ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.TECH. ARTIFICAL INTELLIGENCE AND DATA SCIENCE
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To provide graduates with the proficiency to utilize the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volume of data.
2. To enrich graduates with necessary technical skills to pursue pioneering research in the field of AI and Data Science and create disruptive and sustainable solutions for the welfare of ecosystems.
3. To enable graduates to think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.
4. To enable the graduates to design and model AI based solutions to critical problem domains in the real world.
5. To enrich the innovative thoughts and creative ideas of the graduates for effective contribution towards economy building.

PROGRAM OUTCOMES (POs) ENGINEERING GRADUATES WILL BE ABLE TO:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and Artificial Intelligence and Data Science basics to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

1. Graduates should be able to evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains.
2. Graduates should be able to arrive at actionable Fore sight, Insight, hind sight from data for solving business and engineering problems
3. Graduates should be able to create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve wicked societal problems
4. Graduates should be capable of developing data analytics and data visualization skills, skills pertaining to knowledge acquisition, knowledge representation and knowledge engineering, and hence capable of coordinating complex projects.
5. Graduates should be able to carry out fundamental research to cater the critical needs of the society through cutting edge technologies of AI.

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CHOICE BASED CREDIT SYSTEM
I - VIII SEMESTERS CURRICULUM
SEMESTER I

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics – I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
			TOTAL	**31**	**19**	**0**	**12**	**25**

SEMESTER II

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8252	Linear Algebra	BS	4	4	0	0	4
3.	AD8251	Data Structures Design	PC	3	3	0	0	3
4.	GE8291	Environmental Science and Engineering	BS	3	3	0	0	3
5.	BE8255	Basic Electrical, Electronics, and Measurement Engineering	ES	3	3	0	0	3
6.	AD8252	Digital Principles and Computer Organization	ES	5	3	0	2	4
PRACTICALS								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	AD8261	Data Structures Design Laboratory	PC	4	0	0	4	2
			TOTAL	**30**	**20**	**0**	**10**	**25**

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA8351	Discrete Mathematics	BS	4	4	0	0	4
2.	AD8301	Introduction to Operating Systems	PC	5	3	0	2	4
3.	AD8302	Fundamentals of Data Science	PC	3	3	0	0	3
4.	CS8392	Object Oriented Programming	PC	3	3	0	0	3
5.	AD8351	Design and Analysis of Algorithms	PC	5	3	0	2	4
PRACTICALS								
6.	AD8311	Data Science Laboratory	PC	4	0	0	4	2
7.	CS8383	Object Oriented Programming Laboratory	PC	4	0	0	4	2
8.	HS8381	Interpersonal Skills/Listening & Speaking	HS	2	0	0	2	1
			TOTAL	**30**	**16**	**0**	**14**	**23**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA8391	Probability and Statistics	BS	4	4	0	0	4
2.	AD8401	Database Design and Management	PC	3	3	0	0	3
3.	AD8402	Artificial Intelligence I	PC	3	3	0	0	3
4.	AD8403	Data Analytics	PC	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
6.	AD8411	Database Design and Management Laboratory	PC	4	0	0	4	2
7.	AD8412	Data Analytics Laboratory	PC	4	0	0	4	2
8.	AD8413	Artificial Intelligence – I Laboratory	PC	4	0	0	4	2
9.	HS8461	Advanced Reading and Writing	HS	2	0	0	2	1
			TOTAL	**30**	**16**	**0**	**14**	**23**

SEMESTER V

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AD8501	Optimization Techniques	PC	4	4	0	0	4
2.	CW8691	Computer Networks	PC	5	3	0	2	4
3.	AD8502	Data Exploration and Visualization	PC	5	3	0	2	4
4.	AD8551	Business Analytics	PC	3	3	0	0	3
5.	AD8552	Machine Learning	PC	3	3	0	0	3
6.		Open Elective I	OE	3	3	0	0	3
PRACTICALS								
7.	AD8511	Machine Learning Laboratory	PC	4	0	0	4	2
8.	AD8512	Mini Project on Data Sciences Pipeline	PC	4	0	0	4	2
			TOTAL	**31**	**19**	**0**	**12**	**25**

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AD8601	Artificial Intelligence II	PC	3	3	0	0	3
2.	AD8602	Data and Information Security	PC	3	3	0	0	3
3.	IT8501	Web Technology	PC	3	3	0	0	3
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
PRACTICALS								
6.	IT8511	Web Technology Laboratory	PC	4	0	0	4	2
7.	AD8611	Artificial Intelligence - II Laboratory	PC	4	0	0	4	2
8.	HS8581	Professional Communication	HS	2	0	0	2	1
9.	AD8612	Socially relevant Project	PC	4	0	0	4	2
			TOTAL	**29**	**15**	**0**	**14**	**22**

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AD8701	Deep Learning	PC	3	3	0	0	3
2.	AD8702	Text Analytics	PC	3	3	0	0	3
3.	AD8703	Basics of Computer Vision	PC	3	3	0	0	3
4.	AD8704	Big Data Management	PC	5	3	0	2	4
5.	AD8705	AI and Robotics	PC	5	3	0	2	4
6.		Open Elective II	OE	3	3	0	0	3
PRACTICALS								
7.	AD8711	Deep Learning Laboratory	PC	4	0	0	4	2
8.	AD8712	Mini Project on Analytics	PC	4	0	0	4	2
			TOTAL	**30**	**18**	**0**	**12**	**24**

SEMESTER VIII

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Professional Elective IV	PE	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
PRACTICALS								
3.	AD8811	Project Work	PC	20	0	0	20	10
			TOTAL	**26**	**6**	**0**	**20**	**16**

TOTAL NO. OF CREDITS: 183

PROFESSIONAL ELECTIVES (PE)

SEMESTER IV, ELECTIVE - I

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	EC8691	Microprocessors and Microcontrollers	PE	3	3	0	0	3
2.	AD8001	Software Development Processes	PE	3	3	0	0	3
3.	AD8002	Health care Analytics	PE	3	3	0	0	3
4.	AD8003	Mobile Applications Development	PE	3	3	0	0	3
5.	AD8004	Parallel Computing	PE	3	3	0	0	3

SEMESTER VI, ELECTIVE - II

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	AD8005	Embedded Systems and Programming	PE	3	3	0	0	3
2.	CW8591	Software Architecture	PE	3	3	0	0	3
3.	AD8006	Engineering Predictive Analytics	PE	3	3	0	0	3
4.	CS8603	Distributed Systems	PE	3	3	0	0	3
5.	CS8072	Agile Methodologies	PE	3	3	0	0	3

SEMESTER VI, ELECTIVE - III

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	CS8081	Internet of Things	PE	3	3	0	0	3
2.	AD8007	Software Testing and Quality Assurance	PE	3	3	0	0	3
3.	CS8791	Cloud Computing	PE	3	3	0	0	3
4.	CS8085	Social Network Analytics	PE	3	3	0	0	3
5.	AD8008	Web Services and API Design	PE	3	3	0	0	3

SEMESTER VIII, ELECTIVE - IV

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	AD8009	Operations and Supply Chain Management	PE	3	3	0	0	3
2.	AD8010	Speech Processing and Analytics	PE	3	3	0	0	3
3.	AD8011	Cyber Security	PE	3	3	0	0	3
4.	AD8012	Nonlinear Optimization	PE	3	3	0	0	3
5.	AD8013	Ethics Of Artificial Intelligence	PE	3	3	0	0	3

SEMESTER VIII, ELECTIVE - V

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	AD8014	Engineering Economics	PE	3	3	0	0	3
2.	AD8081	Cognitive Science and Analytics	PE	3	3	0	0	3
3.	MG8591	Principles of Management	PE	3	3	0	0	3
4.	AD8015	Bio-inspired Optimization Techniques	PE	3	3	0	0	3
5.	AD8016	Information Extraction and Retrieval	PE	3	3	0	0	3

HS8151	COMMUNICATIVE ENGLISH	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing**- completing sentences- - developing hints. **Listening**- short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development**- Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development-**- prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening**- telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking**- asking about routine actions and expressing opinions. **Language development**- degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing**- letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening**- listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development**- synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing**- brainstorming -writing short essays **–** developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks-conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations-fixed and semi-fixed expressions.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

1. Board of Editors. **Using English** A Coursebook for Undergarduate Engineers and Technologists**.** Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
3. Redston, Chris &Gillies Cunningham Face2Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and RajeevanGeeta. Basic Communication Skills, Foundation Books: 2013.

MA8151 ENGINEERING MATHEMATICS – I

L	T	P	C
4	0	0	4

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus.
- The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions.
- This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

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 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 III INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

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

UNIT V 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.

TOTAL: 60 PERIODS

OUTCOMES:

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.

3. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

PH8151	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.
- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers: population of energy levels, Einstein’s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe’s and Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck’s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of this course,

- The students will gain knowledge on the basics of properties of matter and its applications,
- The students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- The students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. &Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. &Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. &Mosca, G. "Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.

CY8151 ENGINEERING CHEMISTRY L T P C

3 0 0 3

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.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir -

applications of adsorption on pollution abatement. Catalysis:Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - 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) - power alcohol and biodiesel.Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, “A Textbook of Engineering Chemistry”, S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, “Engineering Chemistry” Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

4. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
5. PrasantaRath, “Engineering Chemistry”, Cengage Learning India PVT, LTD, Delhi, 2015.
6. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

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, 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, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 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.

TOTAL: 45 PERIODS

OUTCOMES:

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

GE8152 ENGINEERING GRAPHICS L T P C
2 0 4 4

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) 1

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

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+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 concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis

is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above solids in simple vertical position when 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.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+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 .

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion 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. Natrajan K.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 Panchal V.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, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.

5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

OUTCOMES:

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

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

BS8161 **PHYSICS AND CHEMISTRY LABORATORY** **L T P C**

(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

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. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

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: (Any seven experiments to be conducted)

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

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 chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

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

TOTAL: 30 PERIODS

TEXTBOOK:

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014).

HS8251	TECHNICAL ENGLISH	L	T	P	C
		4	0	0	4

OBJECTIVES:

The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing**- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development**- technical vocabulary **Language Development** –subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing**- interpreting cgarts, graphs- **Vocabulary Development-** vocabulary used in formal letters/emails and reports**Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing**- email etiquette- job

application – cover letter –Résumé preparation(via email and hard copy)- analytical essays and issue based essays--**Vocabulary Development**- finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development- verbal analogies Language Development-** reported speech.

TOTAL :60 PERIODS

OUTCOMES:

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

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES:

1. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
4. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007

Students can be asked to read Tagore, ChetanBhagat and for supplementary reading.

MA8252 LINEAR ALGEBRA L T P C
4 0 0 4

COURSE OBJECTIVES :

- To test the consistency and solve system of linear equations
- 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.

UNIT - I MATRICES AND SYSTEM OF LINEAR EQUATIONS 12

Matrices - Row echelon form - Rank - System of linear equations - Consistency - Gauss elimination method - Gauss Jordon method.

UNIT - II VECTOR SPACES 12

Real and Complex fields - Vector spaces over Real and Complex fields - Subspace - Linear space - Linear independence and dependence - Basis and dimension.

UNIT - III 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 - IV INNER PRODUCT SPACES 12

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

UNIT - V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 12

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

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

1. Test the consistency and solve system of linear equations
2. Find the basis and dimension of vector space
3. Obtain the matrix of linear transformation and its eigenvalues and eigenvectors
4. Find orthonormal basis of inner product space and find least square approximation
5. Find eigenvalues of a matrix using numerical techniques and perform matrix decomposition

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.

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. Bernard Kolman, David R. Hill, Introductory Linear Algebra, Pearson Educations, New Delhi, First Reprint, 2009.

