Scheme of

Year Course Course Name L Т Р Credits Semester Type Code FIRST YEAR 1ST 1ST **MAL105** Calculus for Data Science BS 3 1 0 4 1ST 1ST CSL109 Introduction to Data and Analytics DC 3 0 2 4 1ST 1ST 3 0 **HUL304 Professional Ethics** HU 0 3 1ST 1ST CSL 101 Computer Programming DC 3 0 2 4 1ST 1ST HUL 101 **Communication Skills** HU 2 0 2 3 1ST 1ST SAP 101 Health, Sports & Safety HU 0 0 2 0 1ST 1ST HUL 102 **Environmental Studies** 2 0 0 0 HU Subtotal 17 18 1 6 2nd 1ST **MAL107** Introduction to Linear Algebra BS 3 0 1 4 1ST 2nd 3 1 0 4 MAL106 **Probability and Statistics** BS 1ST 2nd Data Structures 3 0 2 4 CSL102 DC 1ST 2nd CSP101 Web Programming DC 0 0 4 2 1ST 2nd 2 ECL103 **Applied Electronics** ES 3 0 4 1ST 2^{nd} Introduction to Entrepreneurship 3 0 3 HUL103 HU 0 **Subtotal** 14 2 8 21 Total 39 SECOND YEAR 2^{nd} 3rd **MAL202** Advanced Probability and BS 3 1 0 4 Statistics 2nd 3rd CSL 202 Introduction to Object Oriented DC 3 0 2 4 Programming 2nd 3rd CSL204 Discrete Maths & Graph Theory DC 3 1 0 4 3rd 2nd Data Structures With Applications 2 CSL210 DC 0 2 3 2nd 3rd CSP203 Tools and Practices for Data DC 0 2 0 4 Science - I 2nd 3rd Data Handling and Visualization DC CSL214 0 2 2 1 19 **Subtotal** 12 2 10 2nd 4^{th} CSL205 Design and Analysis of Algorithms DC 0 3 2 4 2nd Δ^{th} 3 2 **CSL207 Operating Systems** DC 0 4 2nd 4^{th} CSL215 Sensor Data Analytics 2 DC 3 0 4 2nd 4^{th} CSL216 DC 3 0 Foundation of Computing 0 3 2nd 4^{th} Topics in Data Science 3 0 0 **CSL217** DC 3 2nd 4^{th} CSP204 Tools and Practices for Data DC 0 0 4 2 Science - II Subtotal 15 0 10 20 Total 39 **THIRD YEAR** 3rd 5th CSL422 Machine Learning DC 3 0 2 4 3rd 5th CSL311 Data Privacy and Security DC 3 0 2 4 3rd 5th CSL 301 Database Management Systems DC 3 0 2 4 3rd 5th CSL421 Artificial Intelligence DC 3 0 2 4 3rd 5th 2 2 Fundamentals of Computer DC 0 0 CSL312 Networks 3rd 5th DC 2 CSP301 Tools and Practices for Data 0 0 4 Science III 5th 3rd CSD301 DE 3 Mini Project - I 0 0 6 0 **Subtotal** 14 16 23 3rd 6th 3 CSL313 Computer Vision and Deep DC 0 2 4 Learning

