understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.
CO4	Install Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames.
CO5	Describe key terminologies, concepts and techniques employed in Statistical Analysis

Course Details:

Unit 1: Introduction: R interpreter, Introduction to major R data structures like vectors, matrices, arrays, list and data frames, Control Structures, vectorized if and multiple selection, functions.

Unit 2: Installing, loading and using packages: Read/write data from/in files, extracting data from web-sites, Clean data, Transform data by sorting, adding/removing new/existing columns, centring, scaling and normalizing the data values, converting types of values, using string in-built functions, Statistical analysis of data for summarizing and understanding data, Visualizing data using scatter plot, line plot, bar chart, histogram and box plot.

Unit 3: Designing GUI: Building interactive application and connecting it with database.

Unit 4: Building Packages.

Text Books and Reference:

1) "R for Data Science: Import, Tidy, Transform, Visualize, and Model Data" by Hadley Wickham and Garrett Grolemund. Publisher: O'Reilly Media, 1st edition (2017).
2) "The R Book" by Michael J. Crawley. Publisher: John Wiley & Sons, 2nd edition (2012).
3) "Hands-On Programming with R: Write Your Own Functions and Simulations" by Garrett Grolemund. Publisher: O'Reilly Media, 1st edition (2014).
4) "Data Manipulation with R" by Phil Spector. Publisher: Springer, 1st edition (2008).
5) "Advanced R" by Hadley Wickham. Publisher: Chapman and Hall/CRC, 1st edition (2014).

Course Code: DIT-S562 **Breakup: 3 -0 -0 -4**

Course Name: Numerical Methods And Simulation Techniques For Scientists And Engineers

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems
CO2	Apply numerical methods to obtain approximate solutions to mathematical problems
CO3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations
CO4	Analyse and evaluate the accuracy of common numerical methods
CO5	Implement numerical methods in Matlab

Course Details:

UNIT I: Introduction to Numerical analysis, Importance of error and their calculations, Examples, Root Finding Method of non-linear equations, Bisection Method, Newton Raphson Method, Secant method, Regula- Falsi method, Practical examples.

UNIT II: Curve fitting method, linear and non-linear fitting, Linear interpolation, Lagrange interpolation method, Newton Interpolation formula, Practical examples, Numerical differentiation, central difference methods, higher order derivatives, errors, practical examples.

UNIT III: Numerical integration, Simpson's 1/3 rd rule, Simpson's 3/8 th rule, local and global error analysis, practical examples. Eigenvalue problems, Heun's method, Euler's method, Runge Kutta Method, Gerschgorin disc theorem, Jacobi method, Practical examples

UNIT IV: Simulation Techniques, Random numbers, Monte Carlo Method, Importance Sampling, Metropolis Algorithm, Heat- bath algorithm, practical Examples, Molecular dynamics, interaction and forces in molecular systems, MD and Verlet algorithm, correlations, practical examples

Text Books and Reference:

1) R.H. Landau, M.J. Paez, and C.C. Bordeianu, Computational Physics: Problem soving with Computers Wiley VCH (2007)

2) S.C. Chopra and R.P. Canale, Numerical Methods for Engineers, Tata Mcgraw Hill (2002)

3) M.K. Jain, S.R.K. Iyengar, and R.K. Jain, "Numerical Methods for Scientific and Engineering Computation", New Age Pvt. Pub, New Delhi.

4) M.E.J. Newman and G.T. Barkema, Monte Carlo Methods in Statistical Physics, Oxford University Press (2010)

5) J.M. Haile, Molecular Dynamics Simulations: Elementary methods, Wiley Professional (1992)

Course Code: DIT-S563 **Breakup: 3 -0 -2 -4**

Course Name: Introduction to Machine Learning

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Learn the basics of learning problems with hypothesis and version spaces
CO2	Understand the features of machine learning to apply on real world problems
CO3	Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning
CO4	Analyze the concept of neural networks for learning linear and non-linear activation functions
CO5	Learn the concepts in Bayesian analysis from probability models and methods

Course Details:

UNIT-I: Well defined learning problems, Designing a Learning System, Issues in Machine Learning; THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

UNIT-II: Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning; ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation AlgorithmConvergence, Generalization;

UNIT-III: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; BAYESIAN LEARNING – Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;

UNIT-IV: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-BASED LEARNING – k-Nearest Neighbor Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning

UNIT-V: Hypothesis space search, Genetic Programming, An illustrative example, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms-General to specific beam search-FOIL; REINFORCEMENT LEARNING - The Learning Task, Q Learning.