AD8251 **DATA STRUCTURES DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

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

UNIT I ABSTRACT DATA TYPES 9

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying

Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms

UNIT II LINEAR STRUCTURES 9

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues

UNIT III SORTING AND SEARCHING 9

Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency

UNIT IV TREE STRUCTURES 9

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi-way search trees

UNIT V GRAPH STRUCTURES 9

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees

TOTAL: 45 HOURS

OUTCOMES:

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

- explain abstract data types
- design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications
- design, implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting
- model problems as graph problems and implement efficient graph algorithms to solve them

TEXT BOOK:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, John Wiley & Sons Inc., 2013
2. **Lee**, Kent D., **Hubbard**, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015

REFERENCES:

1. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011

2. Aho, Hopcroft, and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing 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, ECOSYSTEMSAND 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 the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTALPOLLUTION 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. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURALRESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems –

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, 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 – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIALISSUESAND 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, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATIONAND 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 – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. DharmendraS.Sengar,'Environmentallaw',PrenticehallofIndiaPVTLTD,NewDelhi, 2007.
2. ErachBharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

BE8255 BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING **L T P C 3 0 0 3**

OBJECTIVES:

- To understand the fundamentals of electronic circuit constructions.
- 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 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 - Thevenins theorem, Norton theorem, maximum power transfer 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- All day efficiency calculation.

UNIT III UTILIZATION OF ELECTRICAL POWER 9

Renewable energy sources-wind and solar panels. Illumination by lamps- Sodium Vapour, Mercury vapour, Fluorescent tube. Domestic refrigerator and air conditioner-Electric circuit, construction and working principle. Batteries-NiCd, Pb Acid and Li ion–Charge and Discharge Characteristics. Protection-need for earthing, fuses and circuit breakers.Energy Tariff calculation for domestic loads.

UNIT IV ELECTRONIC CIRCUITS 9

PN Junction-VI Characteristics of Diode, zener diode, Transistors configurations - amplifiers. Op amps- Amplifiers, oscillator,rectifiers, differentiator, integrator, ADC, DAC. Multi vibrator using 555 Timer IC . Voltage regulator IC using LM 723,LM 317.

UNIT V ELECTRICAL MEASUREMENT 9

Characteristic of measurement-errors in measurement, torque in indicating instruments- moving coil and moving iron meters, Energy meter and watt meter. Transducers- classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Oscilloscope-CRO.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Discuss the essentials of electric circuits and analysis.
- Discuss the basic operation of electric machines and transformers
- Introduction of renewable sources and common domestic loads.
- Introduction to measurement and metering for electric circuits.

TEXT BOOKS:

1. D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw 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 KaustuvDasgupta, 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 Utilisation of Electrical Energy”, New Age international pvt.ltd.,2003.

AD8252 DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION L T P C
3 0 2 4

UNIT I DIGITAL FUNDAMENTALS 9

Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra – K-Maps – Standard Forms – NAND – NOR Implementation.

UNIT II COMBINATIONAL AND SEQUENTIAL CIRCUITS 9

Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT IV PROCESSOR 9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

UNIT V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel And Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

PRACTICAL EXERCISES (30 hrs)

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits.

6. Implementation of functions using Multiplexers.
7. Implementation of any one of the synchronous counters.
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer architecture.

TOTAL :75 PERIODS

TEXT BOOK:

1. M. Morris Mano, Michael D. Ciletti, “Digital Design”, Fifth Edition, Pearson Education, 2013.
2. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Fifth Edition, Morgan Kaufmann/Elsevier, 2013.

REFERENCES:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2008.

GE8261 ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

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)

I CIVIL ENGINEERING PRACTICE 13

BUILDINGS:

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

PLUMBING WORKS:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers,
elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

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

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

CARPENTRY USING POWER TOOLS ONLY:

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

(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

WELDING:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
(b) Gas welding practice

BASIC MACHINING:

(a) Simple Turning and Taper turning
(b) Drilling Practice

SHEET METAL WORK:

(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

MACHINE ASSEMBLY PRACTICE:

(a) Study of centrifugal pump
(b) Study of air conditioner

DEMONSTRATION ON:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

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

IV ELECTRONICS ENGINEERING PRACTICE 16

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

TOTAL: 60 PERIODS

OUTCOMES:

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

Fabricate carpentry components and pipe connections including plumbing works.
Use welding equipments 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, foundary and fittings
Carry out basic home electrical works and appliances
Measure the electrical quantities
Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools: (a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
4. Multimeters 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

AD8261 DATA STRUCTURES DESIGN LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To implement ADTs in Python
- To design and implement linear data structures – lists, stacks, and queues
- To implement sorting, searching and hashing algorithms
- To solve problems using tree and graph structures

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations of List
5. Implementation of Stack and Queue ADTs
6. Applications of List, Stack and Queue ADTs
7. Implementation of sorting and searching algorithms
8. Implementation of Hash tables
9. Tree representation and traversal algorithms
10. Implementation of Binary Search Trees
11. Implementation of Heaps
12. Graph representation and Traversal algorithms
13. Implementation of single source shortest path algorithm
14. Implementation of minimum spanning tree algorithms

OUTCOMES:

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

- implement ADTs as Python classes
- design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications
- design, implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting
- model problems as graph problems and implement efficient graph algorithms to solve them

TOTAL:60 PERIODS

TEXT BOOK:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, John Wiley & Sons Inc., 2013

REFERENCES:

1. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011

2. Aho, Hopcroft, and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014

MA8351 DISCRETE MATHEMATICS L T P C
4 0 0 4

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.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

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 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 III 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 IV ALGEBRAIC STRUCTURES 12

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism’s – Normal subgroup and cosets – Lagrange’s theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL: 60 PERIODS

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 Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. 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, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

AD8301 INTRODUCTION TO OPERATING SYSTEMS L T P C
3 0 2 4

COURSE OBJECTIVES

- To understand the structure and functions of OS
- To learn about Processes, Threads and Scheduling algorithms
- To understand the principles of concurrency and Deadlocks
- To learn various memory management schemes
- To study I/O management and File systems.

UNIT I OPERATING SYSTEMS OVERVIEW 9

Computer System Overview: Basic elements – Instruction execution – Interrupts – Memory hierarchy – Cache memory – Direct memory access – Multiprocessor and multicore organization; Operating System Overview: Objectives and functions – Evolution of operating system; Computer system organization; Operating System Structure and Operations: System calls – System programs; Operating-System Design and Implementation; Operating-System Debugging

UNIT II PROCESS MANAGEMENT 12

Processes: Process concept – Process scheduling – Operations on processes – Interprocess communication; Threads: Overview – Multithreading models – Thread issues; CPU Scheduling: FCFS, SJF, Priority, Round robin, Rate Monotonic and EDF scheduling; Process synchronization – Critical section problem – Mutex locks – Semaphores; Deadlocks – Avoidance – Prevention – Detection and Recovery.

UNIT III MEMORY MANAGEMENT 8

Main Memory: Contiguous memory allocation – Segmentation – Paging – 32 and 64 bit architecture Examples; Virtual Memory: Demand paging – Page replacement algorithms – Allocation of Frames – Thrashing.

UNIT IV STORAGE MANAGEMENT 9

Mass Storage Structure: Overview – Disk scheduling and management; File System Storage: File concepts – Directory and disk structure – Sharing and protection; File System Implementation: File system structure – Directory structure – Allocation methods – Free space management.

UNIT V CASE STUDY 7

Linux Vs Windows: Design principles – Process management – Scheduling – Memory management – File systems; Mobile OS: iOS and Android – Introduction and architecture.

TOTAL: 45 PERIODS

SUGGESTIVE EXPERIMENTS:

1. Implement the various CPU Scheduling Algorithms
2. Implement Semaphores
3. Implement Bankers Algorithm for Deadlock Avoidance
4. Develop an application using Threads
5. Implement the following Memory Allocation Methods for variable sized partition: a)
6. First Fit b) Worst Fit c) Best Fit
7. Implement Paging Technique of Memory Management
8. Implement the following Page Replacement Algorithms a) FIFO b) LRU c) LFU
9. Implement the following File Allocation Strategies a) Sequential b) Indexed c) Linked
10. Implement Shared memory and IPC

PRACTICAL: 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- Outline the basic services and functionalities of operating systems
- Analyse various scheduling algorithms, and understand the different deadlock, prevention and avoidance schemes
- Illustrate the different memory management schemes
- Outline the functionality of file systems
- Compare and contrast Linux, Windows and mobile operating systems

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc, 2012.
2. Neil Smyth, “iPhone iOS 4 Development Essentials - Xcode”, 4th Edition, Payload media,2011.

REFERENCES

1. Ramez Elmasri, A Gil Carrick, David Levine, “Operating Systems A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. Achyut S Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.
3. Andrew S Tanenbaum, “Modern Operating Systems”, 2nd Edition, Pearson Education, 2004.
4. Harvey M Deitel, “Operating Systems”, 3rd Edition, Pearson Education, 2004.
5. Daniel P Bovet, Marco Cesati, “Understanding the Linux Kernel”, 3rd edition, O‘Reilly,2005.

HARDWARE:

1. Standalone Desktops with Linux OS

SOFTWARE:

1. Python

AD8302 FUNDAMENTALS OF 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 gain understanding in classification and Regression Model
- 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 I 9

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data

UNIT III PYTHON FOR DATA HANDLING 9

Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT IV DESCRIBING DATA II 9

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean

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

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
- Can handle data using primary tools used for data science in Python
- Represent the useful information using mathematical skills
- Can apply the knowledge for data describing and visualization using tools.

TOTAL:45 PERIODS

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 and III)
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Parts of chapters 2–4 for Units IV and V)

REFERENCES

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

CS8392 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

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 10

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment **-** Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- 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 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

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 - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS:

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

REFERENCES:

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

AD8351 DESIGN AND ANALYSIS OF ALGORITHMS L T P C
3 0 2 4

COURSE OBJECTIVES

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand and implement different algorithm design techniques.
- To understand the limitations of Algorithmic power

UNIT I INTRODUCTION AND ANALYSIS 9

Introduction: Fundamentals of algorithmic Problem solving – Important problem types; Recursive algorithms, -- Fundamentals of the Analysis of Algorithm Efficiency: Analysis framework -- Asymptotic notations and basic complexity classes – recurrences – case studies

UNIT II DIVIDE-AND-CONQUER AND GREEDY STRATEGIES 9

Divide and Conquer strategy -- Mergesort -- Quicksort -- Multiplication of large integers and Strassen's matrix multiplication – closest pairs

Greedy strategy – Huffman coding – shortest paths algorithms – minimum-cost spanning tree algorithms –disjoint sets

UNIT III DYNAMIC PROGRAMMING AND STATE-SPACE APPROACH 9

Dynamic Programming: Computing binomial coefficient – Knapsack problem and memory functions – ordering of matrix multiplications -- Warshall's and Floyd's algorithm

State-space approach – exhaustive search: DFS, BFS, Iterative deepening

UNIT IV BACKTRACKING , ITERATIVE IMPROVEMENT, AND BRANCH & BOUND 10

Backtracking and permutations – N-queens problem – Hamilton circuits – best-first search -- Iterative Improvement: Stable marriage -- Maximum matching in bipartite graphs – maximum flow --- Branch and Bound: Knapsack problem -- Traveling salesman problem

UNIT V INTRACTABILITY 8

Introduction to intractability -- Polynomial reductions – SAT and 3-SAT – NP-complete and NP-Hard problems -- Approximation algorithms: Traveling salesman problem -- Knapsack problem – Introduction to randomized and parallel algorithms

THEORY PERIODS: 45

SUGGESTIVE EXERCISES

1. Implementation of iterative and recursive algorithms for the given problem
2. Empirical analysis of algorithms
3. Implementation of divide-and-conquer sorting algorithms
4. Implementation of closest-pairs algorithm
5. Implementation of Huffman coding
6. Implementation of Dijkstra's and Prim's algorithms
7. Implementation of disjoint sets and Kruskal's algorithm
8. Implementation of dynamic programming algorithm for knapsack problem
9. Implementation of backtracking to solve n-Queens and Hamilton circuits problems
10. Implementation of iterative improvement strategy for stable marriage and maxflow problems
11. Implementation of Branch and Bound technique to solve knapsack and TSP problems
12. Implementation of approximation algorithms for knapsack and TSP problems

PRACTICAL PERIODS: 30

TOTAL PERIODS: 75

OUTCOMES:

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

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency
- Ability to implement techniques in solving real time problems

TEXT BOOKS

1. Anany Levitin, ``Introduction to the Design and Analysis of Algorithms'', 3rd Edition, Pearson Education, 2012.
2. Jon Kleinberg and Eva Tardos, ``Algorithm Design'', Pearson Education, 2006.