B. Tech. in CSE (Data Science & Analytics)

3 rd	6 th	CSL444	Big Data Analytics	DC	3	0	2	4
3 rd	6 th	CSL436	Data Mining and Warehousing	DC	3	0	2	4
3 rd	6 th	CSL314	Design Thinking	DC	3	0	0	3
3 rd	6 th		Open Course – I	OC	3	0	0	3
3 rd	6 th	CSD301	Mini Project - II	DE	0	0	6	3
			Subtotal		15	0	10	21
				Total				44
			FINAL YEAR					
4 th	7 th	CSD 403	Project Phase - I	DE	0	0	4	2
4 th	7 th		Elective – I	DE	3	0	0	3
4 th	7 th		Elective –II	DE	3	0	2	4
4^{th}	7 th		Elective – III	DE	3	0	2	4
4 th	7 th		Elective - V	DE	3	0	0	3
4 th	7 th		MooC Course / Open Course – II	OC	3	0	0	3
			0	R		-		
4 th	7 th	CSD 402	Industry Internship Project	DE	0	0	12	6
4^{th}	7 th	CSD 403	Project Phase - I	DE	0	0	4	2
			Subtotal		15	0	24	19 / 8
4 th	8 th	CSD 402	Industry Internship Project	DE	0	0	12	6
4 th	8 th	CSD 404	Project Phase - II	DE	0	0	6	6
			0	R				
4 th	8 th	CSD 404	Project Phase - II	DE	0	0	6	6
4 th	8 th		Elective – I	DE	3	0	0	3
4 th	8 th		Elective – II	DE	3	0	2	4
4 th	8 th		Elective – III	DE	3	0	2	4
4 th	8 th		Elective - V	DE	3	0	0	3
4^{th}	8 th		MooC Course / Open Course – II	OC	3	0	0	3
			Subtotal		15	0	28	12 / 23
				Total				31
	GRAND TOTAL							

ТҮРЕ	CREDITS
BS	16
HU	9
ES	4
OC	6
DE	34
DC	84
Total	153

1st Year Syllabus

Course Code	CSL109	Course Title	Introduction to Data and Analytics				
Category	Core	Credit Assigned	L	Τ	Р	С	
			3	0	2	4	
Pre-requisite	-	Type of Course	CSE with	DSA			
(If any)							

Course Outcomes:

- 1. Identify and describe the methods and techniques commonly used in data science.
- 2. Demonstrate proficiency with the methods and techniques for obtaining, organizing, exploring, and analyzing data.
- 3. Recognize how data analysis, inferential statistics, modeling, machine learning, and statistical computing can be utilized in an integrated capacity.
- 4. Create and modify customizable tools for data analysis and visualization per the evaluation of characteristics of the data and the nature of the analysis.
- 5. Demonstrate the ability to clean and prepare data for analysis and assemble data from a variety of sources.

Course Contents:

Module – I: Introduction

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Module – II: Data Collection and Data Pre-Processing

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Module – III: Exploratory Data Analytics

Descriptive Statistics – Mean, Standard Deviation, Skewness, and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Module -IV: Data Definitions and Analysis Techniques

Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Introduction to statistical learning

Module -V: Descriptive Statistics

Measures of central tendency, Measures of the location of dispersions, Practice, and analysis Statistical hypothesis generation, and testing, Chi-Square test, t-Test, Analysis of variance, Correlation analysis, Maximum likelihood test, Practice, and analysis

Text Books:

- 1. An introduction to Data Science by Jeffrey Stanton
- 2. The Elements of Data Analytic Style by Jeff Leek
- 3. Exploratory Data Analysis with R, by Roger Peng
- 4. OpenIntro Statistics, by Diez, Barr, and Centinkaya-Rundel
- 5. R Programming for Data Science, by Roger Peng

References:

1. UC Irvine Machine Learning Repository https://archive.ics.uci.edu/ml/index.php

- 2. Variety of consumer datasets https://www.kaggle.com/datasets
- 3. World Bank https://data.worldbank.org/data-catalog/
- 4. US Government Data https://www.data.gov/

Course Code	HUL304	Course Title	Professional Ethics			
Category	Core	Credit Assigned	L	Т	Р	С
			3	0	0	3
Pre-requisite	-	Type of Course	Basic S	cience		
(If any)						

Course Outcomes:

After the successful completing of this course the students will be able to:

- Define professional ethics associated with engineering profession.
- Identify various types of ethics
- Recognize the essential complimentary nature of ethics -professions, and human-computer interactions.
- Illustrate the workplace responsibilities and ethical dilemmas associated with the engineering profession.
- Demonstrate broad framework of responsible technology development and social impact of engineering solutions.

