S. A. ENGINEERING COLLEGE, CHENNAI-77
(AN AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)
B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATION – 2020
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR I- VIII SEMESTER

SEMESTER I

S.NO	SUBJECT CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS1101A	Technical English	HS	3	3	0	0	3
2.	MA1101A	Calculus and its application	BS	4	3	1	0	4
3.	PH1101A	Applied Physics	BS	3	3	0	0	3
4.	CY1101A	Engineering Chemistry	BS	3	3	0	0	3
5.	CS1101A	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	ME1101A	Engineering Graphics	ES	4	2	0	2	3
PRACTICALS								
7.	BS1101A	Physics and Chemistry Laboratory	BS	4	0	0	4	2
8.	CS1102A	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
MANDATORY COURSE								
9.	CI1101A	Indian Constitution	MC	2	2	0	0	0
10.	FL0001A	French/Japanese	MC	2	2	0	0	0
			TOTAL	**32**	**21**	**1**	**10**	**23**

SEMESTER II

S.NO	SUBJECT CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS1201A	English for Communication	HS	3	3	0	0	3
2.	MA1303A	Discrete Mathematics	BS	4	3	1	0	4
3.	PH1201A	Material Science	BS	3	3	0	0	3

4.	EE1202A	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
5.	CS1201A	Programming in C	PC	3	3	0	0	3
6.	EC1306A	Digital Principles and System Design	ES	3	3	0	0	3
PRACTICALS								
7.	GE1201A	Engineering Practice Laboratory	ES	4	0	0	4	2
8.	CS1203A	Programming in C Laboratory	PC	4	0	0	4	2
MANDATORY COURSE								
9.	CY1201A	Environmental Science and Engineering	MC	2	2	0	0	0
			TOTAL	**29**	**20**	**1**	**8**	**23**

SEMESTER III

S.NO	SUBJECT CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA1304A	Computational Statistics	BS	4	3	1	0	4
2.	AD1301A	Introduction to Data Science	PC	3	3	0	0	3
3.	IT1301A	Object Oriented Programming	PC	3	3	0	0	3
4.	CS1301A	Data Structures	PC	3	3	0	0	3
5.	CS1302A	Software Engineering	PC	3	3	0	0	3
PRACTICAL								
6.	AD1302A	Data Science Laboratory	PC	4	0	0	4	2
7.	CS1303A	Data Structures Laboratory	PC	4	0	0	4	2
8.	IT1302A	Object Oriented Programming Laboratory	PC	4	0	0	4	2
9.	HS1301A	Interpersonal Skills Laboratory	EEC	2	0	0	2	1
			TOTAL	**30**	**15**	**1**	**14**	**23**

SEMESTER IV

S.NO	SUBJECT CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA1405A	Linear Algebra and Optimization Techniques	BS	4	3	1	0	4
2.	AD1401A	Fundamentals of Artificial Intelligence	PC	3	3	0	0	3
3.	AD1402A	Data Analytics	PC	3	3	0	0	3
4.	IT1401A	Database Management systems	PC	3	3	0	0	3
5.	HV1401A	Universal Human Values	ES	3	2	1	0	3
PRACTICAL								
6.	AD1403A	Artificial Intelligence Laboratory	PC	4	0	0	4	2
7.	AD1404A	Data Analytics Laboratory	PC	4	0	0	4	2
8.	IT1402A	Database Management Systems Laboratory	PC	4	0	0	4	2
9.	HS1401A	Employability And Soft Skills Lab	EEC	2	0	0	2	1
			TOTAL	**30**	**14**	**2**	**14**	**23**

SEMESTER V

S.NO	SUBJECT CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AD1501A	Information and Network Security	PC	3	3	0	0	3
2.	IT1701A	Distributed Systems and Cloud Computing	PC	3	3	0	0	3
3.	CS1701A	Machine Learning	PC	3	3	0	0	3
4.	AD1502A	Digital Image Processing	PC	3	3	0	0	3
5.		Open Elective	OE	3	3	0	0	3

6.		Professional Elective-I	PE	3	3	0	0	3
PRACTICAL								
7.	IT1702A	Cloud Computing Laboratory	PC	4	0	0	4	2
8.	CS1702A	Machine Learning Laboratory	PC	4	0	0	4	2
			TOTAL	**26**	**18**	**0**	**8**	**22**

SEMESTER VI

S.NO	SUBJECT CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AD1601A	Cryptography and Cyber Security	PC	3	3	0	0	3
2.	AD1602A	Deep Learning	PC	3	3	0	0	3
3.	AD1603A	Computer Vision	PC	3	3	0	0	3
4.	AD1604A	Data Visualization	PC	3	3	0	0	3
5.		Professional Elective-II	PE	3	3	0	0	3
PRACTICAL								
6.	AD1605A	Security Laboratory	PC	4	0	0	4	2
7.	AD1606A	Deep Learning Laboratory	PC	4	0	0	4	2
8.	ECS1601A	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	4	0	0	6	3
			TOTAL	**27**	**13**	**0**	**14**	**21**

SEMESTER VII

S.NO	SUBJECT CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AD1701A	Soft Computing	PC	3	3	0	0	3
2.	AD1702A	Big Data Analytics	PC	3	3	0	0	3

3.		Open Elective	OE	3	3	0	0	3
4.		Professional Elective-III	PE	3	3	0	0	3
5.		Professional Elective-IV	PE	3	3	0	0	3
PRACTICAL								
6.	AD1703A	Soft Computing Laboratory	PC	4	0	0	4	2
7.	AD1704A	Data Analytics Laboratory	PC	4	0	0	4	2
8.	AD1705A	Project Work - I	EEC	6	0	0	6	3
			TOTAL	**25**	**15**	**0**	**14**	**22**

SEMESTER VIII

S.NO	**SUBJECT CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1.		Professional Elective-V	PE	3	3	0	0	3
2.		Professional Elective-VI	PE	3	3	0	0	3
PRACTICAL								
3.	AD1801A	Project Work - II	EEC	6	0	0	6	3
			TOTAL	**12**	**6**	**0**	**6**	**9**

Total No. of Credits:165

PROFESSIONAL ELECTIVES

Elective I (Semester V)								
SNO	**SUBJECT CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	CS1713A	Block Chain Technologies	PE	3	3	0	0	3
2.	AD1503A	Speech Analytics	PE	3	3	0	0	3
3.	AD1504A	Cyber Forensics	PE	3	3	0	0	3
4.	AD1505A	VR & AR	PE	3	3	0	0	3
5.	AD1507A	Recommender systems	PE	3	3	0	0	3

Elective II (Semester VI)								
SNO	**SUBJECT CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	AD1607A	Virtual and Augmented Reality	PE	3	3	0	0	3
2.	AD1608A	Pattern Recognition	PE	3	3	0	0	3
3.	AD1609A	Cognitive Analysis	PE	3	3	0	0	3
4.	AD1610A	Business Intelligence	PE	3	3	0	0	3
5.	AD1611A	Speech Processing	PE	4	2	0	2	3

Elective III (Semester VII)								
SNO	**SUBJECT CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	AD1706A	Human Intelligent System	PE	3	3	0	0	3
2.	AD1707A	Fuzzy logic for Data Science	PE	3	3	0	0	3
3.	AD1708A	Optimization in ML	PE	3	3	0	0	3
4.	AD1709A	Applied Machine Learning	PE	3	3	0	0	3
5.	AD1710A	Intelligent Information Retrieval	PE	3	3	0	0	3

Elective IV(Semester VI)								
SNO	**SUBJECT CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	AD1711A	AI for Cyber Security	PE	3	3	0	0	3
2.	AD1712A	Optimization for Data Science	PE	3	3	0	0	3
3.	AD1713A	Software Project Management	PE	3	3	0	0	3
4.	AD1714A	Database Security and Auditing	PE	3	3	0	0	3
5.	AD1715A	Game Theory for AI and Data Science	PE	3	3	0	0	3
Elective V(Semester VIII)								
SNO	**SUBJECT CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	AD1802A	Robotics	PE	3	3	0	0	3
2.	AD1803A	Information Security	PE	3	3	0	0	3
3.	AD1804A	Professional Ethics in Engineering	PE	3	3	0	0	3
4.	AD1805A	Data Security and Access Control	PE	3	3	0	0	3
5.	AD1806A	Multi core Architecture and Programming	PE	3	3	0	0	3

Elective VI(Semester VII)								
SNO	**SUBJECT CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	AD1807A	Bio Inspired algorithms	PE	3	3	0	0	3
2.	AD1808A	Business Data Analytics	PE	3	3	0	0	3
3.	AD1809A	Large-Scale Visual Analytics	PE	3	3	0	0	3
4.	AD1810A	Quantum Artificial Intelligence	PE	3	3	0	0	3
5.	AD1811A	Real Time Video AI Technologies	PE	3	3	0	0	3

SUMMARY

NO	Subject Area	Credits per semester								Credits total	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	3	3							**6**	.036
2.	BS	12	7	4	4					**27**	.163
3.	ES	8	8		3					**19**	.115
4.	PC		5	18	15	16	16	10		**80**	.479
5.	PE					3	3	6	6	**18**	.163
6.	EEC			1	1		3	3	3	**11**	.066
7.	OE					3		3		**6**	.036
TOTAL		**23**	**23**	**23**	**23**	**22**	**22**	**22**	**9**	**167**	

HS1101A **TECHNICAL ENGLISH**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Nurture their ability in technical writing like to prepare professional job applications and effective reports.
- Develop their speaking skills by participating in various speaking activities.
- Strengthen their listening skill to comprehend lectures and talks in their areas of specialization.
- Improve their ability to explicit their excellence in all modes of technical communication.

UNIT I **9**

Reading- Reading short texts Listening- Listening to different formal / informal conversations Writing- Instructions, Jumbled sentences Speaking- Self introduction Language development- Parts of speech, Prepositions Vocabulary development- Word formation- root words from foreign language and their use in English.

UNIT II **9**

Reading-Skimming and Scanning to find specific information Listening- Listening to INK talks Writing- Job Application – cover letter, resume writing Speaking- Asking and Giving directions Language development- Conjunctions, Types of Nouns Vocabulary development- Prefixes and Suffixes.

UNIT III **9**

Reading- Reading for predicting the content Listening- Listening to situational short talks Writing- Types of paragraphs- Descriptive/Analytical/ compare and contrast Speaking- Mini presentations, Expressing greeting and thanks Language development- Adjectives, Numerical Adjectives, Conditional Clauses Vocabulary development- Homophones, Homonyms.

UNIT IV **9**

Reading- Practice in speed reading Listening- Listening to short texts and fill the data Writing- Interpretation of Graphics / Information, Note making Speaking-Contributing for Group Discussion Language development- Active, Passive, Impersonal passive voice Vocabulary development- Definitions, Nominal Compounds.

UNIT V **9**

Reading- Reading short stories Listening- Listening for note taking Writing- Report writing, E-mail Writing Speaking- Picture descriptions, Speaking in familiar situations Language development- Tenses Vocabulary development- British and American Vocabulary.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialization successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write correctly, clearly and concisely with coherence and cohesion.
- Prepare job applications and resume in an inspiring manner.