REFERENCES

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, ``Introduction to Algorithms'', 3rd Edition, PHI Learning Private Limited, 2012.
2. Steven S Skiena, ``The Algorithm Design Manual'', 2nd Edition, Springer, 2008.
3. S Dasgupta, C H Papadimitriou, U V Vazirani,``Algorithms'',1st Edition, McGraw Hill Education, 2017.
4. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2015.
5. Sara Baase and Allen Van Gelder, Computer Algorithms, Third Edition, Pearson Education, 2000.
6. Dexter C. Kozen, The Design and Analysis of Algorithms, Springer-Verlag, 1992.

AD8311 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.

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

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions
5. Averages
6. Variability
7. Normal curves
8. Correlation and scatter plots
9. Correlation coefficient
10. Regression

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

CS8383 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES

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

LIST OF EXPERIMENTS

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

   If the type of the EB connection is domestic, calculate the amount to be paid as follows:

   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - > 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - > 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.

3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

5. Write a program to perform string operations using ArrayList. 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 Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name 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 implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a 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 mini project for any application using Java concepts.

TOTAL : 60 PERIODS

OUTCOMES

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

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

HS8381	INTERPERSONAL SKILLS/LISTENING&SPEAKING	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- 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

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

Lexical chunking for accuracy and fluency- 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

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

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

TOTAL :30PERIODS

OUTCOMES:

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

- 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 MamtaBhatnagar. 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. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

MA8391 PROBABILITY AND STATISTICS L T P C

4 0 0 4

OBJECTIVES:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To familiarize the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES:

1. Probability and Statistics for Engineering and the Sciences, 9E by Jay L. Devore, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
4. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
5. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

AD8401 DATABASE DESIGN AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce database development life cycle and conceptual modelling
- To learn SQL for data definition, manipulation and querying a database
- To learn relational database design using conceptual mapping and normalization
- To learn transaction concepts and serializability of schedules
- To learn data model and querying in object-relational and No-SQL databases

UNIT I CONCEPTUAL DATA MODELING 8

Database environment – Database system development lifecycle – Requirements collection – Database design -- Entity-Relationship model – Enhanced-ER model – UML class diagrams.

UNIT II RELATIONAL MODEL AND SQL 10

Relational model concepts -- Integrity constraints -- SQL Data manipulation – SQL Data definition – Views -- SQL programming.

UNIT III RELATIONAL DATABASE DESIGN AND NORMALIZATION 10

ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).

UNIT IV TRANSACTION MANAGEMENT 8

Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two-phase locking techniques.

UNIT V OBJECT RELATIONAL AND NO-SQL DATABASES 9

Mapping EER to ODB schema – Object identifier – reference types – rowtypes – UDTs – Subtypes and supertypes – user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Understand the database development life cycle and apply conceptual modeling
- Apply SQL and programming in SQL to create, manipulate and query the database
- Apply the conceptual-to-relational mapping and normalization to design relational dataabse
- Determine the serializability of any non-serial schedule using concurrency techniques
- Apply the data model and querying in Object-relational and No-SQL databasses.

TEXT BOOKS:

1. Thomas M. Connolly, Carolyn E. Begg, *Database Systems – A Practical Approach to Design, Implementation, and Management*, Sixth Edition, Global Edition, Pearson Education, 2015.
2. Ramez Elmasri, Shamkant B. Navathe, *Fundamental of Database Systems*, 7th Edition,

Pearson, 2017.

REFERENCES:

1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, “DATABASE MODELING AND DESIGN - Logical Design”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012
3. Abraham Silberschatz, Henry F Korth, S Sudharshan, “Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.
4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson.
5. S Sumathi, S Esakkirajan, “ Fundamentals of Relational Database Management Systems ", (Studies in Computational Intelligence), Springer-Verlag, 2007.
6. Raghu Ramakrishnan, “Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

AD8402 ARTIFICIAL INTELLIGENCE I 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.

UNIT I INTELLIGENT AGENTS 9

Introduction to AI – Agents and Environments – Concept of rationality – Nature of environments – Structure of agents

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 KNOWLEDGE REPRESENTATION AND PLANNING 9

Ontological engineering – categories and objects – events – mental objects and modal logic – reasoning systems for categories – reasoning with default information

Classical planning – algorithms for classical planning – heuristics for planning – hierarchical planning – non-deterministic domains – time, schedule, and resources -- analysis

COURSE OUTCOMES:

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

1. Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings
2. Choose appropriate algorithms for solving given AI problems
3. Design and implement logical reasoning agents
4. Design and implement agents that can reason under uncertainty

TOTAL : 45 PERIODS

TEXT BOOK:

1. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.

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

AD8403 DATA ANALYTICS L T P C

3 0 0 3

COURSE OBJECTIVES

- To study the basic inferential statistics and sampling distribution.
- To understand the concept of estimation of parameters using fundamental tests and testing of hypotheses.
- To understand the techniques of analysis of variance.
- To gain knowledge in predictive analytics techniques.
- To perform a case study with any available sample data sets.

UNIT I INFERENTIAL STATISTICS I 9

Populations – samples – random sampling – probability and statistics

Sampling distribution – creating a sampling distribution – mean of all sample means – standard error of the mean – other sampling distributions

Hypothesis testing – z-test – z-test procedure – statement of the problem – null hypothesis – alternate hypotheses – decision rule – calculations – decisions - interpretations

UNIT II INFERENTIAL STATISTICS II 9

Why hypothesis tests? – Strong or weak decisions – one-tailed and two-tailed tests – case studies

Influence of sample size – power and sample size

Estimation – point estimate – confidence interval – level of confidence – effect of sample size

UNIT III T-TEST 9

t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error – case studies

t-test for two independent samples – statistical hypotheses – sampling distribution – test procedure – p-value – statistical significance – estimating effect size – meta analysis

t-test for two related samples

UNIT IV ANALYSIS OF VARIANCE 9

F-test – ANOVA – estimating effect size – multiple comparisons – case studies

Analysis of variance with repeated measures

Two-factor experiments – three f-tests – two-factor ANOVA – other types of ANOVA

Introduction to chi-square tests

UNIT V PREDICTIVE ANALYTICS 9

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling

Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy

Time series analysis – moving averages – missing values – serial correlation – autocorrelation

Introduction to survival analysis

TOTAL: 45 PERIODS

COURSE OUTCOME

- Understand the concept of sampling
- Apply the knowledge to derive hypotheses for given data
- Demonstrate the skills to perform various tests in the given data
- Ability to derive inference using Predictive Analytics
- Perform statistical analytics on a data set

TEXT BOOKS

1. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014. [Unit V]

REFERENCES

1. David Spiegelhalter, “The Art of Statistics: Learning from Data”, Pelican Books, 2020.
2. Peter Bruce, Andrew Bruce, and Peter Gedek, “Practical Statistics for Data Scientists”, Second Edition, O’Reilly Publishers, 2020.
3. Charles R. Severance, “Python for Everybody: Exploring Data in Python 3”, Shroff Publishers, 2017.
4. Bradley Efron and Trevor Hastie, “Computer Age Statistical Inference”, Cambridge University Press, 2016.

AD8411 DATABASE DESIGN AND MANAGEMENT LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To understand the database development life cycle
- To learn database design using conceptual modelling, Normalization
- To implement database using Data definition, Querying using SQL manipulation and SQL programming
- To implement database applications using IDE/RAD tools
- To learn querying Object-relational databases

SUGGESTIVE EXPERIMENTS

1. Database Development Life cycle:
   Problem definition and Requirement analysis
   Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) – top-down approach
   Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming
   - Stored Procedures/Functions
   - Constraints and security using Triggers
6. Database design using Normalization – bottom-up approach
7. Develop database applications using IDE/RAD tools (Eg., NetBeans,VisualStudio)
8. Database design using EER-to-ODB mapping / UML class diagrams
9. Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition
10. Querying the Object-relational database using Objet Query language

COURSE OUTCOMES

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

- Understand the database development life cycle
- Design relational database using conceptual-to-relational mapping, Normalization
- Apply SQL for creation, manipulation and retrieval of data
- Develop a database applications for real-time problems
- Design and query object-relational databases

TOTAL : 60 PERIODS

HARDWARE:

- Standalone Desktops

SOFTWARE:

- PostgreSQL

AD8412 DATA ANALYTICS LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES

- To study and write simple programs using the basic packages for handling data
- To do various sampling and T,Z,Anova test in various samples
- To perform case study and design a system
- To demonstrate Time Series Analysis in any real time application

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

Suggested Exercises:

1. Random Sampling
2. Z-test case study
3. T-test case studies
4. ANOVA case studies
5. Regression
6. Logistic Regression
7. Time series Analysis

COURSE OUTCOME

- After the completion of this course, students will be able to:
- To become skilled to use various packages in Python
- Demonstrate the understanding of data distribution with various samples
- Ability to Implement T-Test ,Anova and Z-Test on sample data sets
- Understanding of Mathematical models in real world problems.
- Conduct time series analysis and draw conclusion.

TOTAL : 60 PERIODS

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.

HARDWARE:

- Standalone Desktops with Linux OS

SOFTWARE:

- Python with statistical Packages

AD8413	ARTIFICIAL INTELLIGENCE – I 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 A* and memory bounded A* algorithms
4. Implement genetic algorithms for AI tasks
5. Implement simulated annealing algorithms for AI tasks
6. Implement alpha-beta tree search
7. Implement backtracking algorithms for CSP

8. Implement local search algorithms for CSP
9. Implement propositional logic inferences for AI tasks
10. Implement resolution based first order logic inferences for AI tasks
11. Implement classical planning algorithms
12. Mini-Project

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 technics for a given AI task

SOFTWARE:

- C++ or Java Software

HS8461	ADVANCED READING AND WRITING	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Strengthen the reading skills of 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.

UNIT I **6**

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title **Writing**-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II **6**

Reading-Read for details-Use of graphic organizers to review and aid comprehension **Writing**-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III **6**

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-**Writing-** Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV **6**

Reading- Genre and Organization of Ideas- **Writing-** Email writing- visumes – Job application-project writing-writing convincing proposals.

UNIT V **6**

Reading- Critical reading and thinking- understanding how the text positions the reader- identify
Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES:

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

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- 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

AD8501 **OPTIMIZATION TECHNIQUES**

L	T	P	C
4	0	0	4

OBJECTIVES:

The objective of this course is to enable the student to

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models.

UNIT I LINEAR MODELS **12**

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Big M method, Two-Phase method

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS 12

Integer programming: Branch and bound method- Transportation and Assignment problems - Travelling salesman problem.

UNIT III PROJECT SCHEDULING 12

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM

UNIT IV CLASSICAL OPTIMISATION THEORY 12

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.

UNIT V QUEUING MODELS 12

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.

TOTAL PERIODS: 60

COURSE OUTCOMES:

On successful completion of this course, the student will able to

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models

TEXT BOOK:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.

REFERENCES:

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.
2. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
4. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

CW8691 COMPUTER NETWORKS L T P C

3 0 2 4

OBJECTIVES:

- To understand the protocol layering and physical level communication
- To analyze the performance of a network
- To understand the various components required to build different networks
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer

UNIT I INTRODUCTION AND PHYSICAL LAYER 9

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II DATA-LINK LAYER & MEDIA ACCESS 9

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III NETWORK LAYER 9

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV TRANSPORT LAYER 9

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT V APPLICATION LAYER 9

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

LIST OF EXPERIMENTS :

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
   a) Echo client and echo server
   b) Chat
   c) File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of an error correction code (like CRC).

SOFTWARE:

- C/C++/JAVA/Equivalent compiler
- Network Simulator like NS2/OPNET/Wireshark

OUTCOMES:

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

- Comprehend the basic layers and its functions in computer networks.
- Evaluate the performance of a network.
- Understand the basics of how data flows from one node to another.

- Analyze and design routing algorithms.
- Design protocols for various functions in the network.
- Understand the working of various application layer protocols.