Course Contents:

Module 1:

Basic concepts to understand Professional Ethics: society, values, ethics, tradition and modernization, social organization and disorganization, power vs. social justice, society and engineering profession, technology, digitalization and non-personal data.

Module 2:

Types of Ethics: the difference between professional ethics, and general ethics. Legal ethics, environmental ethics, and computer ethics, duty ethics vs. rights ethics, data ethics.

Module 3:

Professional responsibility and Ethical dilemmas: The conflict of interests: individual rights and social responsibility, Meaningful work, Whistle- blowing, ethical relativism, issue of privacy, honesty and research integrity, safety at work-place, surveillance.

Module 4:

Technology development and Professional ethics: appropriate technology, technology transfer and global justice, social impact of technology development and engineering solutions, interactions between human and internet, harnessing data for world poor

Case studies will be discussed to provide practical experiences to students.

Text Books

- 1. Martin, M. W., & Schinzinger, R. (1989). Ethics in engineering. McGraw-Hill.
- 2. Camenisch, P.F. (1983). Grounding Professional Ethics in a Pluralistic Society, N.Y.: Haven Publications.
- 3. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2010). *A Foundation Course in Human Values and Professionals Ethics*. Excel Books India.
- 4. World Bank. World development report 2021: Data for better lives. The World Bank; 2021 Jun 15.

5. Srinivasan, S., Comini, N. and Minges, M., 2021. The Importance of National Data Infrastructure for Low and Middle-Income Countries. *Available at SSRN 3898094*.

References

- 1. E.F. Schumacher, (1973). Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
- 2. Sussan George, (1976). How the Other Half Dies, Penguin Press
- 3. PL Dhar, RR Gaur, (1990). Science and Humanism, Commonwealth Publishers.
- 4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, (1972). Limits to Growth- Club of Rome's report, Universe Books.
- 5. E G Seebauer & Robert L. Berry, (2000). Fundamentals of Ethics for Scientists and Engineers, Oxford University Press.
- 6. R R Gaur, R Sangal, G P Bagaria, (2009). A Foundation Course in Value Education.
- 7. Koehn, D. (1995). The Ground of Professional Ethics, Routledge.
- 8. N. Tripathy, (2003). Human Values, New Age International Publishers.
- 9. J. Timmons Roberts and Amy Bellone Hite, Eds. The Globalization and Development Reader: Perspectives on Development and Global Change, Blackwell: London, 2007 Amartya Sen, Development as Freedom, Anchor Books: New York, 1999
- **10.** IT Governance: How Top Performers Manage IT Decision Rights for Superior Results Kindle Edition by Peter Weill (Author), Jeanne W. Ross

Course Code:	CSL314	Course Title:	Des	Design Thinking			
Category:	Core	Credit	L	Τ	Р	С	
		Assigned	3	0	0	3	
Pre- Requisite (if Any)	Nil	Type of Course	CSF	E with	DSA		

Course Outcomes:

- 1. Appreciate various design process procedures
- 2. Generate and develop design ideas through different techniques
- 3. Identify the significance of reverse Engineering to Understand products
- 4. Draw technical drawing for design ideas

Course Contents:

Module 1-PROCESS OF DESIGN

Understanding Design thinking Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across the globe – MVP or Prototyping

Module 2- Tools for Design Thinking

Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space, Empathy for design – Collaboration in distributed Design

Module 3- Design Thinking in IT

Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping

Module 4- DT For strategic innovations

Growth – Story telling representation – Strategic Foresight - Change – Sense Making -Maintenance Relevance – Value redefinition - Extreme Competition – experience design Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.

Module 5- Design thinking workshop

Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test

Text books:

1.John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.

2.Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.

3.Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve

– Apply", Springer, 2011

4.Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

References:

• Yousef Haik and Tamer M.Shahin, "Engineering Design Process", CengageLearning,

Second Edition, 2011.

• Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).