TEXT BOOKS:

1. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.
2. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
3. Darlene Smith-Worthington, Sue Jefferson, Technical writing for Success, South-Western Cengage Learning,USA-2011
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi, 2014
6. Swan Michael, Practical English Usage. Oxford University Press, Eighth impression 2002.

MA1101A CALCULUS AND ITS APPLICATIONS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To understand the concepts of limits, continuity, differentiation and use it to find maxima and minima of functions of one variable.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations of first and second order that model in various engineering problems.
- To familiarize the student with functions of several variables that is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS **12**

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules Maxima and Minima of functions of one variable.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER WITH APPLICATIONS **12**

Basic concepts- Separable differential equations - Exact differential equations - Integrating factors - Linear differential equations - Bernoulli's equation - Geometric Applications- Orthogonal trajectories - Physical Applications - Simple electronic circuits-Newton law of cooling-Heat flow-Rate of decay of radioactive materials-Chemical reaction and solutions.

UNIT III DIFFERENTIAL EQUATIONS **12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS **12**

Double integrals – Change of order of integration – Double integrals in polar co-ordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- Use both the limit definition and rules of differentiation to differentiate functions. apply differentiation to solve maxima and minima problems.
- The subject helps the students to develop the fundamentals and basic concepts in ODE
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.

TEXTBOOKS:

1. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2016.

2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, Inc., 2016.

REFERENCES:

1. Bali,N.P., Goyal,M.,Watkins,C.,Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.

2. Boyce,W.E.,and DiPrima,R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.

3. O'Neil. P. V., "Advanced Engineering Mathematics", 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.

4. T.Veerarajan, Engineering Mathematics, Mc Grawhill Publications, New Delhi 2017.

PH1101A **APPLIED PHYSICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER **9**

Elasticity- plasticity – Different Types of Stress and Strain- concept of stress-strain diagram and its application - three types of modulus of elasticity- Poisson's Ratio – Bending of beams- Expression for bending moment –- young's modulus uniform and Non uniform bending : Theory and Experiment – I Shape girders – Torsional oscillation Theory and Experiment- Application of Elastic Materials.

UNIT II APPLIED OPTICS **9**

Laser : characteristics of laser - Principle of spontaneous emission and stimulated emission – Laser action – Einstein A & B coefficients - Population inversion - Pumping – Basic requirement of laser – Types of laser : Nd-YAG and CO_2 – Applications : Welding , Drilling & Cutting – Medical field Fiber optics: Introduction- Principle and propagation of light – Numerical aperture and acceptance angle – classification of optical fibers – Losses in optical fibers(Qualitative) – Fiber optics communication system (Block Diagram) – Advantages with fiber optic communication system.

UNIT III THERMAL PHYSICS **9**

Modes of heat transfer- thermal conduction, convection and radiation – Specific heat capacity- thermal conductivity- Newton's law of cooling - Searle's and Lee's disc methods: theory and experiment - conduction through compound media (series and parallel) – thermal expansion of solids, liquids and gases - Applications: heat exchangers, refrigerators and solar water heaters.

UNIT IV WAVE AND PARTICLE PHYSICS **9**

Inadequacy of Classical Mechanics - Development of quantum theory- Planck's Black body radiation and Distribution Laws(Qualitative) – Compton Effect (Derivation) - De Broglie wavelength – properties of matter waves – Experimental Verification (G.P Thomson experiment) – Heisenberg's uncertainty principle - Schrodinger's wave equation – time dependent – time independent wave equations – physical significance of Wave function – applications: particle in a one dimensional potential box**.**

UNIT V CRYSTALOGRAPHY **9**

Single crystalline, polycrystalline and amorphous materials Lattice - unit cell- Crystal systems-Bravais lattices- Lattice planes- Miller indices- Interplanar- d- Spacing in cubic Lattice- calculation of number of atoms per unit cell – atomic radius – packing factor for SC, BCC, FCC and HCP structures- Crystal Defects – types.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, students will be able to

- The students will gain knowledge on the basics of properties of matter and its applications
- Use the concepts of waves and optical devices and their applications in Laser and fiber

optics

- The students will understand the properties of thermal materials and its applications
- The students will get knowledge on advanced physics concepts of quantum theory and its application in one dimensional box.
- The students will understand the different types of crystals structures and different crystal growth techniques.

TEXT BOOKS:

1. Gupta S.L. and Sanjeev Gupta, Modern Engineering Physics, Dhanpat Rai Publishers, 2015.
2. R. K. Gaur and S.C. Gupta, Engineering Physics, Dhanpat Rai Publication (P) Ltd, New Delhi, 2014.
3. Bhattacharya, D.K. and Poonam, T. Engineering Physics, Oxford University Press, 2015.

REFERENCES:

1. C. Kittel , Introduction to Solid State Physics 8th Edition , Wiley Eastern Ltd,2004.
2. Halliday, D., Resnick, R. and Walker, J. Principles of Physics. Wiley, 2015.
3. Tipler, P.A. and Mosca, G. Physics for Scientists and Engineers with Modern Physics, W.H.Freeman, 2007.
4. Einstein coefficient calculation,https://youtu.be/TvfiZHXUtXg (Video lecture)
5. Lattice structures, https://youtu.be/Rm-i1c7zr6Q (Video lecture)

CY1101A ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and
- Two component systems and appreciate the purpose and significance of alloys.
- It enables the students to gain information about Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells
- It deals with the information about the types of fuels, calorific value calculations and manufacture of solid, liquid and gaseous fuels.
- To impart knowledge about the nano materials synthesis, properties and applications

UNIT I WATER TREATMENT AND TECHNOLOGY **9**

Introduction – characteristics, Water quality parameters -hardness– types, Determination-EDTA method, Alkalinity ,boiler feed water requirements-boiler troubles – scale & sludge -Caustic Embrittlement, boiler explosion -softening of hard water - external treatment process - demineralization and zeolite, internal treatment - boiler compounds (phosphate, calgon, carbonate and colloidal conditioning methods) – desalination of brackish water –reverse osmosis.

UNIT II PHASE RULE AND ALLOYS **9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system,Sulphur,CO2 system, Thermal Analysis and cooling curves, Reduced phase rule - Two Component

Systems- classification – lead-silver system-problems. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel.

UNIT III ENERGY SOURCES AND STORAGE DEVICES **9**

Energy – Types – Non-renewable energy - Nuclear energy -renewable energy - solar energy conversion - solar cells. Introduction to Electrochemistry, Nernst Equation-Electrochemical cells – reversible and irreversible cells –Cell construction and representation - Batteries -types of batteries – characteristics – construction and working of primary battery (dry cell) - secondary battery(lithium-ion-battery) - fuel cells (H2-O2).

UNIT IV FUELS AND COMBUSTION **9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) – petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number – diesel oil- cetane number – natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG) producer of fuels: introduction- theoretical calculation of calorific value- ignition temperature- explosive range – flue gas analysis (ORSAT Method).

UNIT V NANOCHEMISTRY **9**

Basics - distinction between nanoparticles and bulk materials; size- dependent properties, Nano cluster, Nano rod, nanotube(CNT)-Types of CNT and nanowire. Synthesis: precipitation, thermolysis, chemical vapour deposition, Properties, Characterization and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- The knowledge gained on water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.
- With the help of phase rule, they could understand the various phase diagrams and able to predict the low melting alloys.
- Students can get knowledge about various fuels and its applications based on its calorific value.
- It provides the students to understand about conventional and non-conventional energy sources and its applications
- Students gain an insight about the recent trends in nano materials.

TEXT BOOKS:

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, DhanpatRai Publishing Company (P) Ltd., New Delhi, 2010.

REFERENCES:

1. Dara S.S, Umare S.S, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Ozin G. A. and Arsenault A. C., “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005.

CS1101A PROBLEM SOLVING AND PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards and guess an integer number in a range, Towers of Hanoi.

UNIT II DATA EXPRESSIONS, STATEMENTS **9**

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 III CONTROL FLOW, FUNCTIONS **9**

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 search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

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, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES &TURTLE **9**

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- Case study: Simple Graphics using Turtle: Draw a Random Pattern of Circle, Square and Rectangle; Draw a Pattern of Straight Lines, Plotting Graphs in Python: Menu Driven Program to Create Mathematical 3D Objects.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples and dictionaries.
- Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Allen B. Downey, `Think Python: How to Think Like a Computer Scientist', 2nd edition, Updated for Python Shr off/ O'Reilly Publishers, 2016(http://greenteapress.com/wp/thinkpython/)
2. Reema Thareja, Problem Solving and Programming with python, 2nd edition, Oxford University press, 2019.
3. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press, 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.

ME1101A ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications –Use of drafting instruments – BIS conventions and specifications – Size and layout of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND ORTHOGRAPHIC PROJECTIONS **12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization principles – Layout of views- Orthographic projection of multiple views(Free Hand Sketching) from pictorial views of objects-Principal planes-Projection of points-Demo using CAD software for above topics.

UNIT II PROJECTION OF POINTS STRAIGHT LINES AND PLANE SURFACES 12

Orthographic projections-principles-Principal planes-First angle projection-Projection of points- Projection of straight lines (only First angle projections) inclined to one of the principal planes - Determination of true lengths and true inclinations - Projection of planes (polygonal and circular surfaces) inclined to one of the principal planes - Demo using CAD software for above topics.

UNIT III PROJECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method-Demo using CAD software for above topics.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 12

Sectioning of above solids in simple vertical position - the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones-Demo using CAD software for above topics.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions – Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method-Demo using CAD software for above topics.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the student will be able to

- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.

TEXT BOOKS:

1. NatrajanK.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers,Chennai,2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

REFERENCES:

1. Bhatt N.D. and PanchalV.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition,2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores,Bangalore, 2007.
4. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition,

Prentice Hall of India Pvt. Ltd, New Delhi,2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, NewDelhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2ndEdition, 2009.

BS1101A PHYSICS AND CHEMISTRY LABORATORY

L	T	P	C
0	0	4	2

PHYSICS LABORATORY

COURSE OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. Determination of wavelength, and particle size using Laser
4. Determination of acceptance angle in an optical fiber.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
7. Determination of wavelength of mercury spectrum – spectrometer grating
8. Determination of band gap of a semiconductor
9. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- Upon completion of the course, the students will be able to apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY

COURSE OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.

LIST OF EXPERIMENTS (Any seven experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of TDS of water sample.
5. Determination of strength of acids in a mixture of acids using conductivity meter.
6. Estimation of iron content of the given solution using potentiometer.
7. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline /

thiocyanate method).
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

CS1102A PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To study python programs with conditionals and loops
- To use functions for python structured programs.
- Use strings for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- To read and write data from and to files in python.

LIST OF EXPERIMENTS:

1. Write a program to display the largest number among three numbers.
2. Write a program to display the Fibonacci series by using looping constructs.
3. Write a function to compute the GCD of two numbers.
4. Explore String Functions
5. With the help of strings, array or list, display a simple calendar in python program without using the calendar module.
6. With the help of list perform linear search and Binary search.
7. Write a program to perform Selection sort, Insertion sort, Merge sort
8. Create a text file using python file I/O. Read the content of the file and change them from lower to upper case characters.
9. Programs that take command line arguments (word count)
10. Find the most frequent words in a text read from a file
11. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the student should be able to

- Design simple programs using conditionals and loops.
- Write functions to solve mathematical problems

- Use strings for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- Identify to read and write data from and to files in python.