PRACTICALS 30 PERIODS
THEORY 45 PERIODS
TOTAL 75 PERIODS

TEXT BOOK:

1. Behrouz A. Forouzan, Data Communications and Networking, **Fifth Edition TMH, 2013.**
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, Pearson Education, 2017.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

AD8502 **DATA EXPLORATION AND VISUALIZATION** **L T P C**
3 0 2 4

OBJECTIVES:

- To understand the basics of Data Explorations
- To understand the basic concepts of Data visualization
- To study the linear and non-linear ways of Data visualization
- To explore the data visualization using R language
- To apply various data visualization techniques for a variety of tasks

UNIT I INTRODUCTION TO DATA EXPLORATION 9

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardising – Inequality - Smoothing Time Series.

UNIT II INTRODUCING TWO VARIABLE AND THIRD VARIABLE 9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations - Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data.

UNIT III BASICS OF DATA VISUALIZATION 9

The Seven Stages of Visualizing Data - Getting Started with Processing - Mapping - Time Series - Connections and Correlations - Scatterplot Maps - Trees, Hierarchies, and Recursion - Networks and Graphs – Acquiring Data – Parsing Data

UNIT IV DATA EXPLORATION AND DATA VISUALIZATION IN R **9**

Introduction to R and RStudio - The Basics of Data Exploration - Loading Data into R - Transforming Data - Creating Tidy Data

UNIT V TECHNIQUES AND APPLICATIONS OF DATA EXPLORATION AND VISUALIZATION IN R **9**

Basic Data Exploration Techniques - Basic Data Visualization Techniques - Visualizing Geographic Data with ggmap - R Markdown - Case Study – Wildfire Activity in the Western United States - Case Study – Single Family Residential Home and Rental Values

LIST OF EXPERIMENTS:

1. Install standalone R.
2. Use R tool to explore various commands for descriptive data analytics using bench mark datasets.
3. Explore various variable and row filters in R for cleaning data.
4. Use R commands for probability distributions and probability statistics.
5. Formulate real business problems scenarios to hypothesis and solve using R statistical testing features.
6. Apply various plot features in R on sample data sets and visualize.
7. Write and execute word count, word search and pattern search problems from large text files.
8. Explore various data preprocessing options using bench mark data sets.

SOFTWARE:

- R-Studio

PRACTICALS	**30 PERIODS**
THEORY	**45 PERIODS**
TOTAL	**75 PERIODS**

OUTCOMES:

- Understand the basics of Data Exploration
- Use Univariate and Multivariate Analysis for Data Exploration
- Explain various Data Visualization methods
- Apply the concept of Data Visualization on various datasets
- Apply the data visualization techniques using R language

TEXT BOOKS

1. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.
2. Visualizing Data: Exploring and Explaining Data with the processing Environment, O Reily Publications, 2007
3. Eric Pimpler, Data Visualization and Exploration with R, Geo Spatial Training service, 2017
4. Authors: Xiang Zhou, Sean, Yong Rui, Huang, Thomas S., Exploration of Visual Data, Springer Publications, 2003
5. Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, O'Reily Publications, 2019

AD8551 **BUSINESS ANALYTICS** **L T P C**
3 0 0 3

OBJECTIVES:

1. To understand the Analytics Life Cycle.
2. To comprehend the process of acquiring Business Intelligence
3. To understand various types of analytics for Business Forecasting
4. To model the supply chain management for Analytics.
5. To apply analytics for different functions of a business

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

UNIT II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions

UNIT III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

UNIT V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Explain the real world business problems and model with analytical solutions.
- Identify the business processes for extracting Business Intelligence
- Apply predictive analytics for business fore-casting
- Apply analytics for supply chain and logistics management
- Use analytics for marketing and sales.

REFERENCES:

1. R. Evans James, Business Analytics, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition, Pearson Education, 2018.

AD8552 **MACHINE LEARNING** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basics of Machine Learning (ML)
- To understand the methods of Machine Learning
- To know about the implementation aspects of machine learning
- To understand the concepts of Data Analytics and Machine Learning
- To understand and implement usecases of ML

UNIT I MACHINE LEARNING BASICS 8

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

UNIT II MACHINE LEARNING METHODS 11

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization

UNIT III MACHINE LEARNING IN PRACTICE 9

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon's Machine Learning Tool Kit: Sagemaker

UNIT IV MACHINE LEARNING AND DATA ANALYTICS 9

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

UNIT V APPLICATIONS OF MACHINE LEARNING 8

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

TOTAL: 45 PERIODS

OUTCOMES:

- Understand the basics of ML
- Explain various ZMachine Learning methods
- Demonstrate various ML techniques using standard packages.
- Explore knowledge on Machine learning and Data Analytics
- Apply ML to various real time examples

TEXT BOOKS:

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
2. John D. Kelleher, Brain Mac Namee, Aoife D' Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press,2015

REFERENCES:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

AD8511 **MACHINE LEARNING LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES:

- To get practical knowledge on implementing machine learning algorithms in real time problem for getting solutions
- To implement supervised learning and their applications
- To understand unsupervised learning like clustering and EM algorithms
- To understand the theoretical and practical aspects of probabilistic graphical models.

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. Study and implement amazon toolkit: Sagemaker
5. Implement character recognition using Multilayer Perceptron
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7. Implement sentiment analysis using random forest optimization algorithm
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. Choose best machine learning algorithm to implement online fraud detection
10. Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

TOTAL : 60 PERIODS

OUTCOMES:

- Understand the implementation procedures for the machine learning algorithms.
- Design Java/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.

REFERENCES

1. Sebastain Raschka, “Python Machine Learning”, Packt publishing (open source).
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.
3. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.

SOFTWARE:

- Python/Java with ML packages

AD8512 **MINI PROJECT ON DATA SCIENCE PIPELINE** **L T P C**
0 0 4 2

OBJECTIVES:

- The students are expected to develop a mini project for solving real world problems with the concepts and tools they are familiar with.
- To use the Python packages for performing analytics.

- To learn using analytical tools for real world problems.
- The students are expected to used different platforms and tools that support data analysis, machine learning, deep learning, Apache Spark, R, Weka, Tensor Flow,

LIST OF EXPERIMENTS:

1. Use Twitter data for Sentiment Analysis
2. Mail classification for Spam Detection
3. Use of ML algorithms for Stock market Prediction
4. Designing a Recommendation System
5. Using Apache Spark for Time Series Forecasting
6. Implementation of Disease Prediction System
7. Usage of Image Segmentation
8. Design a Face recognition System
9. Use Natural Language Processing for short text Summarization

TOTAL: 60 PERIODS

OUTCOMES:

- Install analytical tools and configure distributed file system.
- Have skills in developing and executing analytical procedures in various distributed frameworks and databases.
- Develop, implement and deploy simple applications on very large datasets.
- Implement simple to complex data modeling in NoSQL databases.
- Implement real world applications by using suitable analytical framework and tools.

REFERENCES:

1. www.kaggle.com
2. https://amankharwal.medium.com/130-machine-learning-projects-solved-and-explained-605d188fb392
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
4. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
5. Data Science From Scratch: First Principles with Python, Second Edition by Joel Grus, 2019

AD8601 **ARTIFICIAL INTELLIGENCE II** **L T P C**
3 0 0 3

OBJECTIVES:

- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in probabilistic Reasoning.
- To know the automated learning techniques.
- To explore the techniques in Reinforcement Learning.
- To explore artificial intelligence techniques for Robotics.

UNIT I PROBABILISTIC REASONING I **9**

Acting under uncertainty – Bayesian inference – naïve bayes models
Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks

UNIT II PROBABILISTIC REASONING II 9

Probabilistic reasoning over time – time and uncertainty – inference in temporal models – Hidden Markov Models – Kalman filters – Dynamic Bayesian networks

Probabilistic programming

UNIT III DECISIONS UNDER UNCERTAINTY 9

Basis of utility theory – utility functions – Multiattribute utility functions – decision networks – value of information – unknown preferences

Sequential decision problems – MDPs – Bandit problems – partially observable MDPs

Multiagent environments – non-cooperative game theory – cooperative game theory – making collective decisions

UNIT IV LEARNING PROBABILISTIC MODELS 9

Statistical learning theory – maximum-likelihood parameter learning – naïve bayes models – generative and descriptive models – continuous models – Bayesisn parameter learning – Bayesian linear regression – learning Bayesian net structures – density estimation

EM Algorithm – unsupervised clustering – Gaussian mixture models – learning Bayes net parameters – learning HMM – learning Bayes net structures with hidden variables

UNIT V REINFORCEMENT LEARNING AND ROBOTICS 9

Learning from rewards – passive reinforcement learning – active reinforcement learning – generalization in reinforcement learning – policy search – inverse reinforcement learning – applications

Robots – robotic perception – planning movements – reinforcement learning in robotics – robotic frameworks -- applications of robotics

Philosophy, ethics, and safety of AI – the future of AI

TOTAL:45 PERIODS

OUTCOMES:

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

- Explain the probabilistic reasoning using Bayesian inference
- Apply appropriate Probabilistic reasoning techniques for solving uncertainty problems
- Explain use of game theory for decision making.
- Explain and apply probabilistic models for various use cases
- Apply AI techniques for robotics

TEXT BOOK

1. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.

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/)

AD8602 **DATA AND INFORMATION SECURITY** **L T P C**
3 0 0 3

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 FUNDAMENTALS OF SECURITY 9

Computer Security Concepts - Threats, Attacks and Assets – Security Functional Requirements – Fundamental Security Design Principles – Attack Surfaces and Attack Trees. Computer Security Strategy– Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCD and 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 ENCRYPTION TECHNIQUES AND KEY MANAGEMENT 9

Symmetric Encryption Principles – Data Encryption Standard – Advanced Encryption Standard – Stream Ciphers and RC4 - Cipher Block Modes Operation – 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, Ransomeware, 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 SECURITY APPLICATIONS 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.

OUTCOMES:

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

TOTAL:45 PERIODS

TEXT BOOKS:

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. Tim Mather, Subra Kumaraswamy and Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, 2009, Oreilly
2. Mikhail Gloukhovtsev, “IoT Security: Challenges, Solutions & Future Prospects”, 2018, Knowledge Sharing Article, Dell Inc.
3. Pradip KumarDas, Hrudaya Kumar Tripathy, Shafiz Affendi Mohd yusuf, Privacy and Security Issues in Big Data, An Analytical View on Business Intelligence. Springer 2021.

IT8501	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about client-server communication and protocols used during communication.
- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

UNIT I WEB SITE BASICS AND HTML 9

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

UNIT II CSS AND CLIENT SIDE SCRIPTING 9

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

UNIT III SERVER SIDE SCRIPTING 9

Host Objects: Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-

Accommodating Noncompliant Browsers Properties of window. Server-Side Programming: Java Servlets- Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle- Parameter Data-Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency-Databases and Java Servlets.

UNIT IV JSP AND XML 9

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Databases and JSP. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces- DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT V AJAX AND WEB SERVICES 9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods. Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design simple web pages using markup languages like HTML and XHTML.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.
- Understand various web services and how these web services interact.

TEXT BOOK:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

REFERENCES

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition,Pearson Education, 2007 .
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown," Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
4. Bates, "Developing Web Applications", Wiley, 2006

IT8511 WEB TECHNOLOGY LABORATORY

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OBJECTIVES:

- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

LIST OF EXPERIMENTS:

1. Create a web page with the following using HTML.
   i) To embed an image map in a web page.
   ii) To fix the hot spots.
   iii) Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
   To invoke servlets from HTML forms.
   Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
   - For conducting on-line examination.
   - For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Design simple web pages using markup languages like HTML and XHTML.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.
- Understand various web services and how these web services interact.

SOFTWARE REQUIRED:

- Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP

AD8611	ARTIFICIAL INTELLIGENCE – II LABORATORY	L	T	P	C
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OBJECTIVES:

- To impart knowledge about Artificial Intelligence.
- To understand the main abstractions and reasoning for intelligent systems.
- To understand the use of Artificial Intelligence in various applications

LIST OF EXPERIMENTS:

1. To implement Bayesian Belief networks
2. Approximate inferences in Bayesian network
3. To implement decision problems for various real-world applications
4. To learn various Bayesian parameters
5. Implementation of Hidden Markov Models
6. Implement EM algorithm for HMM

7. Implement the Reinforcement learning for various reward based applications
8. Mini-Project

OUTCOMES: **TOTAL PERIODS:60**

- Solve basic AI based problems.
- Implement the concept of Bayesian Network.
- Apply AI techniques to real-world problems to develop intelligent systems
- Implement HMM for real-world application.
- Use Reinforcement Learning to implement various intelligent systems.