Course Code	MAL106	Course Title	Probability and Statistics				
Category	Core	Credit Assigned	L	Т	Р	С	
			3	1	0	4	
Pre-requisite	-	Type of Course	Basic Scien	nce			
(If any)							

Course Outcomes:

- 1. Solve problems of basic probability, two types of random variables and their probability functions.
- 2. Observe and analyze the behaviour of various discrete and continuous probability distributions.
- 3. Formulate an appropriate null and alternative hypothesis. Perform test of Hypothesis for decision making and validation.
- 4. Apply the statistics for testing the significance of the given large and small sample data by using t-test, F- test and Chi-square test.
- 5. Compute and interpret the results of Bivariate and Multivariate Regression and Correlation Analysis, for prediction and forecasting.

Course Contents:

Probability

Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye's theorem, Random variables – Discrete and continuous, probability density function; probability distribution function for discrete and continuous random variable joint distributions. Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

Distributions

Binomial , Poisson & normal distributions related properties . Sampling distributions –Sampling distribution of means (known and Unknown).

Testing of Hypothesis I

Tests of hypothesis point estimations - interval estimations Bayesian estimation. Large samples, Null hypothesis - Alternate hypothesis type I, & type II errors - critical region confidential interval for mean testing of single variance. Difference between the mean.

Testing of Hypothesis II

Confidential interval for the proportions. Tests of hypothesis for the proportions single and difference between the proportions. Small samples, Confidence interval for the t- distribution – Tests of hypothesis – t- distributions, F- distributions distribution. Test of Hypothesis.

Regression and Correlation Analysis

Regression and Correlation Analysis: Introduction, Bi-Variate Normal distribution and the associated marginal and conditional distributions, estimation and analysis of simple regression models, correlation coefficients, analysis of correlation coefficients, Hypothesis tests associated with regression and correlation coefficients, curvilinear regression models, Multiple regression models, multiple and partial correlation coefficients.

Text Books:

- 1. D. K. Murugesan & P. Guru Swamy, "Probability & Statistics", Anuradha Publications.
- 2. G. S. S. Bhisma Rao, "Probability & Statistics for Engineers", Scitech Publications.
- 3. Spiegel, Murray, "Probability and Statistics", Schaum's series.

Reference Books:

- 1. K.V. Iyengar & B. Krishna Gandhi , "Probability & Statistics", S.Chand.
- 2. William Mendenhall & Others, "Probability & Statistics", Cengage Publications.
- 3. P. Billingsley, "Probability and Measure", John Wiley & Sons (SEA) Pvt. Ltd.
- 4. W. Feller, "An introduction to probability theory and its applications", John Wiley and Sons.

Course Code	CSP101	Course Title	Web Programming			
Category	Core	Credit Assigned	L	Т	Р	С
			0	0	4	2
Pre-requisite	-	Type of Course	CSE with	DSA	·	
(If any)						

Course Outcomes:

- 1. Build awesome front-end features.
- 2. Architect scalable back-end infrastructure.
- 3. Test features with minimal effort and deploy features seamlessly to production.
- 4. Build a working industry application from scratch.

Ready for the Role of **Full stack developer.**

Module 1: HTML

Introduction to HTML 5, Browsers and HTML, Editor's Offline and Online, Tags, Attribute and Elements, Doctype element, Comments, Headings, Paragraphs, Formatting text, Lists and Links Images, Table.

Module 2: CSS

Introduction CSS, Applying CSS to HTML, Selectors, properties and values, CSS Colors, Backgrounds, CSS Box Model, CSS Margins, Padding, Borders, CSS Text and Font Properties, CSS General Topics.

Module 3: JavaScript

Introduction to JavaScript, Applying JavaScript (internal, external), Understanding JS Syntax, Introduction to Document and Window Object, Variables, Operators, Data Types, Num Type Conversion, Math, String, Manipulation, Objects, Arrays, Date and Time, Conditional Statements, Switch Case, Looping in JS, Functions.