CI1101A **INDIAN CONSTITUTION**

L	T	P	C
2	0	0	0

Prerequisites: Basic law.

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India have played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President

of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

HS1201A **ENGLISH FOR COMMUNICATION**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Improve their language ability to improve the four basic skills of communication (LSRW).
- Enhance the skills and methods to enrich their reading and comprehending ability.
- Strengthen their skills to listen to the lectures and talks related to their fields of studies.
- Foster their ability to write effectively in all contexts.
- Cultivate their oral presentation skills through technical presentations and contribution in group discussions.

UNIT I **9**

Reading- Reading for detailed comparison Listening- Listening to interviews Writing- Developing hints, summarizing Speaking- Talk about future plans, arrangements intensions Language development- Sentence structures Vocabulary development- Synonyms, Antonyms, Adverbs

UNIT II **9**

Reading-Extended reading Listening- Listening to telephonic conversations Writing- Formal Letter Writing - Letters for bona fide certificate - to the principal for permission for in plant training, industrial visit, paper presentations, inter college events, Letter to the Editor, Recommendations Speaking- Formal conversation Language development-Use of Punctuation, Modal verbs Vocabulary development- One word substitutes, Common Phrasal verbs

UNIT III **9**

Reading- Identify topic sentences by reading a short story Listening- Listening to TED talks Writing- Process/product description Speaking- Formal Conversations Language development-Relative Clauses, Concord, Error correction Vocabulary development- Idioms & Phrases, Minimal pair.

UNIT IV **9**

Reading- Reading newspaper articles Listening- Listening to inspirational speeches Writing- Essays, Checklist Speaking- Technical Presentations Language development- Degrees of Comparison Vocabulary development- Articles, Cause and Effect Expressions

UNIT V **9**

Reading- Close reading Listening- Listening for summarizing Writing- Dialogue conversations Speaking- Movie/ Book Review Language development- Wh Questions, Yes/ no Questions Vocabulary development- Foreign Expressions and its applications, Reference words

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Read for comprehending and responding in general and professional settings.
- Demonstrate the communication skills (LSRW) in academic, professional and social Environment.
- Participate effectively in formal and informal conversations and express findings and opinions with proper language ability.
- Comprehend conversations and short talks delivered in English.
- Use the language effectively to write with clarity and accuracy in general and technical contexts.

REFERENCES:

1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
4. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013
5. Means,L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning USA: 2007.

RECCOMENDED WEBSITES:

TED.com
learningenglish.voanews.com
islcollective.com
examenglish.com
englishclass101.com

MA1303A **DISCRETE MATHEMATICS**

L	T	P	C
3	1	0	4

(Common to second semester AIDS and third semester CSE/IT)

COURSE OBJECTIVES:

- To extend student‘s logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of
- Ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.

UNIT I LOGIC AND PROOFS **12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II SET THEORY **12**

Basic concepts – Notations – Subset – Algebra of sets – The power set – Ordered pairs and Cartesian product – Relations on sets –Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations – Partial ordering – Poset – Hasse diagram – Lattices and their properties – Sub lattices – Boolean algebra – Homomorphism.

UNIT III COMBINATORICS **12**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

UNIT IV GRAPHS **12**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT V ALGEBRAIC STRUCTURES **12**

Algebraic systems – Definitions-Examples-Properties-Semi groups and monoids–Homomorphism's-Groups – Subgroups – – Normal subgroup and cosets – Lagrange's theorem – Codes and group codes – Basic notions of error correction-Error recovery in group codes.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students would:

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

TEXTBOOKS:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw
2. Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
3. Tremblay, J.P. and Manohar. R, " Discrete Mathematical Structures with Applications To Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES:

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition
2. Pearson Education Asia, Delhi, 2007.
3. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
4. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

PH1201A **MATERIAL SCIENCE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS **9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity –Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states –carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS **9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination –Elemental and Compound Semiconductors – N-type and P-type semiconductor (Qualitative) – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS **9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism –Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials –Ferrites and its applications. Electro static Discharge (ESD)-Superconductivity: properties – Type I and Type II superconductors–BCS theory of superconductivity (Qualitative) - High Tc superconductors – Electrical, medical, magnetic and computer application of superconductors.

UNIT IV DIELECTRIC MATERIALS **9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientation and space charge polarization – frequency and temperature dependence of polarisation – Clausius mosotti relation - dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer).

UNIT V ADVANCED ENGINEERING MATERIALS **9**

Metallic glasses - melt spinning process, applications - shape memory alloys: Ni-Ti alloy, applications – nano materials: preparation (bottom up and top down approaches), properties and applications- Bio materials – introduction- properties of bio materials-examples- medical applications- Ophthalmology- bio sensors- characteristics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students would:

- The students will gain knowledge of conducting materials and variation of its properties with Temperature.
- Acquire knowledge on basics of semiconductor physics and its applications in various devices.
- Get knowledge on magnetic and superconducting materials properties and their various applications.

- The students will understand the basics of dielectric materials, properties and applications of dielectric materials.
- The students will get knowledge about new engineering materials and its applications in social applications.

TEXT BOOKS:

1. S.Mohan, Principles of Materials Science, MJP Publishers, 2018.
2. Jasprit Singh, Semiconductor Devices, Basic Principles, Wiley 2012.
3. Umesh K Mishra and Jasprit Singh, Semiconductor Device Physics and Design‖, Springer, 2008.

REFERENCES:

1. Wahab, M.A. Solid State Physics: Structure and Properties of Materials‖, Narosa Publishing House, 2009.
2. William D.Callister Jr, David G. Rethwisch, Materials Science and Engineering, An Introduction, Wiley India (P) Ltd., 8th Edition, 2009.
3. Pillai S.O., Solid State Physics, New Age International (P) Ltd., Publishers, 2009.
4. Semiconductor Introduction, https://youtu.be/k6ZxP9Yr02E (Video lecture)
5. Superconductivity, https://youtu.be/D-9M3GWOBrw (Video lecture)

EE1202A BASIC ELECTRICAL, ELECTRONICS & MEASUREMENT ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamental laws, theorems of electrical circuits and also to analyze them
- To study the basic principles of electrical machines and their performance
- To study the different energy sources, protective devices and their field applications
- To understand the fundamentals of electronic circuit constructions
- To understand the principles and operation of measuring instruments and transducers

UNIT I ELECTRICAL CIRCUITS ANALYSIS 9

Ohms Law, Kirchhoff‘s Law-Instantaneous power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- network theorems –Thevenin’s theorem, Norton theorem and superposition theorem, three phase supply-Instantaneous, Reactive and apparent power-star delta conversion.

UNIT II ELECTRICAL MACHINES 9

DC and AC rotating machines: Types, Construction, principle, Emf and torque equation, application - Speed Control- Basics of Stepper Motor – Brushless DC motors- Transformers-Introduction- types and construction, working principle of Ideal transformer-Emf equation

UNIT III UTILIZATION OF ELECTRICAL POWER 9

Overview of "Renewable Energy Sources". (Wind and Solar). Illumination by lamps- Energy Saving lamps (Compact Fluorescent Lamp, Cold Cathode Tube, LED bulbs). Domestic refrigerator and air conditioner- Electric circuit, construction and working principle. Li-Ion Battery's Operation & Maintenance. Protection- need for earthing, fuses and circuit breakers – MCB, RCB and ELCB. Energy Tariff calculation for domestic loads.

UNIT IV ELECTRONIC CIRCUITS **9**

Introduction to Electron Devices – PN Junction diode, Zener Diode, Transistor)-. Op-amps- Amplifiers, differentiator, integrator, ADC, DAC. Multi vibrator using 555 Timer IC. Voltage regulator IC using LM 723, LM 317.

UNIT V ELECTRICAL MEASUREMENT **9**

Characteristics of measurement-errors in measurement, torque in indicating instruments- moving coil and moving iron meters, Energy meter and watt meter. Transducers- classification- RTD, Strain gauge, LVDT, LDR and piezoelectric. Functional Block diagram of DSO

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students would:

- Discuss the essentials of electric circuits and analysis
- Discuss the basic operation of electric machines and transformers
- Introduction of renewable sources and recent trends in illumination
- Discuss the basics of electronics components
- Introduction to measurement and metering for electric circuits

TEXT BOOKS:

1. D.P. Kothari and I.J Nagrath, Basic Electrical and Electronics Engineering, McGraw Hill, 2016, Third Edition.
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.

REFERENCES:

1. S.B. LalSeksena and Kaustuv Dasgupta, fundaments of Electrical Engineering, Cambridge,2016.
2. B.L. Theraja, Fundamentals of Electrical Engineering and Electronics, Chand & Co, 2008.
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson 2015.
4. John Bird,-Electrical and electronic principles and Technology, Fourth Edition, Elsevier, 2010.
5. Mittle, Mittal, Basic Electrical Engineering, 2nd edition, Tata McGraw-Hill Edition, 2016.
6. C.L.Wadhwa, "Generation, Distribution and utilization of Electrical Energy", New Age international pvt ltd .2003.

CS1201A **PROGRAMMING IN C**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop applications in C using functions and pointers.
- To develop applications in C using structures.
- To do input/output and file handling in C.

UNIT I BASICS OF C PROGRAMMING **9**

Introduction to programming paradigms - Structure of C program - C programming: Identifiers- Keywords- Data Types - Variables - Constants. Operators: Precedence and Associativity - Expressions- Input/ Output statements - Decision making statements - Switch statement - Looping statements - Pre-processor directives - Compilation process

UNIT II ARRAYS AND STRINGS **9**

Introduction to Arrays: Declaration, Initialization - One dimensional array - Example Program: Computing Mean, Median and Mode - Two dimensional arrays - Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String- String operations – String Arrays.

UNIT III FUNCTIONS AND POINTERS **9**

Introduction to functions: Function prototype,-function definition,- function call,- Built- in functions (string functions, math functions) - Recursion-Types of Recursion - Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions-Storage Classes - Pointers - Pointer operators - Null Pointers- Pointer arithmetic - Arrays and pointers - Array of pointers - Example Program: Sorting of names - Parameter passing: Pass by value, Pass by reference- Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT IV STRUCTURES **9**

Structures-Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure – Passing structures to functions – Array of structures – Pointers to structures – Union - Programs using structures and Unions, Enumerated data type-Dynamic Memory Allocation.

UNIT V FILEPROCESSING **9**

Files-Types of file processing: Sequential access, Random access- Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Payroll System and Transaction processing using random access files - Command line arguments

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students would:

- Develop simple applications in C using basic constructs
- Design and implement applications using arrays and strings
- Develop and implement applications in C using functions and pointers.
- Develop applications in C using structures.
- Design applications using sequential and random access file Processing.

TEXTBOOKS:

1. Reema Thareja,"Programming in C", Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education,2006

REFERENCES:

1. Paul Deitel and Harvey Deitel,"C How to Program", Seventh editin, Pearson Publication

2. Juneja,B.L and Anita Seth ,"Programming in C",CENGAGE Learning India pvt.Ltd., 2011
3. Pradip Dey ,Manas Ghosh, "Fundamentals of Computing and Programming in C" ,First Edition,OxfordUniversityPress,2009.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley(India)Pvt.Ltd.,PearsonEducationinSouthAsia,2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-HillEducation, 1996. C", ,McGraw-HillEducation,1996.