SOFTWARE:

- **Python/Java with Machine Learning packages.**

REFERENCES:

1. aimacode · GitHub (https://github.com/aimacode
2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007
3. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
4. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006
5. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)

HS8581	PROFESSIONAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTAL:30 PERIODS

OUTCOMES:

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

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

RECOMMENDED SOFTWARE

1. Open Source Software
2. Win English

REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

AD8612	SOCIALLY RELEVANT PROJECT	L	T	P	C
		0	0	4	2

OBJECTIVES:

- The students are expected to develop solution for socially existing problems with the concepts and tools they are familiar with.
- A few broad areas related to the course are presented below.
- The list below is only a guideline for the students and the students are motivated to build the projects to portray their own creativity.

PRACTICAL EXERCISES:

1. Solve social problems using Statistical and Mathematical Concepts
2. Solving Big Data related Concepts
3. Solving Business Intelligence related Concepts
4. Solving problems with Machine Learning Algorithms.
5. Solving problems with Deep Learning Algorithms
6. Solving any Security Related Problems.
7. Solving health Related Problems.
9. problems related to Data wrangling

TOTAL: 60 PERIODS

OUTCOMES:

- The students are expected to use different platforms and tools like SAS, Python, R, Scala.
- Big Data: Hadoop Ecosystem (Hive, Pig, Sqoop, Flume), Big Data Lakes,No SQL, Apache

Spark, Spark MLLib , HPCC, Strom.

- Business Intelligence : SQL, Microsoft Power BI, SAP BI, Tableau, Oracle Fusion,
- Machine Learning and Deep Learrning : TensorFlow, Keras, Artificial Neural Networks, Deep NeuralNets, Convolution Neural Networks, Auto encoders.

REFERENCES:

1. https://www.jeremyjordan.me/ml-projects-guide/
2. Problems listed in Smart India Hackathon : www.sih.gov.in

AD8701 **DEEP LEARNING** **L T P C**
3 0 0 3

OBJECTIVES:

1: To understand the basics of deep neural networks
2: To understand CNN of architectures of deep neural networks
3: To understand the concepts of Artificial Neural Networks
4: To learn the basics of Data science in Deep learning
5: To learn about applications of deep learning in AI and Data Science

UNIT I DEEP NETWORKS BASICS 9

Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient-based Optimization – Machine Learning Basics: Capacity -- Overfitting and underfitting -- Hyperparameters and validation sets -- Estimators -- Bias and variance
-- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization -- Optimization.

UNIT II CONVOLUTIONAL NEURAL NETWORKS 9

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers -- Gradient Computation.

UNIT III DEEP LEARNING ALGORITHMS FOR AI 9

Artificail Neural Netowrks – Linear Associative Networks – Perceptrons -The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Autoencoders - Deep Backprop Networks- Autoencoders

UNIT IV DATA SCIENCE AND DEEP LEARNING 9

Data science fundamentals and responsibilities of a data scientist - life cycle of data science – Data science tools - Data modeling, and featurization - How to work with data variables and data science tools - How to visualize the data - How to work with machine learning algorithms and Artificial Neural Networks

UNIT V APPLICATIONS OF DEEP LEARNING 9

Detection in chest X-ray images -object detection and classification -RGB and depth image fusion - NLP tasks - dimensionality estimation - time series forecasting -building electric power grid for controllable energy resources - guiding charities in maximizing donations and robotic control in industrial environments.

TOTAL:45 PERIODS

OUTCOMES:

CO1: Explain the basics in deep neural networks (K2)
CO2: Apply Convolution Neural Network for image processing (K3)
CO3: Explain the basics of Artificial Intelligence using deep learning (K2)
CO4: Apply deep learning algorithms for data science
CO5: Apply deep learning algorithms for variety applications

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning'', MIT Press, 2016
2. Stone, James. (2019). Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, Sebtel Press, United States, 2019
3. Vance, William , Data Science: A Comprehensive Beginners Guide to Learn the Realms of Data Science (Hardcover - 2020), Joiningthedotstv Limited
4. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), Deep Learning Applications, Volume 3,Springer Publications 2022
5. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook'', Springer International Punlishing, 2018.

AD8702 TEXT ANALYTICS L T P C
3 0 0 3

OBJECTIVES:

1: To understand the methods for keyword extraction from documents.
2: To learn clustering methods for grouping of documents.
3: To explore the methods for classification of documents and E-mails.
4: To explore text visualization techniques and anomaly detection.
5: To learn about Events and trends in text streams

UNIT I TEXT EXTRACTION 9

Introduction- Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords-Benchmark evaluation: precision and recall, efficiency, stoplist generation, Evaluation on new articles.

UNIT II DOCUMENT CLUSTERING 9

Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments; Constrained clustering with k-means type algorithms**.**

UNIT III CONTENT BASED CLASSIFICATION 8

Classification algorithms for Document Classification, Content-based spam email classification, Utilizing nonnegative matrix factorization for email classification problems.

UNIT IV ANOMALY AND TREND DETECTION 9

Text visualization techniques: Visualization in text analysis, Tag clouds, tag clouds, authorship and change tracking, Data Exploration and the search for noval patterns, sentiment tracking, visual analytics and FutureLens, scenario discovery.
adaptive threshold setting for novelty mining: Introduction, adaptive threshold for anomaly detection, Experimental study.

UNIT V TEXT STREAMS **10**

Events and trends in text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions. Embedding semantics in LDA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding.

TOTAL:45 PERIODS

OUTCOMES:

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

CO1: Design text extraction techniques
CO2: Devise clustering techniques for text mining
CO3: Design classification techniques for text mining
CO4: Apply visualization techniques and perform anomaly & trend detection
CO5: Perform Event operations in Text streams

REFERENCES

1. Michael W. Berry & Jacob Kogan,"Text Mining Applications and Theory", Wiley publications, 2010.
2. Aggarwal, Charu C., and ChengXiangZhai, eds., “Mining text data”, Springer Science & Business Media, 2012.
3. Miner, Gary, et al., “Practical text mining and statistical analysis for non-structured text data applications”, Academic Press, 2012.
4. Srivastava, Ashok N., and MehranSahami, “Text mining: Classification, clustering, and applications”, Chapman and Hall/CRC, 2009.
5. Buitelaar, Paul, Philipp Cimiano, and Bernardo Magnini, eds., “Ontology learning from text: methods, evaluation and applications”, Vol. 123. IOS press, 2005.

AD8703 **BASICS OF COMPUTER VISION**

L	T	P	C
3	0	0	3

OBJECTIVES:

1: To review image processing techniques for computer vision.
2: To understand various features and recognition techniques
3: To learn about histogram and binary vision
4: Apply three-dimensional image analysis techniques
5: Study real world applications of computer vision algorithms

UNIT I INTRODUCTION **9**

Image Processing, Computer Vision ,What is Computer Vision - Low-level, Mid-level, High-level ; Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT II FEATURE EXTRACTION AND FEATURE SEGMENTATION **9**

Feature Extraction -Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space

Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.
Image Segmentation -Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.

UNIT III IMAGES, HISTOGRAMS, BINARY VISION 9

Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing – 1D and 3D histograms - Histogram/Image Equalisation - Histogram Comparison - Back-projection - k-means Clustering – Thresholding - Threshold Detection Methods - Variations on Thresholding - Mathematical Morphology – Connectivity.

UNIT IV 3D VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion–spline-based motion- optical flow – layered motion.

UNIT V APPLICATIONS 9

Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing , Virtual Reality and Augmented Reality.

OUTCOMES:

- Explain low level processing of image and transformation techniques applied to images.
- Explain the feature extraction, segmentation and object recognition methods.
- Apply Histogram transform for detection of geometric shapes like line, ellipse and objects.
- Illustrate 3D vision process and motion estimation techniques.
- Apply vision techniques to real time applications.

TOTAL:45 PERIODS

TEXT BOOKS:

1. 1. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.

2. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited,2011.

REFERENCES:

1. B. K. P. Horn -Robot Vision, McGraw-Hill.
2. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
3. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
4. E. R. Davies, (2012), “Computer & Machine Vision”, Fourth Edition, Academic Press.
5. Concise Computer Vision: An Introduction into Theory and Algorithms, by Reinhard Klette, 2014

AD8704 **BIG DATA MANAGEMENT** **L T P C**
3 0 2 4

OBJECTIVES:

1. To understand about big data.
2. To learn and use NoSQL big data management.
3. To learn mapreduce analytics using Hadoop and related tools.
4. To work with map reduce applications
5. To understand the usage of Hadoop related tools for Big Data Analytics

UNIT I UNDERSTANDING BIG DATA 9

What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations.

UNIT III BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.

UNIT IV MAPREDUCE APPLICATIONS 9

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT V HADOOP RELATED TOOLS 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

TOTAL:45 PERIODS

OUTCOMES:

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

- Describe big data and use cases from selected business domains.
- Explain NoSQL big data management.
- Install, configure, and run Hadoop and HDFS.
- Perform map-reduce analytics using Hadoop.
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

LIST OF EXPERIMENTS: **PRACTICALS:15 PERIODS**

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
7. Installation of HBase, Installing thrift along with Practice examples
8. Patrice importing and exporting data from various data bases.

Software Requirements:

Hadoop, Java, Hive and HBase.

TOTAL:75 PERIODS

TEXT BOOKS:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

REFERENCES:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

AD8705 AI AND ROBOTICS L T P C
3 0 2 4

OBJECTIVES:

1. To study the Robot Locomotion and types of robots.
2. To explore the kinematic models and constraints
3. To Learn sensors of robots and image processing for robotics.
4. To understand the methods for mobile robot Localization
5. To study the Path planning and Navigation of Robots.

UNIT I ROBOT LOCOMOTION 9

Introduction to AI and Robotics – robot locomotion – legged mobile robots – wheeled mobile robots – aerial mobile robots.

UNIT II MOBILE ROBOT KINEMATICS 9

Kinematic models and constraints – mobile robot maneuverability – mobile robot workspace – advanced kinematics – motion control.

UNIT III ROBOT PERCEPTION 9

Sensors for mobile robots – computer vision for robots – image processing for robotics – place recognition – range data.

UNIT IV MOBILE ROBOT LOCALIZATION **9**

Introduction to localization – noise and aliasing – localization-based navigation – belief representation – map representation – probabilistic map-based localization – autonomous map building.

UNIT V ROBOT PLANNING AND NAVIGATION **9**

Planning and navigation – planning and reacting – path planning – obstacle avoidance – navigation architectures.

TOTAL:45 PERIODS

OUTCOMES:

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

CO1: Explain the types of Robots
CO2: Narrate the kinematics of Robots
CO3: Implement image processing algorithms
CO4: Devise Localization algorithms
CO5: Devise Path planning methods for navigation

LIST OF EXPERIMENTS: **PRACTICALS:15 PERIODS**

1. Line tracing bot
2. Gesture controlled bot
3. 4(Four) DOF Robotic Arm
4. Home Security System using NodeMCU
5. RF Controlled or WiFi controlled Navigation bot
6. Pick and place bot with Object Detetction
7. Wall Following bot
8. Maze solving Robot
9. Forward and reverse kinematics based experiment using open source platforms
10. Computer Visio based robotic tasks execution

Software Requirements:

Open Source Software

TOTAL:75 PERIODS

TEXT BOOKS:

1. R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza, “Introduction to Autonomous Mobile Robots”, Second Edition, MIT Press, 2011.
2. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.

AD8711 **DEEP LEARNING LABORATORY** **L T P C 0 0 4 2**

OBJECTIVES:

1: To learn deep neural networks and apply for simple problems
2: To Learn and apply Convolution Neural Network for image processing
3: To Learn and apply Recurrent Neural Network and its variants for text analysis
4: To augment data using generative models

5: To explore real world applications with deep neural networks

LIST OF EXPERIMENTS:

1. Solving XOR problem using Multilayer perceptron
2. Implement character and Digit Recognition using ANN.
3. Implement the analysis of X-ray image using autoencoders
4. Implement Speech Recognition using NLP
5. Develop a code to design object detection and classification for traffic analysis using CNN
6. Implement online fraud detection of share market data using any one of the data analytics tools.
7. Implement image augmentation using deep RBM.
8. Implement Sentiment Analysis using LSTM.
9. Mini Project: Number plate recognition of traffic video analysis.