Module 4: <u>ReactJS</u>

Introduction, Templating using JSX, Components, State and Props, Lifecycle of Components, Rendering List, Portals, , Error Handling, Routers, Redux, Redux Saga, Immutable.js, Service side rendering, Unit testing, Webpack.

Module 5: <u>Node.js</u>

Node.js overview, Node.js – basics and setup, Node.js console, Node.js command utilities, Node.js modules, Node.js concepts, Node.js events, Node.js with Express.js, Node.js database access.

Module 6: MongoDB

SQL and NoSql concepts, Create and manage MongoDB, Migration of data into MongoDB, MongoDB with

PHP, MongoDB with NodeJS, Services offered by MongoDB.

Module7: Python

Python installation & configuration, Developing a Python application, Connect MongoDB with Python.

Reference books :

1. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer

2.Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker 3.Full-Stack React, TypeScript, and Node: Build Cloud-ready Web Applications Using React 17 with Hooks and GraphQL

4.Full-Stack React Projects: Learn MERN Stack Development by Building Modern Web Apps Using MongoDB, Express, React, and Node.js, 2nd Edition.

Course Code	HUL103	Course Title	Introduction to Entrepreneurship			
Category	Core	Credit Assigned	L T P C			
			3	0	0	3
Pre-requisite	-	Type of Course	Basic Science			
(If any)						

Course Outcomes:

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

- Define entrepreneurship and its association with engineering profession, and create basic understanding of conceiving, creating, and managing an entrepreneurial venture.
- Identify various characteristics of Entrepreneurship, entrepreneurial culture and India's status with respect to entrepreneurship development.
- Recognize the essential complimentary nature of ethics/ values and creativity for entrepreneurship development
- Describe the MSMEs, SEZ and entrepreneurship development schemes and financial resources
- Demonstrate broad framework of opportunities for smart entrepreneurial efforts and start-up development

Course Contents:

Module 1:

Meaning and Importance, Evolution of term 'Entrepreneurship', Factors influencing entrepreneurship'. Characteristics and types of an entrepreneur, New generations of entrepreneurship viz. social entrepreneurship, Barriers to entrepreneurship.

Module 2:

Motivation theory, Achievement Theory, Culture and Society, Values / Ethics- national entrepreneurial culture, make in India concept and practices, creativity and entrepreneurship, Decision making and Problem Solving (steps in decision making), entrepreneurship and employment.

Module 3:

Special Economic Zone (Meaning, features & amp; examples), Export-oriented units, Small Scale Industries, Make in India initiated by the government of India and Support for Industries. Scheme and packages, Financial and legal assistance for entrepreneurial development.

Module 4:

Opportunity for smart entrepreneurial efforts, branding, the management of property rights,

social value, technological innovation, online commerce, emerging markets and entrepreneurial solutions

Module 5:

Introduction to Idea Selection, Selection of the Product / Service, Phases of a Project, Project Report, and

Contents of a Project Report. Case studies to provide real knowledge.

Basic Readings

- Gordon, E., Natarajan, K., & Arora, A. (2009). Entrepreneurship development. Himalaya publishing house.
- Megginson, W.L., Byrd, M.J. and Megginson, L.C., 2000. Small business management: an entrepreneur's guidebook.
- Watson, J., Gatewood, E.J. and Lewis, K., 2014. A framework for assessing entrepreneurial outcomes: an international perspective. *International Journal of Gender and Entrepreneurship*.
- Katz, J.A. and Green, R.P., 2021. Entrepreneurship Small Business.
- Blomberg, J., Burrell, M., and Guest, G. An Ethnographic Approach to Design, Human-Computer Interaction Handbook, L. Erlbaum Associates Inc. Hillsdale, NJ, USA, 2003
- Lerner, J. and Schoar, A. eds., 2010. *International differences in entrepreneurship*. University of Chicago Press.