EC1306A DIGITAL PRINCIPLES AND SYSTEM DESIGN

L	T	P	C
3	0	0	3

(Common to second semester AIDS and third semester CSE/IT)

COURSE OBJECTIVES:

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES **12**

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Arithmetic Operations – Binary Codes- Boolean Algebra and Logic Gates – Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Simplification of Boolean Functions using Karnaugh Map – Logic Gates – NAND and NOR Implementations.

UNIT II COMBINATIONAL LOGIC **12**

Combinational Circuits – Analysis and Design Procedures, Design of Half and Full Adders, Half and Full Subtractors – Binary Adder-Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – Introduction to HDL – HDL Models of Combinational circuits.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC **12**

Sequential Circuits – Storage Elements: Latches, Flip-Flops -SR, JK, T, D, – operation and excitation tables – Analysis of Clocked Sequential Circuits – Moore/Mealy models, State Reduction and Assignment – Design Procedure – Registers and Counters – HDL Models of Sequential Circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC **12**

Analysis and Design of Asynchronous Sequential Circuits – cycles and races, Reduction of State and Flow Tables – Race-free State Assignment – Hazards, Essential Hazards, and Design of Hazard free circuits

UNIT V MEMORY AND PROGRAMMABLE LOGIC **12**

RAM – Memory Decoding – Error Detection and Correction – ROM – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices. Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students would:

- Simplify Boolean functions using KMap
- Design and Analyze Combinational and Sequential Circuits
- Implement designs using Programmable Logic Devices
- Write HDL code for combinational and Sequential Circuits

TEXT BOOK:

1. M. Morris R. Mano, Michael D. Ciletti, ―Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog, 6th Edition, Pearson Education, 2017.

REFERENCES

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE
4. Learning, 2013
5. Donald D. Givone, Digital Principles and Design‖, Tata Mc Graw Hill, 2003.

GE1201A ENGINEERING PRACTICES LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

CIVIL ENGINEERING PRACTICE **13**

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

Study of pipeline joints, its location and functions: valves, taps, couplings, Unions, reducers, elbows in household fittings.

Study of pipe connections requirements for pumps and turbines.

Preparation of plumbing line sketches for water supply and sewage works.

Hands-on-exercise: Basic pipe connections – Mixed pipe material connection –.pipe connections with different joining components.

Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

Study of the joints in roofs, doors, windows and furniture.

Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

MECHANICAL ENGINEERING PRACTICE **18**

Welding:

Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
Gas welding Practice basic

Machining:

Simple Turning and Taper turning
Drilling Practice Sheet Metal Work:
Forming & Bending:
Model making – Trays and funnels.
Different type of joints.
Machine assembly practice:
Study of centrifugal pump
Study of air conditioner Demonstration on:
Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of Hexagonal headed bolt.
Foundry operations like mould preparation for gear and step cone pulley.
Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP -B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICE **13**

Residential house wiring using switches, fuse, indicator, lamp and energy meter.
Fluorescent lamp wiring.
Stair case wiring
Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
Measurement of energy using single phase energy meter.
Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE **16**

Study of Electronic components and equipment's – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms period, frequency) using CR.
Study of logic gates AND, OR, EX-OR and NOT.
Generation of Clock Signal.
Soldering practice – Components Devices and Circuits – Using general purpose PCB.
Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students would:

- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipment's to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings

- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

CS1203A **PROGRAMMING IN C LABORATORY**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

- To develop programs in C using basic constructs.
- To develop programs in C using control statements.
- To develop applications in C using arrays, strings, pointers.
- To develop applications in C using functions, structures.
- To develop applications in C using file processing

LIST OF EXPERIMENTS

1. Input and Output statements
2. Control statements – Branching &Looping
3. Write a C program to generate Pascal's triangle.
4. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*,/,% and use Switch Statement)
5. Write a C program to find the sum of individual digits of a positive integer.
6. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
7. Write program to generate the first n terms of the sequence.
8. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
9. Write a C program to swap Numbers Using Temporary Variables.
10. Arrays
11. Write a C program to search an array element using linear search.
12. Write a C program to find both the largest and smallest number in a list of integers.
13. Write a C program that uses functions to perform the following:
14. (i) Addition of Two Matrices
15. (ii) Multiplication of Two Matrices
16. Write a C program to implement Bubble sort.

Strings

Write a C program that uses functions to perform the following operations:

(i) To insert a sub-string in to given main string from a given position.

(ii) To delete n Characters from a given position in a given string.

Write a C program to determine if the given string is a palindrome or not

Functions &Pointers:

Write C programs that use recursive functions

(i) To find factorial of given number

(ii) To solve Towers of Hanoi Problem.

(iii) To swap the variables using call by value and call by reference.

Generate mark sheet of students using structures.

Compute salary slip for five employees using structures and functions.
Insert, Update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler 30 Nos.
(Or)
Server with C compiler supporting 30 terminals or more.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students would:

- Develop C programs for simple applications making use of basic constructs
- Develop C programs for control statements.
- Develop C programs involving arrays, strings and pointers.
- Develop C programs involving functions, and structures.
- Design applications using sequential and random access file processing.

CY1201A ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
2	0	0	0

COURSE OBJECTIVES

- To understand nature and the facts about the environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY **14**

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of major ecosystem – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity – Biodiversity at global, national and local levels – India as a mega- diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION **8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and

landslides.

UNIT III NATURAL RESOURCES **10**

Forest resources: Use and over-exploitation, deforestation, case studies- dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water – Mineral resources: environmental effects of extracting and using mineral resources, case studies – Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – 12 Principles of Green chemistry, role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act –- central and state pollution control boards.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, students would:

- Students will be able to understand the functions of ecosystems and appreciate the bio diversity.
- Students will be able to know the measures to control environmental pollution.
- Students will be able to understand the usage as well as the effects of over exploitation of natural resources.
- Students will have knowledge about finding technological, economic and political solutions to environmental problems with various Environmental Protection Act in mind.
- Students will be able to understand the interrelationship between population explosion and the environment and also role of IT in environment and human health.
- Students will be able to understand that Environmental problems can only be solved by Public participation in all aspects and cannot be solved by mere laws.

TEXT BOOKS

1. Environmental Science and Engineering by Anubha Kaushik and C.P. Kaushik-New Age International Publishers. New Delhi, 2017.

REFERENCES

1. Benny Joseph , Environmental Studies, Tata mcgraw - Hill Publishing Company, Ltd., New Delhi, 2006.

2. Dr.B.S. Chauhan,. Environmental Studies, University Science Press, New Delhi, 2011.

MA1304A **COMPUTATIONAL STATISTICS**

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- To understand the necessary basic concepts of statistical methods.
- To understand the concepts of estimation and time series analysis
- To understand the techniques of Analysis of Variance
- To be able to use exploratory and confirmatory multivariate statistical methods effectively.
- To use Factor analysis and Principal component analysis to identify patterns in the correlations between variables and to have insights in to various cluster analysis methods

UNIT I INFERENTIAL STATISTICS – I **12**

Introduction – critical region and level of significance – types of errors – large sample tests - z-test for single mean and difference of means – Small Sample tests: Student's t-test for testing significance of single mean and difference of means - F – test for comparison of variances – Chi-square test: Test for goodness of fit – Test of independence of attributes.

UNIT II INFERENTIAL STATISTICS – II **12**

Point estimation, Criteria for good estimates (unbiasedness, consistency) Method of estimation including maximum likelihood estimation. Basics of Time series: stationary ARIMA Models: Identification, Estimation and forecasting.

UNIT III ANALYSI OF VARIANCE **12**

Analysis of Variance – One way classification – Completely Randomized Design - Two way classifications: Randomized Block Design – Three way classifications: Latin square Design.

UNIT IV MULTIPLE LINEAR REGRESSION MODEL AND DISCRIMINANT ANALYSIS **12**

Standard multiple regression models with emphasis on detection of Collinearity, outliers, non-normality and autocorrelation, Validation of model assumption. Assumptions of multivariate regression models. Parameter estimation Statistical Background, linear discriminant function analysis, Estimating linear discriminant functions and their properties. Multivariate Analysis of Variance and Covariance.

UNIT V PRINCIPAL COMPONENT ANALYSIS, FACTOR ANALYSIS AND CLUSTER ANALYSIS **12**

Principal components, algorithms for conducting Principal component analysis, deciding on how many Principal components to retain, H-plot. Factor analysis Model, extracting common factor, determining number of factors, Transformation of factors analysis solutions, factor sources.

Introduction, types of clustering, correlations and distances, clustering by portioning methods, hierarchical clustering, overlapping clustering, K-means clustering – Profiling and Interpreting

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

- Apply the statistical tests for solving engineering problems involving small and large samples.
- Compute the probabilities of two-dimensional random variables and use the central limit theorem to find the probability of the sum of independent and identically distributed random variables.
- Apply the concepts of analysis of variance to experimental data.
- Apply and interpret the results of multivariate regression and apply the discriminate analysis between groups and classify new observations.
- Apply the principal component and factor analysis for multivariate data and explain groupings and associations using cluster and correspondence Analysis.

TEXT BOOKS

1. Jay.L. Devone "Probability and Statistics for Engineering and Sciences", 9th Edition, Cengage Learning U.S.A, 2016 for Unit I, II, III, IV &V.
2. The Analysis of Time Series: An Introduction, Chris Chatfield,2003
3. An Introduction to Multivariate Statistical Analysis, T Anderson, 3rd edition, Wiley 2003. Learning Python, Mart Lutz, 5th edition,

REFERENCE BOOKS

1. Gupta S.C and kapoor V.K ,"Fundamentals of Mathematical Statistics", 11th edition, Sultan Chand and sons 2002.
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D.C. Boes, 2017.
3. J.D. Jobson, "Applied Multivariate Data Analysis", Volume I: Regression and Experimental Design Springer, 1991.
4. J.D. Jobson, "Applied Multivariate Data Analysis", Volume II: Categorical and Multivariate Methods, 1st edition Springer, 1992.
5. H. Kris, "Statistical Tests for Multivariate Analysis", Springer – Verlag, Heidelberg. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, 2009.
6. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", 2nd edition, 2008.

AD1301A INTRODUCTION TO DATA SCIENCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Will gain knowledge in the basic concepts of Data Analysis
- To acquire skills in data preparatory and preprocessing steps
- To understand the mathematical skills in statistics
- To learn the tools and packages in Python for data science
- To acquire knowledge in data interpretation and visualization techniques

UNIT I INTRODUCTION **9**

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the

models – presenting and building applications.

UNIT II DESCRIBING DATA **10**

Frequency distributions –Outliers –relative frequency distributions –cumulative frequency distributions – frequency distributions for nominal data –interpreting distributions –graphs –averages -normal distributions –z scores –normal curve problems –finding proportions –finding scores –more about z–interpretation of r2 –multiple regression equations –regression toward the mean- statistical metrics with python.