Hardware/Software Requirements

Software:

- Understanding on Working of Colab and Transfer Learning Networks
- High end GPU Systems (Huge Computation)

OUTCOMES:

CO1: Apply deep neural network for simple problems
CO2: Apply Convolution Neural Network for image processing
CO3: Apply Recurrent Neural Network and its variants for text analysis
CO4: Apply generative models for data augmentation
CO5: Develop a real world application using suitable deep neural networks

TOTAL:60 PERIODS

REFERENCES

1. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), "Deep Learning Applications", Volume 3, Springer Publications 2022.
2. Stone, James. (2019), " Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning", Sebtel Press, United States, 2019

EC8691	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

UNIT I THE 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE 9

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT III I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller..

UNIT IV MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V INTERFACING MICROCONTROLLER 9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

OUTCOMES:

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

- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007. (UNIT I - III)

2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.(UNIT IV-V)

REFERENCES:

1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012

AD8001 **SOFTWARE DEVELOPMENT PROCESSES** **L T P C**
3 0 0 3

OBJECTIVES:

1: To acquire knowledge on software process management
2: To acquire managerial skills for software project development.
3: To understand software economics
4: To acquire knowledge about real time software development scenarios.

UNIT I SOFTWARE PROCESS 9

Software Process Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

UNIT II SOFTWARE ECONOMICS AND LIFECYCLE 9

Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

UNIT III SOFTWARE PROCESSES PLANNING 9

Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments. Process Planning Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT IV PROJECT MANAGEMENT AND METRICS 9

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

UNIT V UNIT TITLE 9

CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

OUTCOMES:

CO1: Understand the software process phases in the cycle of software development.
CO2: Gain knowledge of software economics, project organization, project control and process instrumentation
CO3: Analyze the major and minor milestones, artifacts and metrics from management and technical perspective.
CO4: Design and develop software product using conventional and modern principles of software project management
CO5: Analyze the real time software development processes.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Managing the Software Process, Watts S. Humphrey, Pearson Education
2. Software Project Management, Walker Royce, Pearson Education

REFERENCES:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000 Process Improvement essentials, James R. Persse, O'Reilly, 2006
2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
3. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
4. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
5. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2 nd edition, Wiley India, 2004.
6. Agile Project Management, Jim Highsmith, Pearson education, 2004.

AD8002 **HEALTH CARE ANALYSIS** **L T P C**
3 0 0 3

OBJECTIVES:

1: Understand the health data formats, health care policy and standards
2: Learn the significance and need of data analysis and data visualization
3: Understand the health data management frameworks
4: Learn the use of machine learning and deep learning algorithms in healthcare
5: Apply healthcare analytics for critical care applications

UNIT I INTRODUCTION TO HEALTHCARE ANALYSIS 9

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

UNIT II ANALYTICS ON MACHINE LEARNING 9

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

UNIT III HEALTH CARE MANAGEMENT 9

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

UNIT IV HEALTHCARE AND DEEP LEARNING 9

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

UNIT V CASE STUDIES 9

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.

OUTCOMES:

CO1: Use machine learning and deep learning algorithms for health data analysis
CO2: Apply the data management techniques for healthcare data
CO3: Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
CO4: Design health data analytics for real time applications
CO5: Design emergency care system using health data analysis

TOTAL:45 PERIODS

REFERENCES:

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
4. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
5. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

AD8003 MOBILE APPLICATIONS DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:

1. Understand system requirements for mobile applications
2. Generate suitable design using specific mobile development frameworks
3. Generate mobile application design
4. Implement the design using specific mobile development frameworks
5. Deploy the mobile applications in marketplace for distribution

UNIT I INTRODUCTION TO MOBILE APPLICATIONS 9

Web Vs mobile App – Cost of Development – Myths - Mobile Applications – Marketing - Mobile User Interface Design - Effective Use of Screen – Mobile Users - Mobile Information Design - Mobile Platforms - Tools of Mobile Interface Design

UNIT II ANDROID USER INTERFACE DESIGN 9

Android Architecture – Android SDK Tools - Application Components - Intents - Content providers - Broadcast receivers – Services - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Notifications - Android Localization

UNIT III ANDROID DATA STORAGE 9

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media Store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLite Databases

UNIT IV ANDROID NATIVE CAPABILITIES 9

Camera – Audio - Sensors and Bluetooth - Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with

Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services - Location Updates - Location Providers - Selecting a Location Provider - Finding Location

UNIT V IOS DESIGN **9**

iPhone Craze – iOS Features – iOS Tools - iOS Project – Objective C Basics – Building iOS App – Actions and Outlets – Delegates - User Interface Elements – Accelerometer – Location Handling - SQLite Database

OUTCOMES:

CO1: Describe the requirements for mobile applications
CO2: Design user interface for mobile applications
CO3: Store mobile data of android applications
CO4:Evaluate native capabilities of android applications
CO5:Design iOS applications with tools

TOTAL:45 PERIODS

REFERENCES:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.

AD8004 **PARALLEL COMPUTING** **L T P C**
3 0 0 3

OBJECTIVES:

1: To understand different parallelism techniques.
2: To know parallel architecture.
3: To learn about parallel algorithm design
4: Understand parallel programming
5: Learn about the interpretation of parallel programmng

UNIT I INTRODUCTION **9**

Historical progression leading to current state – types of parallism including temporal, data and functional. Instructional level parallelism – pipelined processors – super scalar processors – VLIW processors – multithreaded processors – proposed future processors including trace, multiscalar and super flow – case studies

UNIT II PARALLEL ARCHITECTURES **9**

Classification – inter connection networks – vector computers – shared memory parallel computers – cache coherence – distributed shared memory parallel computers – message passing parallel computers – cluster of workstations.

UNIT III PARALLEL ALGORITHMS PLATFORM **9**

Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models.

UNIT IV PARALLEL PROGRAMMING DESGN 9

Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.

UNIT V COMPILER TRANSFORMATIONS AND PERFORMANCE EVALUATION 9

Dependence analysis loop transformations – transformations for parallel computers including data layouts, computational and communication optimization. Peformance Metrics –performance lows – scalability – performance measurement books.

OUTCOMES:

CO1: Understand different parallel computing technique
CO2: Learn parallel computing architecture
CO3: Learn to design parallel algorithms
CO4: Understand how to develop parallel program
CO5: Know compiler interpretation of parallel programming

TOTAL:45 PERIODS

TEXT BOOKS:

1. V. Rajaraman and C. Siva Ram Murthy, “Parallel Computers – Architecture and Programming”, Prentice-Hall of India, 2003.
2. Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar, “Introduction to Parallel Computing”, Pearson Education, Second edition, 2004.

REFERENCES:

1. Selim G.Akl – The design and analysis of parallel algorithms – Prentice Hall International Inc, 1989.
2. Hwang K. Briggs F.A. – Computer Architecture and parallel processing – MCGraw Hill – 1985
3. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

AD 8005 EMBEDDED SYSTEMS AND PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To understand the architecture of embedded processors, microcontrollers and peripheral devices
- To learn programming the embedded processor in assembly
- To understand the challenges in developing operating systems for embeddedsystems
- To learn programming the embedded systems in high level language such as C
- To understand the Real time operating systems

UNIT I INTRODUCTION TO EMBEDDED SYSTEM 9

Components of Embedded System – Classification - Characteristic of embedded system- Microprocessors & Micro controllers- Introduction to embedded processors - Embedded software architectures: Simple control loop - Interrupt controlled system - Cooperative multitasking - Preemptive multitasking or multi-threading - Micro kernels and kernels - Monolithic kernels - Exotic custom operating systems.

UNIT II EMBEDDED HARDWARE ARCHITECTURE 9

ARM 2 TDMI core based 32 Bitmicrocontrollers and family of processors, Register, Memory and Data transfer, Arithmetic and Logic instructions, Assembly Language, I/O operations interrupt structure, ARM cache. ARMBus, Embedded systems with ARM.

UNIT III REAL TIME OPERATING SYSTEMS 9

Tasking Models, Task States, Services and Transitions - Real- Time Scheduling Algorithms: Round-Robin, FIFO, Priority-Based Preemptive Scheduling - Rate-Monotonic Scheduling - Priority Inversion and Priority Ceiling - Deadlocks - Process Synchronization – IPC - Shared Memory, Memory Locking, Memory Allocation - Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual Sockets.

UNIT IV SOFTWARE DEVELOPMENT 9

Embedded Programming in C and C++ - Source Code Engineering Toolsfor Embedded C/C++ - Program Modeling Concepts in Single and Multiprocessor Systems - Software Development Process - Software Engineering Practices in the Embedded Software Development – Hardware / Software Co-design in an Embedded System

UNIT V STUDY OF MICRO C/OS-II 9

RTOS System Level Functions – Task Service Functions Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions Mailbox Related Functions – Queue Related Functions – Case Studies of Programming withRTOS.

OUTCOMES:

CO1: Understand the embedded systems
CO2: Learn the embedded systems Architecture
CO3: Understand the embedded systems programming
CO4: Learn about the real time operating systems
CO5: Understand the concept on micro C

TOTAL:45 PERIODS

TEXT BOOKS:

1. Rajkamal, "Embedded System: Architecture, Programming and Design" Tata McGraw- Hill, 2003.
2. Wayne Wolf, “Computers as Components – Principles of Embedded Computing System Design”, Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, First Indian Reprint, 2001.

REFERENCES:

1. Steve Heath, “Embedded Systems Design”, Newnes, Second edition, 2003.
2. Noergaard, “Embedded System Architecture”, Elsevier India Private Limited, 2005
3. Sriram Iyer and Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata McGraw-Hill, 2004.

CW8591 **SOFTWARE ARCHITECTURE** **L T P C**
3 0 0 3

OBJECTIVES:

- Understand the fundamentals of software architecture.
- Study the various software development methodologies.
- Learn the importance of architectural documentation and evaluation.
- Learn the various software architecture design components.
- Relate software architecture and software quality.

UNIT I INTRODUCTION 9

Basic concepts of software architecture – Context of Software Architecture – ABC cycle – What software architecture is and what it isn't – Architectural patterns – Good Architecture- Reference models – Architectural structures and views-Introduction to styles – Decentralized Architectures

UNIT II DESIGN METHODOLOGIES 9

Structured design- Design practices-Stepwise refinement – Incremental design- Structured system analysis and design –Jackson structured programming – Jackson system Development.

UNIT III ARCHITECTURAL DESCRIPTION DOCUMENTATION AND EVALUATION 9

Early architecture description languages-Domain and style specific ADL's- Extensible ADL's – Documenting software architecture – Uses and Audiences for Architecture Documentation – Views – Choosing Views – Combining Views –Architecture evaluation – Evaluation Factors – Architecture Tradeoff Analysis Method – Lightweight Architecture Evaluation – ATAM.

UNIT IV ARCHITECTURE DESIGN 9

Typical architectural design-Dataflow-Independent components-Call and return – Using styles in design – Architectural design space-Design space of architectural elements – Design space of architectural styles.

UNIT V IMPLEMENTATION AND CONFORMANCE TO ARCHITECTURE 9

Understanding quality attributes- Implementation of Quality attributes in Architecture – Architecture and requirements conformance –Functionality– Quality attribute considerations – System quality attributes-Introduction to tactics – Achieving Quality Attributes through Tactics – Tactics types –Architectural patterns and styles – Architecture and Quality Attributes – Quality attribute scenarios in practice.

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Develop Software applications starting from software architecture and design.
- Learn and evaluate existing software architectures.
- Realize importance of architectural documentation and document them.
- Employ various software architecture design components.
- Design methods for improving software quality from the perspective of software architecture.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Third Edition, Addison,Wesley, 2012.
2. David Budgen, "Software Design", Second Edition, Pearson Education, 2004.

REFERENCES:

1. Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy, "Software Architecture, Foundations,Theory and Practice", Wiley 2010.
2. Hong Zhu, "Software Design Methodology from Principles to Architectural Styles", Elsevier, 2005.