References

- Oughton, E. J., Comini, N., Foster, V., & Hall, J. W. (2022). Policy choices can help keep 4G and 5G universal broadband affordable. *Technological Forecasting and Social Change*, *176*, 121409.
- Sterling, B. The Epic Struggle of the Internet of Things, Moscow: Strelka Press, 2014.
- Castells, Manuel (2001): Internet Galaxy. Oxford University Press
- J. Timmons Roberts and Amy Bellone Hite, Eds. The Globalization and Development Reader: Perspectives on Development and Global Change, Blackwell: London, 2007
- Udyamita (in Hindi) by Dr. MMP. Akhouri and S.P Mishra, pub. By National Institute for Entrepreneurship and Small Business Development (NIESBUD), NSIC-PATC Campus, Okhla
- Amartya Sen, Development as Freedom, Anchor Books: New York, 1999
- IT Governance: How Top Performers Manage IT Decision Rights for Superior Results Kindle Edition by Peter Weill (Author), Jeanne W. Ross
- Science Tec. Entrepreneur (A Bi Monthly Publication), Centre for Entrepreneurship Development, M.P (CEDMAP)

Course Code	MAL105	Course Title	Calculus	Calculus for Data Science				
Category	Core	Credit Assigned	L T P C					
			3	1	0	4		
Pre-requisite	-	Type of Course	Basic Sci	ence				

Course Outcomes:

1) To analyze the nature (convergence or divergence) of a sequence or series.

2) To apply mean value theorems in the study of motion of an object.

3) To use integration in the calculation of area, volume, mass, and centre of gravity.

4) To apply multivariable calculus to study the nature of multivariable functions.

5) To understand the concept of Differential equation and its application

Course Contents:

Module 1:

Sequences and series: Sequences of real numbers, Series, ratio and root test.

Module 2:

Calculus of functions of single variable: Review of limits, continuity, and differentiability. Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's theorem with remainders, indeterminate forms, curvature, curve tracing. Fundamental theorem of Integral calculus, mean value theorems of integral calculus, evaluation of definite integrals, applications in area, length, volumes and surface of solids of revolutions, Improper integrals: Beta and Gamma functions, differentiation under integral sign.

Module 3:

Calculus of Functions of Several Variables: Limit, continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation, Tangent plane and normal line. Total differentiation, chain rules, Taylor's formula, maxima and minima, Lagrange's method of undetermined multipliers. Double and triple integrals, Jacobian, change of order of integration, change of variables, application to area, volumes, Mass, Centre of gravity.

Module 4:

Differential equation and its modelling with curve fitting: Modelling with Differential Equations , Direction Fields and Euler's Method , Linear and Bernoulli's differential equations, Nonlinear differential equations, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems Canter and circle of curvature, evolutes and involutes.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons

Reference Books:

1. Piskunov, N., Differential and Integral calculus, Mir publishers Moscow (Vol. 1, Vol. 2)

Course Code	ECL103	Course Title	Applied Electronics				
Category	Core	Credit Assigned	L T P C				
			3	0	2	3	
Pre-requisite	-	Type of Course	Electronics Engineering				
(If any)							

Course Contents:

Module 1: ELECTRONIC DEVICES

Theory of P-N Junction Diode, Junction Transistors Theory of Operation, Static Characteristics, Break Down Voltages, Current Voltage Power Limitations, Field Effect Transistor & MOSFET, Principle of Operation & Characteristics.

Module 2: APPLICATIONS of ELECTRONIC DEVICES

Rectifiers, Zener Diode as Regulators, Biasing of BJT Different Biasing Arrangements, Stability Factor, Small Signal Analysis & High Frequency Analysis of BJT, Power Amplifiers, Push Pull Configuration, Complimentary Symmetry, Feedback Amplifiers, RC, LC & Crystal Oscillators.

Module 3: COMBINATIONAL and SEQUENTIAL LOGIC

Logic minimization using K-map method, multiplexers, demultiplexers, decoders, encoders, Arithmetic circuits, Adders, Combinational multiplier and code converters. Basic latches, master-slave latch, Flip flops, Registers, Counters.