UNIT III INTRODUCTION TO NUMPY **8**

Data types in Python -basics of Numpy arrays - computations on Numpy Arrays-universal functions-aggregations: min, max and Everything in between-computation on arrays: broadcasting - comparisons, masks, and Boolean logic - fancy indexing -sorting values in Numpy array-fast sorting-sorting along rows or columns-partial sorts-K nearest neighbors- Numpy's structured arrays.

UNIT IV DATA MANIPULATION WITH PANDAS **9**

Pandas objects - data indexing and selection - operating on data in pandas -handling missing data - hierarchical indexing - combining datasets: concat and append - combining datasets: merge and join-aggregation and grouping- pivot tables-vectorized string operations - working with time Series - high-performance pandas: eval()and query().

UNIT V PYTHON FOR DATA VISUALIZATION **9**

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density –three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course Students will be able to:

- Apply the skills of data inspecting and cleansing.
- Determine the relationship between data dependencies using statistics
- Represent the useful information using mathematical skills
- Can handle data using primary tools used for data science in Python
- Can apply the knowledge for data describing and visualization using tools.

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Parts of chapters 2–4 for Units III,IV and V)

REFERENCES

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

IT1301A **OBJECT ORIENTED PROGRAMMING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS **9**

Inheritance–Superclasses-subclasses–Protectedmembers–constructors in subclasses-the Object class–abstract classes and methods –final methods and classes–Interfaces–defining an interface, implementing interface, differences between classes and interfaces and extending interfaces-Object cloning-inner classes, Array Lists-Strings

UNIT II INHERITANCE AND INTERFACES **9**

Inheritance–Superclasses-subclasses–Protectedmembers–constructors in subclasses-the Object class–abstract classes and methods –final methods and classes–Interfaces–defining an interface, implementing interface, differences between classes and interfaces and extending interfaces-Object cloning-inner classes, Array Lists-Strings

UNIT III EXCEPTION HANDLING AND I/O **9**

Exceptions-exception hierarchy-throwing and catching exceptions –built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics–Streams–Byte streams and Character streams–Reading and Writing Console–Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING **9**

Understanding Threads, Thread Priorities, Synchronizing Threads, Thread lifecycle, Inter-thread communication. Generic Programming–Generic classes–generic methods–Bounded Types–Restrictions and Limitations-Introduction to JDBC, JDBC Drivers and Architecture, Accessing Database with JDBC.

UNIT V EVENT DRIVEN PROGRAMMING **9**

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes -actions - mouse events - Introduction to Swing –Swing GUI Components – Text Fields , Text Areas – Buttons- Check Boxes –Radio Buttons – Lists-choices- Scrollbars – Windows –Menus – Dialog Boxes. Swing packages-Swing Control classes and Methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students should be able to:

- Develop Java programs using OOP principles

- Develop Java programs with the concepts of inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Design problems solutions using Generic Collections and Exception Handling
- Create a Database connectivity and manipulate database using JDBC
- Develop interactive Java programs using swings

TEXT BOOKS:

1. Herbert Schildt, Java The complete reference, 8th Edition, McGraw Hill Education, 2011.
2. CayS.Horstmann, Garycornell, Core Java Volume–I Fundamentals, 9th Edition, Prentice Hall, 2013.

REFERENCES:

1. Paul Deitel, Harvey Deitel, Java SE8 for programmers, 3rd Edition, Pearson, 2015.
2. Steven Holzner, Java2Blackbook, Dream tech press, 2011.
3. Timothy Budd, Understanding Object-oriented programming with Java Updated Edition, Pearson Education, 2000.

CS1301A **DATA STRUCTURES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To Study the concepts of ADTs
- To Acquire linear data structures – lists, stacks, and queues
- To learn non-linear data structures and apply Tree and Graph structures
- To understand sorting, searching and hashing algorithms

UNIT I LINEAR DATA STRUCTURES – LIST **9**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists-doubly-linked lists – circularly-linked list-applications of lists –Polynomial Manipulation.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES **9**

Stack ADT – Operations – Evaluating arithmetic expressions- Other Applications-Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue –Double Ended Queues – applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES **9**

Introduction to Tree ADT – Implementations of trees- Binary Tree ADT -tree traversals -expression trees – – binary search tree ADT –Threaded Binary Trees- AVL Trees –Multi-way Search Trees-B-Tree – B+ Tree-Heap-Priority Queue.

UNIT IV GRAPHS AND HASHING **9**

Graph and their representations-Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS)-Topological Sort- Hashing- Hash Functions – Collision in hashing-Separate Chaining – Open

Addressing-Rehashing-Applications of Hashing.

UNIT V SEARCHING AND SORTING **9**

Searching- Linear Search – Binary Search. Sorting – Bubble Sort – Selection Sort – Insertion Sort – Quick Sort-Merge Sort-Shell Sort – Radix Sort-Heap Sort.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Learn and apply the concept and operations of List ADT
- Understand and apply the concept and operations of Stack and Queue ADT
- Gain the knowledge about Tree ADT and its Applications.
- Ability to apply Graph data structures in real world scenarios.
- Ability to comprehend the implementation of sorting, searching and hashing Techniques.

TEXT BOOKS:-

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.
2. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011

REFERENCES:-

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

CS1302A SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts and key activities of process models.
- To develop and design the software project using process models.
- To understand the requirements engineering concepts and Analysis Modeling.
- To understand the basic concepts of object models.
- To learn various testing strategies in object oriented models.
- To learn the measures for maintaining & to identify the risk analysis.

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT **9**

Introduction: The Nature of Software, Software Engineering, The Software Process, Software Engineering practice, Software Myths, Process models: Prescriptive Process Perspective and Specialized Process Models, Agile development: Introduction to Agility - Agile Process Models: Scrum, Dynamic system development and Agile unified process-Tool Set for the Agile Process- Extreme programming-XP Process

UNIT II REQUIREMENT ENGINEERING PROCESS AND MODELING **9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management. Requirements Modeling: Behavior, patterns, and web/mobile apps, Case Study: SRS-Library Management, Student Fee Registration Details.

UNIT III SOFTWARE DESIGN **9**

Design engineering: Design Process, Design Concepts, Design Model. Architectural design: Software Architecture, Architectural Genres, Architectural Styles, Architectural Design, Architectural Mapping using Data Flow. User-Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps. Component level Design: Designing Class based components-Component-Level Design for WebApps and Mobile Apps.

UNIT IV TESTING STRATEGIES **9**

Software testing strategies: A Strategic Approach to Software Testing, Test Strategies for Conventional Software and Object Oriented Software, Validation Testing, White- Box Testing, Basis Path Testing, Black-Box Testing, System Testing. Software Implementation Techniques: Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V PROJECT AND RISK MANAGEMENT **9**

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, Risk management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, RMMM, RMMM Plan-Case Study: Risk Management-Manufacturing Company, Banks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Identify and Compare the basic concepts and the key activities in process models.
- Concepts of requirements engineering design and Analysis Modeling.
- Understand the basic models using the object oriented methodologies.
- Apply systematic testing procedure for software design and deployment.
- Compare and contrast the various testing strategies.
- Understand the maintenance and to identify the risk in object oriented models.

TEXT BOOKS:

1. Roger S. Pressman, “Software Engineering - A Practitioner’s Approach”, 6thEdition, TMH, 2010.
2. Sommerville, “Software Engineering”, 9th Edition, Pearson Education, 2011.

REFERENCES:

1. K.K.Agarwal & Yogesh Singh, “Software Engineering”, 3rd Edition, New Age International Publishers, 2008.
2. Shely Cashman Rosenblatt, “System Analysis and Design”, 2nd Edition, Thomson Publications, 2011.

3. PankajJalote, “An Integrated Approach to Software Engineering”, 3rd Edition, Narosa Publishing House, 2011.

AD1302A **DATA SCIENCE LABORATORY**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

- Understand the Python Programming packages Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Language.
- To prepare data for data analysis through understanding its distribution.
- Exposure on data processing using NUMPY and PANDAS
- To acquire knowledge in plotting using visualization tools.
- To understand and implement classification and Regression Model.

SOFTWARE REQUIREMENTS

Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

LIST OF EXPERIMENTS

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions
5. Normal curves
6. Correlation coefficient
7. Regression
8. Data Acquisition using python web Scraping
9. Classification and tabulation of data and Graphical and diagrammatic presentation of data.
10. CORRELATION AND COVARIANCE
    a. Find the correlation matrix.
    b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
    c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.
11. Demonstration of Data Visualization in Python.
12. Importing Data from External Source Using Python

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- Develop relevant programming abilities.
- Demonstrate knowledge of statistical data analysis techniques
- Exhibit proficiency to build and assess data-based models.
- Demonstrate skill in Data management & processing tasks using Python
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

REFERENCES:

1. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
3. Data Science from Scratch: First Principles with Python, Second Edition by Joel Grus, 2019.

CS1303A	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph algorithms
- To get familiarized to sorting, searching and hashing algorithms

LIST OF EXPERIMENTS

1. Array implementation of List ADT
2. Implement the following data structures
3. Singly Linked List
4. Doubly Linked List
5. Array implementation of Stack and Queue ADTs
6. Applications of List, Stack and Queue ADTs
7. Implementation of Binary Search Trees
8. Implementation of AVL Trees
9. Implementation of heaps using priority queues.
10. Programs for implementation of graph traversals
11. BFS
12. DFS
13. Implementation of searching algorithms
14. Implementation of Insertion Sort, Merge Sort, Quick Sort and Heap Sort algorithms
15. Programs to implement hashing
16. Separate Chaining
17. Open Addressing

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.
(Or)
Server with C compiler supporting 30 terminals or more.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students should be able to:

- Implement abstract data types for linear data structures
- To apply different linear data structures to problem solutions
- Comprehend and implement the different operations of various Trees.
- Critically analyze the various algorithms

- Understand and implement various sorting, searching and hashing algorithms

IT1302A OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing.
- To develop applications using generic programming and event handling

LIST OF EXPERIMENTS

1. Develop a java application using classes & objects
2. Develop a java application using packages.
3. Develop a java application using Inheritance.
4. Design a Java interface for ADT Stack. Provide necessary exception handling.
5. Write a program to perform string operations using Array List. Write functions for the following
   a. Append-add at end
b. Insert–add at particular index
c. Search
d. List all string starts with given letter.
6. Write a Java Program to create an abstract class named and demonstrate polymorphism.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a filename from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implement multi-threading.
10. Write a java program to create generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.
    a) Decimal manipulations
    b) Scientific manipulations
12. Develop a simple student database management system using event-driven and concurrent programming paradigms of Java. Use JDBC to connect a back-end database.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with java 30 Nos.
(Or)
Server with java supporting 30 terminals or more.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java Programs with Array list.

- Develop and implement Java programs with exception handling and multithreading.
- Design applications using file processing, generic programming and event handling.
- Ability to solve real world problems using features of Object Oriented Programming
- Ability to write, debug and document well-structured Java Applications

HS1301A INTERPERSONAL SKILLS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills.
- Make effective presentation.

UNIT I **6**

Listening as a key skill- its importance- Speaking- give personal information- asks for personal information- Improving pronunciation- pronunciation basics- Taking lecture notes- preparing to listen to a lecture- articulate a complete idea.