3. Mary Shaw and David Garlan, “Software Architecture –Perspectives on an emerging Discipline”,Pearson Education, 2008.

AD8006 ENGINEERING PREDICTIVE ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain terminology, technology and applications of predictive analysis
- To apply data preparation techniques and generate appropriate association rules.
- To discuss various descriptive models, their merits, demerits and application.
- To describe various predictive modelling methods.
- To introduce the text mining tools, technologies and case study which is used in day-to-day analytics cycle

UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 9

Overview of Predictive Analytics- Setting Up the Problem - Data Understanding- Single Variable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions- The Value of Statistical Significance- Pulling It All Together into a Data Audit.

UNIT II DATA PREPARATION AND ASSOCIATION RULES 9

Data Preparation- Variable Cleaning- Feature Creation- Item sets and Association Rules- Terminology- Parameter Settings- How the Data Is Organized- Measures of Interesting Rules- Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules.

UNIT III MODELLING 9

Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation

UNIT IV PREDICTIVE MODELLING 9

Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms.

UNIT V TEXT MINING 9

Motivation for Text Mining- A Predictive Modeling Approach to Text Mining- Structured vs. Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features- Modeling with Text Mining Features- Regular Expressions- Case Studies:- Survey Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain terminology, technology and applications of predictive analysis
CO2: Apply data preparation techniques to effectively interpret big data
CO3: Discuss various descriptive models, their merits, demerits and application.
CO4: Describe principles of predictive analytics and apply them to achieve real, pragmatic

solutions.

CO5: Illustrate the features and applications of text mining.

REFERENCES:

1. Dean Abbott, “Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst”, Wiley, 2014
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
3. Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, 1st Edition, Que Publishing, 2012.
4. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. An Introduction to Statistical Learning with Applications in R Springer 2013
5. Alberto Cordoba, “Understanding the Predictive Analytics Lifecycle”, Wiley, 2014
6. Anasse Bari, Mohammad Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, 2017.

CS8603 **DISTRIBUTED SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

UNIT I Introduction **9**

Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. **A model of distributed computations:** A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications. **Logical Time**: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.

UNIT II MESSAGE ORDERING & SNAPSHOTS **9**

Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. **Global state and snapshot recording algorithms:** Introduction –System model and definitions –Snapshot algorithms for FIFO channels

UNIT III DISTRIBUTED MUTEX & DEADLOCK **9**

Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport’s algorithm –

Ricart-Agrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm. **Deadlock detection in distributed systems:** Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model.

UNIT IV RECOVERY & CONSENSUS 9

Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. **Consensus and agreement algorithms:** Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

UNIT V P2P & DISTRIBUTED SHARED MEMORY 9

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. **Distributed shared memory:** Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.

OUTCOMES:

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

- Elucidate the foundations and issues of distributed systems
- Understand the various synchronization issues and global state for distributed systems.
- Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
- Describe the features of peer-to-peer and distributed shared memory systems

TOTAL:45 PERIODS

TEXT BOOKS:

1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.

REFERENCES:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
4. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.

CS8072 **AGILE METHODOLOGIES** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing.

UNIT I AGILE METHODOLOGY **9**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT II AGILE PROCESSES **9**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT **9**

Agile Information Systems – Agile Decision Making - Earl‘S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING **9**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE **9**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Realize the importance of interacting with business stakeholders in determining the requirements for a software system
- Perform iterative software development processes: how to plan them, how to execute them.
- Point out the impact of social aspects on software development success.

- Develop techniques and tools for improving team collaboration and software quality.
- Perform Software process improvement as an ongoing task for development teams.
- Show how agile approaches can be scaled up to the enterprise level.

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.
2. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

REFERENCES:

1. Craig Larman, “Agile and Iterative Development: A Manager‘s Guide”, Addison-Wesley, 2004.
2. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management”, Butterworth-Heinemann, 2007.

CS8081 INTERNET OF THINGS L T P C
3 0 0 3

OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF IoT 9

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS 9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN AND DEVELOPMENT 9

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL : 45 PERIODS

OUTCOMES:

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

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015

2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012 (for Unit 2).

3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.

5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

https://www.arduino.cc/
https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

AD8007	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of testing, planning, designing and managing test cases.
- To study the various types of test in the life cycle of the software product.
- To build design concepts for system testing and execution.
- To learn the software quality assurance ,metrics, defect prevention techniques
- To learn the techniques for quality assurance and applying for applications.

UNIT I SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES 9

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black, test Planning and design, Test Tools and Automation, Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building

UNIT II SYSTEM TESTING 9

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

UNIT III SYSTEM TEST CATEGORIES 10

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. System test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

UNIT IV SOFTWARE QUALITY 8

Software quality - People‘s Quality Expectations, Frameworks and ISO-9126, McCall‘s Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model.

UNIT V SOFTWARE QUALITY ASSURANCE 9

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

- Perform functional and non-functional tests in the life cycle of the software product.
- Understand system testing and test execution process.
- Identify defect prevention techniques and software quality assurance metrics.
- Apply techniques of quality assurance for typical applications.

TEXT BOOKS:

1. Software Testing And Quality Assurance-Theory and Practice, Kshirasagar Naik, Priyadarshi Tripathy, John Wiley & Sons Inc,2008

2. Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004

REFERENCES:

1. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.
2. Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011
3. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

CS8791 CLOUD COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

UNIT I INTRODUCTION 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine –– Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

OUTCOMES:

On Completion of the course, the students should be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

CS8085 SOCIAL NETWORK ANALYTICS L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

UNIT I INTRODUCTION 9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of

social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

OUTCOMES:

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

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks.

TOTAL PERIODS:45

TEXT BOOKS:

1. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1st Edition, Springer, 2010.

REFERENCES:

1. Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

AD8008 **WEB SERVICES AND API DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

1. To understand the types of web services, resources, APIs and their architectures
2. To analyze the web service / API design patterns
3. To understand the design principles and best practices
4. To develop, deploy RESTful web service APIs in JAVA
5. To understand the security concerns.

UNIT I **INTRODUCTION** **9**

Web Services - Building Blocks, Types; Service Oriented architectures - resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand.

UNIT II RESOURCES AND DESIGN PATTERNS 9

Resources - Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns.

UNIT III RESTFUL API DESIGN PRINCIPLES 9

API front End Design, API back end Design, Identifier Design, Interaction Design with HTTP, Metadata Design, Representation Design, URI design, REST constraints, Best Practices.

UNIT IV DEVELOPMENT AND DEPOLYMENT 9

Frameworks, Standard Languages, API Description Languages, Handover points, Development and Deployment of RESTful web service applications in Java, microservice API, Best Practices.

UNIT V PERFORMANCE AND SECURITY 9

Performance and availability - caching - Traffic shaping - Evolution and versioning, Security concerns - Mechanisms, Authentication, Validation, Access Control, Token Based Authentication, Authorization.

OUTCOMES:

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

- Use a suitable architecture for a given design problem
- Analyze the types of resources and suitable design patterns for development and deployment
- Create and Analyze front-end and Back end designs
- Deploy RESTful API web services using JAVA
- Implement security best practices for preventing security attacks

TOTAL:45 PERIODS

TEXT BOOK:

1. Matthias Biehl, “RESTful API Design, API University Series, 1st Edition, CreateSpace Independent Publishing Platform, 2016.
2. Mark Masse, “REST API Design Rulebook: Designing Consistent RESTful Web Service Interfaces”, 1st Edition, O’ Reilly, 2011.
3. Harihara Subramanian, Pethuru Raj, “Hands-On RESTful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure “RESTful web APIs”, Packt Publishing, 2019.

REFERENCES:

1. JJ Geewax, “API Design Patterns”, 1st Edition, Manning Publications, 2021.
2. Bogunuva Mohanram Balachandar, “Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java, 3rd Edition, Ingram Short Title, 2017.

AD8009	OPERATIONS AND SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an insight on the operations, quality management and sampling tools and fundamentals of supply chain networks, tools and techniques

UNIT I INTRODUCTION TO OPERATIONS AND SUPPLY CHAIN MANAGEMENT 9

Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles - The Operations Function - The Evolution of Operations and Supply Chain Management – Globalization - Productivity and Competitiveness - Strategy and Operations-Operational Decision-Making Tools: Decision Analysis-Decision Analysis with and without Probabilities

UNIT II QUALITY MANAGEMENT 9

Quality and Value in Athletic Shoes -What Is Quality-Quality Management System-Quality Tools-Quality in Services-Six Sigma-Quality Costs and Productivity-Quality Awards-ISO 9000-Statistical Process Control-Operational Decision-Making Tools: Acceptance Samp

UNIT III NETWORK DESIGN AND TRANSPORTATION 9

Factors influencing Distribution network design – Design options for Distribution Network-– factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation

UNIT IV SOURCING AND COORDINATION 9

Role of sourcing supply chain - supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY 9

The role IT in supply chain- The supply chain IT frame work - Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

TOTAL:45 PERIODS

OUTCOMES:

- To know about the operations and fundamentals of supply chain
- To understand the quality management tools and sampling process
- To understand the design factors and various design options of distribution networks in industries and the role of transportation and warehousing
- To understand the various sourcing decisions in supply chain

- To understand the supply chain management in IT industries

TEXT BOOKS:

1. Roberta S. Russell, Bernard W. Taylor, "Operations and Supply Chain Management, 10th Edition, Wiley Publications,2019
2. Sunil Chopra, Peter Meindl and Kalra, Supply Chain Management, Strategy, Planning, and Operation, Pearson Education, 2010.

REFERENCES:

1. Jeremy F.Shapiro, Modeling the Supply Chain, Thomson Duxbury, 2002.
2. Srinivasan G.S, Quantitative models in Operations and Supply Chain Management, PHI, 2010
3. David J.Bloomberg , Stephen Lemay and Joe B.Hanna, Logistics, PHI 2002.
4. James B.Ayers, Handbook of Supply Chain Management, St.Lucle press, 2000
5. F. Robert Jacobs (Author), Richard B. Chase, Operations and Supply Chain Management McGraw Hill 2017

AD8010	SPEECH PROCESSING AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the need for morphological processing and their representation
2. To know about the various techniques used for speech synthesis and recognition
3. To appreciate the syntax analysis and parsing that is essential for natural language processing
4. To learn about the various representations of semantics and discourse
5. 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 -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, 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**

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary

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

UNITV 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

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 tagset 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 Rabinerand Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003
3. Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, California Technical Publishing.
4. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education.
5. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.
6. Ben gold and Nelson Morgan, “Speech and audio signal processing”, processing and perception of speech and music, Wiley- India Edition, 2006 Edition.
7. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press

AD8011 CYBER SECURITY L T P C

3 0 0 3

OBJECTIVES:

1. To study the basics of Cyber security.
2. To know about the security aspects operating systems and networks.
3. To explore Cryptography , IDS and IPS
4. To study the privacy principles and policies.
5. To know about the Security management and incidents.

UNIT I INTRODUCTION TO CYBER SECURITY 9

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls – Authentication- Access Control and Cryptography - Web-User Side - Browser Attacks - Web Attacks- Targeting Users - Obtaining User or Website Data - Email Attacks.

UNIT II SECURITY IN OPERATING SYSTEM & NETWORKS 9

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

UNIT III DEFENCES: SECURITY COUNTER MEASURES 9

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

UNIT IV PRIVACY IN CYBERSPACE 9

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies.

UNIT V MANAGEMENT AND INCIDENTS 9

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

OUTCOMES:

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

CO1: Explain the basic concepts of computer security
CO2: Devise methods for Security in operating system & networks
CO3: Differentiate the various security counter measures.
CO4: Devise Privacy principles and policies
CO5: Manage the Cyber space.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Jan L.Harrington,"Network Security – A Practical Approach", Morgan Kaufmann Publishers –An Imprint of Elsevier, 2005,
2. William Stallings, "Cryptography and Network Security – Principles and Practice", Pearson Education Asia, Fourth Edition, 2005

REFERENCES:

1. Edward Amoroso, "Cyber Security", Silicon Press, 2006
2. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
3. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
4. MarttiLehto, PekkaNeittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015
5. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

AD8012 **NONLINEAR OPTIMIZATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

1.To understand the role of optimization techniques and its importance in engineering
2. To introduce the concept of nonlinear optimization methods.
3. To realize the application of non-traditional optimization algorithms
4. To choose appropriate optimization method and solve real world problems.