Module 4: MEMORIES

Introduction to PLA, PAL and ROM, Programmable Logic Devices and FPGAs.

Module 5: INTRODUCTION TO MICROPROCESSORS

Architecture, bus structure, timing diagrams, T-states, machine cycle, instruction cycle. Memory and IO devices interfacing.

Reference Books:

- 1) Electronic devices and circuit theory / Robert L. Boylestad, Louis Nashelsky
- 2) Milman and Halkias, "Integrated Electronics", Second Edition, 2011, McGraw Hill.
- 3) Digital Design by M. Morris Mano and Michael D. Ciletti
- 4) Microprocessor Architecture, Programming, and Applications with the 8085 by Ramesh Gaonkar

Course Code	MAL107	Course Title	Introduction to Linear Algebra				
Category	Core	Credit Assigned	L T P C				
			3	1	0	4	
Pre-requisite (If any)	-	Type of Course	Basic Science				

Course Outcomes:

- 1. Describe properties of linear systems using vectors and Solve systems of linear equations and interpret their results
- 2. Demonstrate an understanding of linear transformations and Perform and interpret matrix operations
- 3. Compute and interpret determinants of matrices and Demonstrate an understanding of vector spaces and sub-spaces
- 4. Demonstrate an understanding of eigenvalues and eigenvectors

Course Contents:

Module-1

Introduction to Vectors, Vectors and Linear Combinations, Lengths and Dot Products, Matrices, Solving Linear Equations, Vectors and Linear Equations, The Idea of Elimination, Elimination Using Matrices, Rules for Matrix, Operations, InverseMatrices, Elimination = Factorization: A = LU, Transposes and Permutations Vector Spaces and Subspaces, Spaces of Vectors, The Nullspace of A: Solving Ax = 0 and Rx = The Complete Solution to Ax = b.

Module-2

Independence, Basis and Dimension, Dimensions of the Four Subspaces, Orthogonality, Orthogonality of the Four Subspaces, Projections, Least Squares Approximations, Orthonormal Bases and Gram-Schmidt Determinants, The Properties of Determinants, Permutations and Cofactors, Cramer's Rule, Inverses, and Volumes, Eigenvalues and Eigenvectors, Introduction to Eigenvalues

Module-3

Diagonalizing a Matrix, Systems of Differential Equations, Symmetric Matrices, Positive Definite Matrices, The Singular Value Decomposition (SVD), Bases and Matrices in the SVD, Principal Component Analysis (PCA by the SVD) The Geometry of the SVD Linear Transformations, The Idea of a Linear Transformation

Module-4

The Matrix of a Linear Transformation, The Search for a Good Basis, Complex Vectors and Matrices, Complex Numbers, Hermitian and Unitary Matrices, The Fast Fourier Transform, Applications, Graphs and Networks, Matrices in Engineering, Markov Matrices, Population, and Economics, Linear Programming, Fourier Series: Linear Algebra for Functions.

Module-5

Numerical Linear Algebra, Gaussian Elimination in Practice, Norms and Condition Numbers, Iterative Methods and Preconditioners, Mean, Variance, and Probability, Covariance Matrices and Joint Probabilities, Multivariate Gaussian and Weighted Least Squares, Matrix Factorization

Text Books:

- 1. Kenneth Hoffman and Ray Kunze: Linear Algebra, Prentice Hall of India limited, New Delhi, 1971.
- 2. Gilbert Strang : Linear Algebra And Its Applications (Paperback) , Nelson Engineering (2007).
- 3. Introduction to Linear Algebra: Gilbert Strang

Reference Books:

1. Gilbert Strang: Introduction to Linear Algebra, Wellesley- Cambridge Press, Fourth Edition, 2011.

2. Jin Ho Kwak and Sungpyo Hong, Linear Algebra, Springer, Second edition, 2004.

- 3. V. Krishnamoorthy et. al., An introduction to linear algebra, New Delhi.
- 4. Elementary of Linear Algebra Howard Anton