UNIT II **6**

Interpersonal skills- nurturing- empathetic- self-control- patient- sociability- warmth- social skills-Team Work-Work Ethic- willing to work- initiative- self-motivated - Integrity.

UNIT III **6**

Factors influence fluency- deliver a five-minute informal talk- greet- respond to greetings-describe health and symptoms-invite and offer- accept- decline- take leave- listen for and follow the gist- listen for detail.

UNIT IV **6**

Being an active listener: giving verbal and non-verbal feedback- participating in a group discussion- asking and getting clarifications- Summarizing academic readings and lectures- Conversational speech- listening to and participating in conversations- persuade.

UNIT V **6**

Formal and informal talk- listen to follow and respond to explanations, directions and instructions in academic and business contexts- Strategies for formal presentations and interactive communication- group/pair presentations.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations

- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES:

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013

MA1405A LINEAR ALGEBRA AND OPTIMIZATION TECHNIQUES

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To test the consistency and solve system of linear equations also to find the basis and dimension of vector space
- To obtain the matrix of linear transformation and its eigenvalues and eigenvectors
- To find orthonormal basis of inner product space and find least square approximation
- To find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.
- Obtain solution to network problems using CPM and PERT techniques and able to optimize the function subject to the constraints

UNIT I SYSTEM OF LINEAR EQUATIONS AND VECTOR SPACE **12**

Matrices - Row echelon form - Rank - System of linear equations - Consistency - Gauss elimination method - Gauss Jordon method. Real and Complex fields - Vector spaces over Real and Complex fields - Subspace - Linear space- Linear independence and dependence - Basis and dimension.

UNIT II LINEAR TRANSFORMATION **12**

Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem - Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation.

UNIT III INNER PRODUCT SPACES **12**

Inner product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidt ortho normalization process - Least square approximation.

UNIT IV EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION **12**

Eigen value Problems: Power method, Jacobi rotation method - Singular value decomposition - QR decomposition

UNIT V CLASSICAL OPTIMISATION THEORY AND PROJECT SCHEDULING 12

Unconstrained problems – necessary and sufficient conditions - Newton- Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions Project network - Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After the completion of the course the student will be able to

- Test the consistency and solve system of linear equations and find the basis and dimension of vector space
- Obtain the matrix of linear transformation and its eigenvalues and eigenvectors
- Find orthonormal basis of inner product space and find least square approximation
- Find eigenvalues of a matrix using numerical techniques and perform matrix decomposition
- Obtain solution to network problems using CPM and PERT techniques able to optimize the function subject to the constraints

TEXT BOOKS:

1. Friedberg A.H, Insel A.J. and Spence L, Linear Algebra, Prentice Hall of India, New Delhi, 2004.
2. Faires J.D. and Burden R., Numerical Methods, Brooks/Cole (Thomson Publications), New Delhi, 2002.
3. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017

REFERENCES:

1. Kumaresan S, Linear Algebra - A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.
2. Strang G, Linear Algebra and its applications, Thomson (Brooks / Cole) New Delhi, 2005.
3. Gerald C.F. and Wheatley P.O, Applied Numerical Analysis, Pearson Educations, New Delhi, 2002.
4. Sundarapandian V, Numerical Linear Algebra, Prentice Hall of India, New Delhi, 2008.
5. Richard Branson, Matrix Operations, Schaum's outline series, 1989.
6. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012
7. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

AD1401A FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES

The objective of this course is to enable the students to

- Understand the basic concepts of intelligent agents
- Develop general-purpose problem solving agents, logical reasoning agents, and agents that reason under uncertainty
- Employ AI techniques to solve some of today's real world problems
- To know about the various applications of AI.

UNIT I INTRODUCTION **9**

Introduction – Definition - Future of Artificial Intelligence -Characteristics of Intelligent Agents –Typical Intelligent Agents – Problem Solving Approach to Typical AI problems- Problem solving agents –search algorithms –uninformed search strategies.

UNIT II PROBLEM SOLVING **9**

Heuristic search strategies –heuristic functions -Local search and optimization problems –local search in continuous space –search with non-deterministic actions –search in partially observable environments – online search agents and unknown environments

UNIT III GAME PLAYING AND CSP **9**

Game theory –optimal decisions in games –alpha-beta search –monte-carlo tree search –stochastic games – partially observable games-Constraint satisfaction problems –constraint propagation –backtracking search for CSP –local search for CSP –structure of CSP

UNIT IV LOGICAL AGENTS **9**

Knowledge-based agents –propositional logic –propositional theorem proving –propositional model checking –agents based on propositional logic First-order logic –syntax and semantics –knowledge representation and engineering –inferences in first-order logic –forward chaining –backward chaining – resolution.

UNIT V APPLICATIONS **9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

- Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings
- Choose appropriate algorithms for solving given AI problems
- Represent a problem using first order and predicate logic.
- Design applications for NLP that use Artificial Intelligence.

TEXT BOOK:

1. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.
2. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.

REFERENCES:

1. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)
5. Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases -by Dennis Rothman, 2018

AD1402A **DATA ANALYTICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The Student should be made to:

- Know the fundamental concepts of big data and analytics
- Learn the different ways of data analysis
- Be familiar with data streams
- Learn the mining and clustering
- Be familiar with the frameworks and NOSQL data management for big data

UNIT I INTRODUCTION TO BIG DATA **9**

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Perception and Quantification of Value - Modern data analytic tools.

UNIT II DATA ANALYSIS **9**

Statistical concepts: Populations - samples - random sampling - Sampling distributions - creating a sampling distribution - mean of all sample means - standard error of the mean - other sampling distribution - resampling, statistical inference, prediction error. Regression modeling: Linear Regression, Logistic Regression, Multivariate analysis, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction

UNIT III MINING DATA STREAMS **9**

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Real time Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.

UNIT IV ASSOCIATION AND CLUSTERING **9**

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity – Clustering Techniques – Hierarchical – K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Clustering high dimensional data – CLIQUE and PROCLUS – Clustering in non-euclidean space

UNIT V FRAMEWORKS AND BIG DATA MANAGEMENT **9**

Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS – Map Reduce and YARN - Map Reduce Programming Model – NoSQL Databases - Hive - Sharding –- Hbase – Case Study: Analyzing big data with twitter - Big data for E-Commerce - Big data for blogs

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

- Understand the fundamentals of big data

- Apply the statistical analysis methods.
- Perform analytics on data streams
- Apply mining algorithm and analyze data by utilizing various clustering algorithms.
- Learn Hadoop frameworks and NoSQL data management for big data

TEXT BOOKS:

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

REFERENCES:

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
4. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.

IT1401A DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn about the internal storage structures using different file and indexing techniques and the basics of query processing and optimization.
- To study the basics of distributed databases, semi-structured and un-structured data models

UNIT I RELATIONAL DATABASES **9**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL .

UNIT II DATABASE DESIGN **9**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency

Preservation – Boyce/Codd's Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form .

UNIT III TRANSACTIONS **9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT IV IMPLEMENTATION TECHNIQUES **9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

UNIT V ADVANCED TOPICS **9**

Overview of Distributed Databases – Data Fragmentation – Replication — Introduction to Object-based Databases - Enhanced Data bases: Temporal Database –Spatial Database –Multimedia Database - XML Databases: XML schema - NOSQL Database: Characteristics –Schema-less models– Applications – Current Trends.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Model an application's data requirements using conceptual modeling and design database schemas based on the conceptual model.
- Formulate solutions to a broad range of query problems using relational algebra/SQL.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- Run transactions and estimate the procedures for controlling the consequences of concurrent data access.
- Explain basic database storage structures, access techniques and query processing.
- Describe distributed, semi-structured and unstructured database systems.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts, Sixth Edition, Tata McGraw Hill, 2014.
2. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2017.
3. David Loshin,"Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL and Graph", Morgan Kaufmann/El Sevier Publishers, 2013.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, ―Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015. 3. G.K.Gupta, "Database Management Systems, Tata McGraw Hill, 2011.
3. G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
4. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems: Design, Implementation and

Management", Ninth Edition, Cengage Learning, 2011.

HV1401A	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	1	0	3

Universal Human Values: Understanding Harmony

COURSE OBJECTIVE:

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family,
- society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE TOPICS:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment 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 fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 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' - happiness and physical facility
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 Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the

foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all pervasive space
21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics
22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. 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 eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. 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
28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

TOTAL: 45 PERIODS

READINGS:

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria,Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

AD1403A ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

- To design and implement different techniques to develop simple autonomous agents that make effective decisions in fully informed, and partially observable, settings.
- To apply appropriate algorithms for solving given AI problems.
- To Design and implement logical reasoning agents.
- To Design and implement agents that can reason under uncertainty.
- To understand the Implementation of these reasoning systems using either backward or forward inference mechanisms.

LIST OF EXPERIMENTS:

1. Develop PEAS descriptions for given AI tasks
2. Implement basic search strategies for selected AI applications
3. Implement Travelling Salesperson Problem using Heuristic approach
4. Implement N-queens problem/Towers of Hanoi problem
5. Implement Hill climbing to solve 8-Puzzle problem
6. Solve problems using Depth First Search
7. Solve problems using Best First Search
8. Implement A* and memory bounded A* algorithms
9. Implement simulated annealing algorithms for AI tasks
10. Implement alpha-beta tree search
11. Implement backtracking algorithms for CSP
12. Implement local search algorithms for CSP
13. Implement propositional logic inferences for AI tasks
14. Implement resolution based first order logic inferences for AI tasks.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

- Implement simple PEAS descriptions for given AI tasks
- Develop programs to implement simulated annealing and genetic algorithms

- Demonstrate the ability to solve problems using searching and backtracking
- Ability to Implement simple reasoning systems using either backward or forward inference mechanisms
- Will be able to choose and implement a suitable technique for a given AI task

SOFTWARE: C++ or Java Software

AD1404A **DATA ANALYTICS LABORATORY**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To implement MapReduce programs for processing big data
- To study and write simple programs using the basic packages for handling data
- To analyse big data using linear and logistic regression models and demonstrate time series analysis in any real time application
- To analyse big data using clustering algorithms
- To perform case study on analyzing and visualizing big data

LIST OF EXPERIMENTS

1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement Random sampling
4. Implement Linear Regression
5. Implement Logistic Regression
6. Implement Time Series Analysis
7. Implement clustering techniques
8. Visualize data using any plotting framework
9. Implement the case study on analyzing big data with twitter using python

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, the students will be able to:

- Process big data using Hadoop framework
- Demonstrate the understanding of data distribution with various samples
- Build and apply linear and logistic regression models, conduct time series analysis
- Perform data analysis with clustering algorithms
- Implement case study on analyzing big data and perform data visualization

LIST OF SOFTWARES FOR A BATCH OF 30 STUDENTS:

Hadoop
YARN
R Package
Hbase

MongoDB
Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

IT1402A DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development

EXPERIMENTS:

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling
8. Database Design using ER modeling, normalization and Implementation for any application
9. Create Document, column and graph based data using NOSQL database tools.
10. Develop a simple GUI based database application

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Use typical data definitions and manipulation commands.
- Design applications to test Nested and Join Queries
- Implement simple applications that use Views
- Critically analyze the use of Tables, Views, Functions and Procedures
- Implement a GUI application that require a Front-end and Back end Tool
- Create and manipulate data using NOSQL database.