Text Books and Reference:

1. Tom M. Mitchell : “Machine Learning”, 2013.
2. Hal Daume III: “A Course in Machine Learning, 2012.
3. Christopher M. Bishop, “” Pattern Recognition and Machine Learning”, 2010.
4. Ian Goodfellow, YoshuaBengio, Aaron Courville, Francis Bach : “Deep Learning”, 2017.

Course code: MTH-S501 **Breakup: 3-0- 0- 3**

Course name: Operations Research

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
CO2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
CO3	Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
CO4	Model competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games
CO5	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems

Course Details:

UNIT-I

Introduction: Uses, scope and applications of operations research.

Linear Programming: Mathematical formulation of Linear programming problems. Solution of LPP by Graphical method, Simplex method, Duality in Linear Programming Problem, Dual Simplex method, Sensitivity analysis.

UNIT-II

Transportation Problems:Various methods for finding initial basic feasible solution and optimal solution .

Assignment Problems: Hungarian method for solving assignment problems.

Sequencing problem: Basic assumptions, n- jobs on two machine, n- jobs on three machines, two jobs onthree machines.

UNIT-III

Game Theory: Two persons zero sum game, pure and mixed strategy games, saddle point, solutions of a game with or without saddle point,dominance rule, different methods of solving (Algebraic, Graphical, Linear programming).

Inventory Control Models: Deterministic EOQ inventory models.

UNIT-IV

Network Models: Minimal spanning tree algorithm, Shortest route problem, Maximal flow model. Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

Text Books and Reference:

1) Wayne L. Winston,"Operations Research" Thomson Learning,2003.

2) Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education,2003.

3) R. Panneer Seevam, "Operations Research" PHI Learning, 2008.

4) V.K.Khanna, "Total Quality Management" New Age International, 2008.

5) Kanti swroop, Manmohan and Gupta-operations research, sultan chand & sons new delhi.

6) V.K.Kapoor- operations Research (S.Chand,4th Edition)

Course Code: MTH-S503 **Breakup: 3 - 0 - 2 - 4**

Course Name: Graph Theory

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Explain vertices and their properties, types of paths, classification of graphs and trees & their properties. (Cognitive Knowledge Level: Understand)
CO2	Demonstrate the fundamental theorems on Eulerian and Hamiltonian graphs. (Cognitive Knowledge Level: Understand)
CO3	Illustrate the working of Prim's and Kruskal's algorithms for finding minimum cost spanning tree and Dijkstra's and Floyd-Warshall algorithms for finding shortest paths. (Cognitive Knowledge Level: Apply)
CO4	Explain planar graphs, their properties and an application for planar graphs. (Cognitive Knowledge Level: Apply)
CO5	Explain the Vertex Color problem in graphs and illustrate an example application for vertex coloring. (Cognitive Knowledge Level: Apply)

Course Details:

Unit-I

Graphs, Sub graphs, Some basic properties, Different types of graphs (Regular, Bipartite, Induced, Quotient etc) walks, paths & circuits, connected graphs, disconnected graphs and its components, Euler graphs andits properties, Fluery's algorithms and Chinese postman problem Operation on graphs, Hamiltonian graphsand its properties, Hamiltonian paths and circuits, the traveling sales man problem. Shortest distance algorithms (Dijkstra's) .

Unit -II

Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets, connectivity and separability, Rank, Nullity of a graph.

Digraphs: Definition, Types of Digraphs, Digraphs and Binary relations, Directed path and connectedness, Euler Digraphs.

Unit- Ill

Trees and its characterization, Distance, Height, Diameters, Radius of a tree, Weighted Tree, Rooted and Binary trees, Spanning trees, Weighted spanning tree, Minimum weight spanning tree algorithms prim's and Kruskal's. Chords, Branches, Fundamental circuits.

Unit-IV

Matrix representation of graphs : Incidence, Adjacency, Circuit, Cut-set and Path matrices and their properties. Matrix representation of Digraphs (Adjacency matrix).

Unit-V

Planarity: Planer graphs, Regions, Euler formula, Kuratowski two graphs, Characterization of planarity, detection of planarity, Thickness and Crossings number of a graph.

Colouring of graphs: Vertex colouring, Edge colouring, Five colour Theorem, Chromatic number, chromatic polynomials, Methods of finding the chromatic polynomial, Chromatic partitioning, Independence number and Covering number.

Matchings, Maximal matching, Augmenting path, Hall's marriage problem

Unit -VI

Enumeration : counting labelled and unlabelled graphs and trees. Cycle index, Figure counting series, Configuration counting series, Polya's Theorem(without Proof). Application to simple and multiple graphs with at most two edges between vertices.

Transportation networks : Network flows, Max flow-Min cut Theorem.

Text Books and Reference :

1. Deo, N, Graph theory with applications to Engineering and Computer Science, PHI
2. V. Balakrishnan, Schaum's Outline of Graph Theory, TMH
3. Robin J. Wilson, Introduction to Graph Theory, Pearson Education Limited; 5th edition 2010
4. Harary, F, Graph Theory, Narosa Publishing House 2001
5. GeirAgnarsson, Graph Theory: Modeling, Applications and Algorithms, Pearson Education India; 1st edition 2008
6. Bondy and Murthy: Graph theory and application. Elsevier Science Ltd 1976

Course Code: MTH-S504 **Breakup: 3 -0 -0 -4**

Course Name: Probability & Statistics

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO-1	Apply the concepts of probability and distributions to some case studies.
CO-2	Apply the concepts of discrete probability distributions.
CO-3	Apply the concepts of continuous probability distributions.
CO-4	Assess the sampling theory and making inferences.
CO-5	Correlate the material of one unit to the material in other units.

Course Details:

UNIT-I

Joint Distribution Functions, Necessary and Sufficient conditions for independence of random variables, Central Limit Theorem, Statistic, Sufficient Statistic.

UNIT- II

Estimation Theory; Methods of Estimation, Unbiased, Consistent, Maximum likelihood estimators, Minimum Variance, Unbiased Estimators.

UNIT- III

Testing of Hypotheses; Simple and Composite Hypotheses, Two types of error, Power of a test, Neyman Pearson Lemma for most powerful Tests, Application of the Lemma, Various tests of significance for the mean and variance, Contingency tables and X2 - tests. Confidence Interval Estimation.

Text Books and Reference:

1. Applied Statistics and Probability for Engineers, Douglas C. Montgomery (Author), George C. Runger, Wiley; Sixth edition,2016
2. Probability and Statistics for Engineering and the Sciences, Jay L. Devore, Cengage India Private Limited, 9th edition, 2020

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Course Code: UHV-S101 **Breakup: 0 -0 -0 -0**

Course Name: HUMAN VALUES AND PROFESSIONAL ETHICS

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
CO2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO3	Articulate what makes a particular course of action ethically defensible
CO4	Assess their own ethical values and the social context of problems
CO5	Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human

Course Details:

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Understanding the need, basic guidelines, content and process for Value Education 2. Self Exploration- what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself! 7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 10.Understanding the characteristics and activities of 'I' and harmony in 'I' 11.Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail 12.Programs to ensure Sanyam and Swasthya- Practice Exercises and Case Studies will be taken up in Practice

Sessions.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in HumanHuman Relationship 13.Understanding Harmony in the family- the basic unit of human interaction 14.Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values ofrelationship 15.Understanding the meaning of Vishwas; Difference between intention and competence 16.Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship 17.Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals 18.Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence 19.Understanding the harmony in the Nature 20.Interconnectedness and mutual fulfillment among the four orders of naturerecyclability and self-regulation in nature 21.Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space 22.Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics 23.Natural acceptance of human values 24.Definitiveness of Ethical Human Conduct 25.Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 26.Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems. 27.Case studies of typical holistic technologies, management models and production systems 28.Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations.

Text Books and Reference:

1. "Ethics for the Information Age" by Michael J. Quinn - Publisher: Pearson, 8th Edition (2019)
2. "The Power of Ethical Management" by Ken Blanchard and Norman Vincent Peale - Publisher: William Morrow, Reprint Edition (1998)
3. "Practical Ethics" by Peter Singer - Publisher: Cambridge University Press, 3rd Edition (2011)
4. "Moral Choices: An Introduction to Ethics" by Scott B. Rae - Publisher: Zondervan Academic, 4th Edition (2018)
5. "The Ethical Brain" by Michael S. Gazzaniga - Publisher: Dana Press, Revised and Updated Edition (2015)