HS1401A EMPLOYABILITY AND SOFT SKILLS LAB

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Strengthen the Employability skills of the students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

- Enrich the Soft Skills of the students.

UNIT I **6**

Soft Skills- Professionalism- Courtesy- manners - etiquette- business etiquette- Flexibility- Positive attitude- Responsibility-Teamwork- Time Management

UNIT II **6**

Communication - oral speaking capability- written- presenting- listening- clear speech & writing- Motivation and initiative-Leadership- Reliability/dependability- Adaptability- Patience- Problem solving- Negotiation and persuasion

UNIT III **6**

Writing- Plan before writing- Use of Graphic organisers- Develop a paragraph: topic sentence, supporting sentences, concluding sentence- Write a descriptive paragraph- opinion paragraph- argumentative- analytical.

UNIT IV **6**

Reading- Genres and Organization of Ideas- Writing- Email writing- resumes- Job application- project writing- writing convincing proposals.

UNIT V **6**

Aptitude- Verbal- Logical Reasoning- Critical reading and thinking- understanding how the text positions the reader- Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- Write different types of paragraphs.
- Write winning job applications.
- Excel in Verbal aptitude, read and evaluate texts logically to solve the puzzles.
- Good in employability and soft skills.
- Display critical thinking in various professional contexts.

TEXT BOOKS:

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011

REFERENCES:

1. Davis, Jason and Rhonda Liss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004

4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004.

AD1501A INFORMATION AND NETWORK SECURITY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of Number Theory and Security
- To understand and analyze the principles of different encryption techniques
- To understand the security threats and attacks
- To understand and evaluate the need for the different security aspects in real time applications
- To learn the different applications of information security
-

UNIT I FUNDAMENTALSOFSECURITY **9**

ComputerSecurityConcepts-Threats,AttacksandAssets–SecurityFunctionalRequirements – Fundamental Security Design Principles – Attack Surfaces and Attack Trees. Computer Security Strategy– Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCDand Euclidean Algorithm, Chinese Remainder Theorem, Multiplication Modulo m and the Totient Function, Problems, Fermat and Euler Theorem. Primitive Roots and the Structure of F*p, Number in other Bases, Fast Computation of Powers in Z/mZ, Multiplicative Functions, Group Theory, Fields and Problems

UNIT II ENCRYPTIONTECHNIQUESANDKEYMANAGEMENT **9**

Symmetric Encryption Principles – Data Encryption Standard – Advanced Encryption Standard – StreamCiphersandRC4-CipherBlockModesOperation– Digital Signatures-Key Distributions - Public Key Cryptosystem: RSA, Elliptic Curve Cryptography - Key Exchange Algorithms: Diffie Hellmen and ELGamal Key Exchange

UNIT III AUTHENTICATION,INTEGRITY AND ACCESS CONTROL **9**

Authentication: Security Hash Function – HMAC – Electronic User Authentication Principles, Password Based Authentication, Token Based and Remote Authentication; Internet Authentication Applications: Kerberos X.509 – Public Key Infrastructure; Access Control: Access Control Principles - Subjects, Objects, and Access Rights - Discretionary Access Control -Example: UNIX File Access Control – Role Based Access Control - Attribute-Based Access Control-Identity, Credential, and Access Management-Trust Frameworks

UNIT IV SECURITY **9**

System Security: Firewall, Viruses, Worms, Ransome ware, Keylogger, Greyware, IDS, DDoS Network Security: SSL – TLs – HTTPS –IP Security; OS Security: Introduction to Operating System Security - System Security Planning - Operating Systems Hardening – Application Security - Security Maintenance - Linux/Unix Security - Windows Security – Virtualization Security; Wireless Security: Risks and Threats of Wireless- Wireless LAN Security- Wireless Security Policy-Wireless Security Architectures-Wireless security Tools

UNIT V SECURITYAPPLICATIONS **9**

IOT security: Introduction- Architectures- Security challenges- Security requirements- Trust, Data confidentiality, and privacy in IOT- Security in future IOT systems; Cloud Security: Security requirements-Security patterns and Architectural elements-Cloud Security Architecture-Security Management in the Cloud- Availability Management- SaaS Availability Management-PaaS Availability Management-IaaS Availability Management-Access control-Security
Vulnerability, Patch and Configuration Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Appraise the fundamentals of security and the significance of number theory in computer security
- Critically analyze the public key cryptographic standards and authentication scheme
- Able to apply the security frameworks for real time applications
- Outline the security threats and attacks in IoT, Cloud.
- Able to develop appropriate security algorithms understanding the possible threats

TEXTBOOKS:

1. William Stallings," Cryptography and Network Security Principles and Practice", Fifth Edition, 2011, Pearson Education International.
2. William Stallings and Lawrie Brown, "Computer Security Principles and Practice", Third Edition, 2015, Pearson Education International.

REFERENCES:

1. TimMather, Subra Kumaraswamy and Shahed Latif,"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance",2009,Oreilly
2. Mikhail Gloukhovtsev,"IoTSecurity: Challenges, Solutions & Future Prospects", 2018, Knowledge Sharing Article, DellInc.
3. Pradip Kumar Das, Hrudaya Kumar Tripathy, Shafiz Affendi Mohdyusuf, Privacy and Security Issues in Big Data, An Analytical View on Business Intelligence.Springer2021.

IT1701A DISTRIBUTED SYSTEMS AND CLOUD COMPUTING

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3	0	0	3

UNIT I INTRODUCTION TO DISTRIBUTED SYSTEM CONCEPTS **9**

Introduction to Distributed Systems – Characteristics – Issues in Distributed Systems -Distributed System Model – Request/Reply Protocols – RPC – RMI – Logical Clocks and Casual Ordering of Events – Election Algorithm – Distributed Mutual Exclusion -Distributed Deadlock Detection Algorithms.

UNIT II PROCESSES AND PROCESSORS IN DISTRIBUTED SYSTEMS **9**

Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues

UNIT III INTRODUCTION TO CLOUD COMPUTING 9

Introduction to Cloud Computing – Evolution of Cloud Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning – NIST Cloud Computing Reference Architecture– Architectural Design Challenges – Deployment Models: Public, Private and Hybrid Clouds – Service Models: IaaS – PaaS – SaaS – Benefits of Cloud Computing.

UNIT IV CLOUD ENABLING TECHNOLOGIES 9

Introduction to Web Service and Service Oriented Architecture – SOAP – REST – Basics of Virtualization – Full and Para Virtualization– Implementation Levels of Virtualization – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Desktop Virtualization – Server Virtualization.

UNIT V CLOUD MANAGEMENT, STORAGE AND SECURITY 9

Resource Provisioning and Methods – Cloud Management Products – Cloud Storage – Provisioning Cloud Storage – Managed and Unmanaged Cloud Storage – Cloud Security Overview – Cloud Security Challenges –Security Architecture. Case Studies: Openstack, Amazon EC2, AWS, Microsoft Azure, Google Compute Engine.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", John Wiley, 2011.
2. John W. Rittinghouse, James F. Ransome, "Cloud Computing: Implementation "Management and Security", CRC Press, 2016.
3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems - Principles and Paradigms", Second Edition, Pearson, 2016.
2. Mukesh Singhal, "Advanced Concepts In Operating Systems", McGraw Hill Series in Computer Science, 2017.

CS1701A MACHINE LEARNING

L	T	P	C
3	0	0	3

COURSEOBJECTIVES:

- To understand the concepts of machine learning and types of problems tackled by machine learning.
- To explore the different supervised learning techniques.
- To learn different aspects of unsupervised learning and reinforcement learning.

- To learn the role of probabilistic methods for machine learning.
- To understand the basic concepts of neural networks and deep learning.

UNIT I INTRODUCTION TO MACHINE LEARNING **7**

Types of Machine Learning, Supervised learning: Classification, Regression, Unsupervised learning, Generative and Discriminative Models, Some basic concepts in machine learning, The Machine Learning Process, Reinforcement Learning.

UNIT II SUPERVISED LEARNING **11**

Supervised Learning, learning a Class from Examples, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Classification, Decision trees – Support vector machines -Neural networks (Gradient Descent and Back Propagation), Naïve Bayes Algorithm, Linear Regression and Logistic Regression, Random Forest, Ensemble Learning

UNIT III UNSUPERVISED LEARNING **9**

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis — EM algorithm.

UNIT IV REINFORCEMENT LEARNING **9**

Reinforcement Learning – Elements –Uses- Model based Learning – Temporal Difference Learning - Generalization - Markov Decision Processes- Partially Observable States Example: Getting Lost- Values: Q-Learning and Sarsa Algorithm - Back on Holiday: Using Reinforcement Learning, The Tiger Problem

UNIT V PROBABILISTIC METHODS FOR LEARNING **9**

Introduction - Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks -Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Generative Models :Hidden Markov Models

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon the completion of course, students will be able to

- Outline problems for each type of machine learning
- Apply the supervised learning algorithms for different applications
- Analyse typical Clustering algorithms for different types of applications.
- Demonstrate the various Reinforcement algorithms
- Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.

REFERENCES

1. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014
2. Stephen Marsland, “Machine Learning: An Algorithmic erspective”, Chapman & Hall/CRC, 2nd Edition, 2014.
3. Kevin Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 20122.
4. Tom M Mitchell, “Machine Learning”, McGraw Hill Education, 2013.

5. Christopher M.Bishop ,Pattern Recognition and Machine Learning, Springer Publications, Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
6. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020

AD1502A **DIGITAL IMAGE PROCESSING**

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COURSE OBJECTIVES:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS **9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, Image Compression- Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG

UNIT II IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION **9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV IMAGE SEGMENTATION **9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V OBJECT REPRESENTATION AND RECOGNITION **9**

Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on Matching, Minimum distance Classifier and Bayes Classifier

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students should be able to:

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Learn the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

TEXT BOOKS:

1. Rafael C.Gonzalez, RichardE. Woods, _Digital Image Processing‘, Pearson, Third Edition, 2010.
2. Anil K.Jain,_ Fundamentals of Digital Image Processing‘, Pearson,2002.

REFERENCES:

1. Kenneth R.Castleman,_DigitalImageProcessing‘,Pearson,2006.
2. Rafael C.Gonzalez, Richard E.Woods, Steven Eddins,_Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
3. D,E.Dudgeon and RM.Mersereau,_Multi dimensional Digital Signal Processing‘, Prentice Hall Professional Technical Reference, 1990.
4. WilliamK.Pratt,_DigitalImage Processing‘,JohnWiley, NewYork, 2002
5. Milan Sonkaetal_Image processing, analysis and machine vision‘,Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

IT1702A **CLOUD COPUTING LAB**

L	T	P	C
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COURSE OBJECTIVES:

- To learn the fundamentals of Cloud Computing and designing Private Cloud and Public Cloud Environment.
- To learn the basic ideas and principles of Virtualization Technology.
- To learn the dynamic programming models for Cloud.
- To gain knowledge on various cloud components mechanism for data center design and management.
- To learn to implement and use parallel programming using Hadoop

LIST OF EXPERIMENTS

1. Virtualization

a. Find procedure to run the virtual machine of different configuration using virt-manager.
b. Virtualize a machine and check how many virtual machine can be utilized at a particular time.
c. Create a VM clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine.

2. Public Cloud

a. Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix/GCC and launch it.
b. Test how a SaaS applications scales in response to demand.
c. Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.

3. Private Cloud

a. Setup a Private Cloud by performing the procedure using a Single node Openstack/Opennebula implementation.
b. Perform Creation, Management and Termination of a CentOS instance in Openstack/Opennebula.
c. Show the virtual machine migration based on certain conditions from one node to the other.

4. Hadoop - Map Reduce

a. Setup a Single Node Hadoop cluster and show all the process through WEB UI.
b. Demonstrate the MAP REDUCE programming model by counting the number of words in a file. Implement the procedure to interact with Hadoop API for Accessing HDFS from local file system.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the students will be able to:

- The strength of virtualization and outline its role in enabling the cloud computing system mode
- Demonstrate the cloud, its characteristics, various delivery and deployment models.
- Recognize the scope of distributed file systems in cloud and their applications in industry.
- The fundamental cloud components mechanism with which cloud data centers are managed and administered

CS 1702A **MACHINE LEARNING LABORATORY**

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LIST OF EXPERIMENTS:

1. Implement the concept of decision trees with suitable data set from real world problem and classify the data set to produce new sample.
2. Detecting Spam mails using Support vector machine
3. Implement facial recognition application with artificial neural network
4. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
5. Implement character recognition using Multilayer Perceptron
6. Implement the kmeans algorithm
7. Implement the Dimensionality Reduction techniques
8. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
9. Study and implement amazon toolkit: Sagemaker
10. Using Weka Tool Perform a). Data preprocessing by selecting or filtering attributes b). Data preprocessing for handling missing value
11. Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Understand the implementation procedures for the machine learning algorithms.
- Design Python programs for various Learning algorithms.
- Apply appropriate Machine Learning algorithms to data sets
- Identify and apply Machine Learning algorithms to solve real world problems.

CS1713A **BLOCK CHAIN TECHNOLOGIES**

L	T	P	C
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COURSE OBJECTIVES

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
- To securely interact with them
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their own projects.

UNIT I BASICS **9**

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 **9**

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

UNIT III DISTRIBUTED CONSENSUS **9**

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT IV CRYPTOCURRENCY **9**

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

UNIT V CRYPTOCURRENCY REGULATION **9**

Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon the successful completion of the Course, the Student would be able to

- Outline the design principles of Bitcoin and Ethereum.
- Appraise the Satoshi Nakamoto consensus.
- Explain the Simplified Payment Verification protocol.
- List and describe differences between proof-of-work and proof-of-stake consensus.
- Interact with a blockchain system by sending and reading transactions.
- Design, build, and deploy a distributed application.
- Evaluate security, privacy, and efficiency of a given blockchain system.

TEXT BOOK

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).

REFERENCE BOOKS

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper. 2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

AD1503A **SPEECH ANALYTICS**

L	T	P	C
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COURSE OBJECTIVES:

- To Comprehend the need for morphological processing and their representation
- To know about the various techniques used for speech synthesis and recognition
- To appreciate the syntax analysis and parsing that is essential for natural language processing
- To learn about the various representations of semantics and discourse
- To have knowledge about the applications of natural language processing

UNIT I SPEECH PROCESSING **9**

Phonetics –Articulatory Phonetics -Phonological Categories -Acoustic Phonetics and Signals -Speech Synthesis –Text Normalization –Phonetic and Acoustic Analysis –Diphone Waveform synthesis – Evaluation-Automatic Speech Recognition –Architecture -Hidden Markov Model to Speech- MFCCvectors-AcousticLikelihoodComputation-Evaluation.Triphones–DiscriminativeTraining-ModelingVariation.ComputationalPhonology-Finite-StatePhonology–ComputationalOptimalityTheory-Syllabification-Learning Phonology and Morphology

UNIT II SPEECH ANALYSIS **9**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization– Dynamic Time Warping, Multiple Time–Alignment Paths

UNIT III SPEECH MODELING **9**

Hidden Markov Models: Markov Processes, HMMs–Evaluation, Optimal State Sequence Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION **9**

Continuous speech recognition system–acoustics and language models–n-grams, context dependent sub-wordunits; Applications and present status.

UNIT V SPEECH SYNTHESIS **9**

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness–role of prosody, Applications and present status.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- Identify the different linguistic components of natural language
- Design a morphological analyser for a given natural language
- Decide on the appropriate parsing techniques necessary for a given language and application
- Design new tag set and a tagger for a given natural language

Design applications involving natural language

REFERENCES:

1. Jurafsky and Martin,"Speech and Language Processing", Pearson Prentice Hall, Second Edition,2008.
2. Lawrence Rabiner and Biing- Hwang Juang, "Fundamentals of Speech Recognition",Pearson Education,2003
3. StevenW.Smith,"The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
4. ThomasF Quatieri,"Discrete-Time Speech Signal Processing– Principles and Practice", Pearson Education.
5. Claudio Becchetti and Lucio Prina Ricotti,"Speech Recognition",John Wileyand Sons,1999.
6. Bengold and Nelson Morgan,"Speech and audio signal processing", processing and perception of speec handmusic,Wiley-IndiaEdition,2006 Edition.
7. Frederick Jelinek,"Statistical Methods of Speech Recognition", MIT Press

AD1504A	CYBER FORENSICS	L	T	P	C
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COURSE OBJECTIVES

- To learn computer forensics.
- To become familiar with forensics tools.
- To learn to analyze and validate forensics data.

UNIT I SPEECH PROCESSING **9**

Phonetics –Articulatory Phonetics -Phonological Categories -Acoustic Phonetics and Signals -Speech Synthesis –Text Normalization –Phonetic and Acoustic Analysis –Diphone Waveform synthesis – Evaluation-Automatic Speech Recognition –Architecture -Hidden Markov Model to Speech- MFCC vectors – Acoustic Likelihood Computation-Evaluation. Triphones–Discriminative Training- Modeling Variation .Computational Phonology-Finite-State Phonology Computational Optimality Theory-Syllabification-Learning Phonology and Morphology

UNIT II SPEECH ANALYSIS **9**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization– Dynamic Time Warping, MultipleTime–Alignment Paths

UNIT III SPEECH MODELING **9**

Hidden Markov Models: Markov Processes, HMMs–Evaluation, Optimal State Sequence Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION **9**

Continuous speech recognition system–acoustics and language models–n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS 9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness–role of prosody, Applications and present status.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- Identify the different linguistic components of natural language
- Design a morphological analyser for a given natural language
- Decide on the appropriate parsing techniques necessary for a given language and application
- Design new tag set and a tagger for a given natural language
- Design applications involving natural language

REFERENCES:

1. Jurafsky and Martin,"Speech and Language Processing", Pearson Prentice Hall, Second Edition, 2008.
2. Lawrence Rabiner and Biing-
3. Hwang Juang,"Fundamentals of Speech Recognition", Pearson Education,2003
4. StevenW.Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
5. Thomas FQuatieri, "Discrete-Time Speech Signal Processing– Principles and Practice", Pearson Education.
6. Claudio Becchetti and Lucio Prina Ricotti,"Speech Recognition", John Wiley and Sons,1999.
7. Bengold and Nelson Morgan, "Speech and audio signal processing", processing and perception of speec hand music, Wiley-IndiaEdition,2006 Edition.
8. Frederick Jelinek,"Statistical Methods of Speech Recognition", MIT Press

AD1505A VIRTUAL REALITY AND AUGMENTED REALITY

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COURSE OBJECTIVES:

The student should be made:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- To know the intricacies of these platform to develop PDA applications with better optimality

UNIT I INTRODUCTION **9**

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three- dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces- Output Devices: Graphics displays-sound displays & haptic feedback.

UNIT II VR DEVELOPMENT PROCESS **9**

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

UNIT III CONTENT CREATION CONSIDERATIONS FOR VR **9**

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

UNIT IV VR ON THE WEB & VR ON THE MOBILE **9**

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics

UNIT V APPLICATIONS **9**

Medical applications-military applications-robotics applications- Advanced Real time Tracking- other applications- games, movies, simulations, therapy

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Analyse & Design a system or process to meet given specifications with realistic engineering constraints.
- Identify problem statements and function as a member of an engineering design team.
- Utilize technical resources
- Propose technical documents and give technical oral presentations related to design mini project results.

TEXT BOOKS:

1. C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc.,2008
2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

REFERENCES:

1. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
2. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human

Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.
3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble & Shel Israel, Patrick Brewster Press; 1 edition, 2016.
4. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.
5. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, O'Reilly Media; 1 edition, 2014.
6. Learning Three.js: The JavaScript 3D Library for WebGL - Second Edition, Jos Dirksen, Packt Publishing - ebooks Account; 2nd Revised ed. Edition 2015.

AD1507A **RECOMMENDER SYSTEMS**

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COURSE OBJECTIVES:

- To understand the basic concepts of recommender systems
- To design a Content-Based Recommender Systems
- To construct Collaborative Filtering (CF)-Based Recommender Systems
- To understand the real time applications on Recommender System

UNIT I INTRODUCTION **9**

Introduction and basic taxonomy of recommender systems (RSs) - Traditional and non-personalized RSs - Overview of data mining methods for recommender systems (similarity measures, classification, Bayes classifiers, censembles of classifiers, lustering, SVMs, dimensionality reduction) - Overview of convex and linear optimization principles.

UNIT II CONTENT-BASED RECOMMENDER SYSTEMS **9**

The long-tail principle - Domain-specific challenges in recommender systems - Content-based recommender systems - Advantages and drawbacks - Basic componenets of content-based RSs - Feature selection - Item representation Methods for learning user profiles.

UNIT III COLLABORATIVE FILTERING (CF)-BASED RECOMMENDER SYSTEMS **9**

Mathematical foundations Mathematical optimization in CF RSs - Optimization objective - Baseline predictor through least squares - Regularization and overfitting - Temporal models - Step-by-step solution of the RS problem.

UNIT IV ADVANCED COLLABORATIVE FILTERING METHODS 9

Systematic approach Nearest-neighbor collaborative filtering (CF) - User-based and item-based CF, comparison - Components of neighborhood methods (rating normalization, similarity weight computation, neighborhood selection) - Hybrid recommender systems.

UNIT V CONTEXT-AWARE RECOMMENDER SYSTEMS 9

Contextual information models for RSs - Incorporating context in Rs - Learning to rank - Active learning in RSs - Multi-armed bandits and Reinforcement learning in RSs - Dynamic RSs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Solve mathematical optimization problems pertain to recommender systems
- Carry out performance evaluation of recommender systems based on various metrics
- Implement machine-learning and data-mining algorithms in recommender systems data sets.
- Design and implement a simple recommender system.
- Learn about advanced topics and current applications of recommender systems in other realms such as mobile computing.

Text Book

1. C.C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. F. Ricci, L Rokach, B. Shapira and P.B. Kantor, Recommender systems handbook, Springer 2010.

Reference

1. J. Leskovec, A. Rajaraman and J. Ullman, Mining of massive datasets, 2nd Ed., Cambridge, 2012. (Chapter 9).
2. M. Chiang, Networking Life, Cambridge, 2010. (Chapter 4).