UNIT I CLASSICAL OPTIMIZATION TECHNIQUES 9

Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers,Karush-Kuhn-Tucker conditions

UNIT II NON-LINEAR PROGRAMMING: ONE-DIMENSIONAL MINIMIZATION METHOD 9

Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods

UNIT III NON-LINEAR PROGRAMMING: UNCONSTRAINED OPTIMIZATION TECHNIQUES 9

Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method Indirect Search Methods: Steepest descent method, Fletcher-Reeves method, Newton's method

UNIT IV NON-LINEAR PROGRAMMING: CONSTRAINED OPTIMIZATION TECHNIQUES 9

Direct Methods: Random search method, Sequential linear programming, Indirect methods: Transformation techniques, Exterior penalty function method, Interior penalty function method

UNITV ADVANCED NON-LINEAR OPTIMIZATION 9

Genetic Algorithms -Working principle-Genetic operators-Numerical problem-Simulated Annealing – Numerical problem - Neural network based optimization-Optimization of fuzzy systems-fuzzy set theory-computational procedure

TOTAL: 45 PERIODS

OUTCOMES:

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

- Comprehend the need and applications of the optimization methods
- understand basic theoretical principles for formulation of optimization models and its solution.
- learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques
- apply detailed theoretical and practical aspects of intelligent modelling, optimization and control of non-linear systems.

REFERENCES:

1. Engineering Optimization Theory and Practice, S.S.Rao, New Age International (P),5th edition,2019
2. C. B Gupta ,Optimization Techniques in Operation Research, I.K.International House

Pvt.Ltd 2007.
3. Godfrey C. Onwubolu, B. V. Babu,New Optimization Techniques in Engineering, 2004
4. Cesar Lopez,MATLAB Optimization Techniques,2014

AD8013 **ETHICS OF ARTIFICIAL INTELLIGENCE** **L T P C**
3 0 0 3

OBJECTIVES:

1: To understand the need for ensuring ethics in AI
2: To understand ethical issues with the development of AI agents
3: To apply the ethical considerations in different AI applications
4: To evaluate the relation of ethics with nature
5: To overcome the risk for Human rights and other fundamental values.

UNIT I INTRODUCTION TO ETHICS OF AI 9

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities

UNIT II FRAMEWORK AND MODELS 9

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

UNIT III CONCEPTS AND ISSUES 9

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder

UNIT IV PERSPECTIVES AND APPROACHES 9

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents

UNIT V CASES AND APPLICATION 9

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics

OUTCOMES:

CO1: Understand the ethical issues in the development of AI agents
CO2: Learn the ethical considerations of AI with perspectives on ethical values
CO3: Apply the ethical policies in AI based applications and Robot development
CO4: To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights.
CO5: This study will help to overcome the evil genesis in the concepts of AI.

TOTAL:45 PERIODS

REFERENCES

1. Paula Boddington, “Towards a Code of Ethics for Artificial Intelligence”, Springer, 2017
2. Markus D. Dubber, Frank Pasquale, Sunit Das, “The Oxford Handbook of Ethics of AI”, Oxford University Press Edited book, 2020
3. S. Matthew Liao, “Ethics of Artificial Intelligence”, Oxford University Press Edited

Book, 2020
4. N. Bostrom and E. Yudkowsky. “The ethics of artificial intelligence”. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.
5. Wallach, W., & Allen, C, “Moral machines: ceaching robots right from wrong”, Oxford University Press, 2008.

AD8014 ENGINEERING ECONOMICS L T P C
3 0 0 3

OBJECTIVES:

1: To Learn the fundamental of Economics.
2: To Understand different methods of depreciation use for calculation
3: To know the various method of comparison used in economic
4: To Understand how funds are managed in an organization.
5: Different methods of production and marketing adopted in an industry.

UNIT I MICRO AND MACRO ECONOMICS AND ITS APPLICATIONS 9

Introduction – Micro Economics – Macro Economics – Economic decisions and Technical Decisions – Demand and Supply Concepts – Elasticity of Demand – Cost of Products – Price of products – Break-Even Analysis – Nature of Functioning of Money –Notional Income – GNP and Savings – Inflation and Deflation Concepts

UNIT II METHODS OF DEPRECIATION 9

Straight line method of Depreciation- Declining Balance Method of Depreciation-Sum of the Years Digits Method of Depreciation-Sinking Fund Method of Depreciation- Service-output Method of Depreciation.

UNIT III METHODS OF COMPARISON OF ALTERNATIVES 9

Introduction – Elementary Economic Analysis – Interest Formulas and their Applications Comparisons – Present Worth Method – Future Worth Method – Annual Equivalent Method – Rate of Return Method.

UNIT IV FINANCIAL MANAGEMENT 9

Sources of finance, internal and external-preparation of balance sheet and profit and loss statements, Types of accounting and significance of each type, interest formulas and their applications.

UNIT V PRODUCTION & MARKETING MANAGEMENT 9

Types of Production; process of planning, scheduling, Routing, material control; product concept concepts of productivity, Core concepts of Marketing- Needs, Wants, Demand-Marketing Vs Selling- Products and Markets- Pricing and its related factors- Channels of Distribution- Promotion- Advertising- Market Research- Sales Forecasting.

OUTCOMES:

CO1: The basic concepts of economics are learned
CO2: Understand the various types depreciation used
CO3: Learn the different comparison technique used in industries.
CO4: The fund flow in the industries are learned

CO5: Understand the different Production and Marketing techniques used in the industries.

TOTAL:45 PERIODS

TEXT BOOKS

1. O.P. Khanna, 'Industrial Engineering and Management', Dhanpat Rai and Sons,201
2. R. Pannerselvam, 'Engineering Economics', Prentice Hall of India Pvt. Ltd,2014

REFERENCES

1. S.K. Jain, "Applied Economics for Engineers and Managers", Vikas Publications House, New Delhi, 1997.
2. Mote Paul, Gupta, "Managerial Economics" Tata Mc Graw Hill, 1987.
3. Joseph L. Massie, "Essentials of Management", Prentice-Hall of India, Third edition, 1979.

AD8081	COGNITIVE SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain cognitive computing and design principles.
- To distinguish between NLP and cognitive computing.
- To apply advanced analytics to cognitive computing.
- To discuss application of cognitive computing in business.
- To illustrate various applications of cognitive computing.

UNIT I FOUNDATION & DESIGN PRINCIPLES 9

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition.

Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.

UNIT II NLP IN COGNITIVE SYSTEM 9

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems.

Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.

UNIT III BIG DATA Vs COGNITIVE COMPUTING 9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.

Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics.

UNIT IV COGNITIVE COMPUTING IN BUSINESS 9

The Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market- IBM Watson as a cognitive systems.

UNIT V APPLICATIONS 9

The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing- Building a cognitive health care application- Smarter cities-Cognitive Computing in Government.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain cognitive computing and design principles.
CO2: Distinguish between NLP and cognitive computing.
CO3: Apply advanced analytics to cognitive computing.
CO4: Discuss application of cognitive computing in business.
CO5: Illustrate various applications of cognitive computing.

REFERENCES:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive computing and Big Data Analytics” , Wiley, 2015.
2. Vijay Raghvan, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications", by Elsevier publications, North Holland Publication, 1st Edition, 2016.
3. Bernadette Sharp (Author), Florence Sedes (Author), Wieslaw Lubaszewski (Author), Cognitive Approach to Natural Language Processing Hardcover, First Edition May 2017.
4. Arun Kumar Sangaiah, Arunkumar Thangavelu, et al., Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and Communications Technologies 1st edition 2018
5. Min Chen and Kai Hwang, Big-Data Analytics for Cloud, IoT and Cognitive Computing Wiley Publication, 1st Edition, 2017.
6. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing”, IGI Global Publishers, 2019.

MG8591 PRINCIPLES OF MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication –communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

AD8015 **BIO-INSPIRED OPTIMIZATION TECHNIQUES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand fundamental topics in bio-inspired optimization techniques
- To Learn the collective systems such as ACO, PSO, and BCO
- To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems
- To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
- To implement the Bio-inspired technique with other traditional algorithms.

UNIT I INTRODUCTION 9

Optimization Techniques: Introduction to Optimization Problems – Single and Muti- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

UNIT II SWARM INTELLIGENCE 9

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies**:** Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.

UNIT III NATURAL TO ARTIFICIAL SYSTEMS 9

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

UNIT IV SWARM ROBOTICS 9

Foraging for food – Clustering of objects – Collective Prey retrieval –Scope of Swarm Robotics – Social Adaptation of Knowledge**:** Particle Swarm – Particle Swarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

UNIT V CASE STUDIES 9

Other Swarm Intelligence algorithms**:** Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems –Travelling Salesman problem.

OUTCOMES:

CO1: Familiarity with the basics of several biologically inspired optimization techniques.
CO2: Familiarity with the basics of several biologically inspired computing paradigms.
CO3: Ability to select an appropriate bio-inspired computing method and implement for any application and data set.

CO4: Theoretical understanding of the differences between the major bio-inspired computing methods.

CO5: Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

TOTAL PERIODS:45

TEXT BOOK

1. A. E. Elben and J. E. Smith, “Introduction to Evolutionary Computing”, Springer, 2010.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007 .

REFERENCES

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, “Swarm Intelligence: FromNatural to Artificial Systems”, Oxford University press, 2000.
2. Christian Blum, Daniel Merkle (Eds.), “Swarm Intelligence: Introduction and Applications”, Springer Verlag, 2008.
3. Leandro N De Castro, Fernando J Von Zuben, “Recent Developments in Biologically Inspired Computing”, Idea Group Inc., 2005.
4. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
5. C. Ebelhart et al., “Swarm Intelligence”, Morgan Kaufmann, 2001.

AD8016 INFORMATION EXTRACTION AND RETRIEVAL L T P C
3 0 0 3

OBJECTIVES:

1: To understand the different ways for extraction of multimedia data
2: To learn and analyze the information retrieval techniques
3: To apply the information retrieval algorithms for real time applications
4: To understand and evaluate the applications of information retrieval techniques
5: To understand the role of information retrieval systems in web applications

UNIT I INTRODUCTION TO INFORMATION EXTRACTION 9

Introduction – Origins – Text, Audio ,Image, Video Extraction – Visual object Feature Localization - Entropy based Image Analysis – 3D shape Extraction Techniques - Semantic Multimedia Extraction using Audio & Video – Multimedia Web Documents.

UNIT II TEXT EXTRACTION 9

Pre-processing Techniques – Clustering – Probabilistic Models – Browsing and Query Refinement on presentation Layer- Link Analysis – Visualization Approaches and its Operations.

UNIT III INFORMATION RETRIEVAL SYSTEMS 9

Text formats –Retrieval and Ranking –Evaluation strategies – Tokens –Query processing –Static Inverted Indices – Dynamic Inverted Indices – Index compression –Categorization and Filtering Classifiers –Probabilistic, Linear ,Similarity based, Generalized Linear, Information Theoretic models- XML Retrieval.

UNIT IV ALGORITHMS ON INFORMATION RETRIEVAL 9

Introduction – Strategies - Utilities – Crossing the language barrier- Cross Language strategies with Utilities – Efficiency Multidimensional data model- Parallel Information Retrieval – Distributed Information Retrieval.

UNIT V APPLICATIONS 9

Sound Authoring Data with Audio MME-CBR Systems-Implementation of Message Recognition Systems – Paralinguistic Information Retrieval in Broadcast – Text mining Applications- Pre-processing Applications using Probabilistic and Hybrid Approaches – Web Search.

OUTCOMES:

- Able to apply the information extraction techniques for real time applications
- Design systems based on the concepts of information retrieval
- Apply data specific information extraction and retrieval
- Create web applications by understanding the information extraction and retrieval techniques
- Use the concepts of information classification and clustering in wide range of other applications

TOTAL PERIODS:45

TEXT BOOKS:

1. Mark T. Maybury, “Multimedia Information Extraction”, Wiley (IEEE), John Wiley & Sons, 2012.
2. Ronen Feldman, James Sanger, “Text Mining Handbook”, Cambridge University press, 2006.

REFERENCES:

1. David A. Grossman, Ophir Frieder, “Information Retrieval: Algorithms and Heuristics”, Second Edition, Springer, 2004.
2. Stefan Buttcher LA Clarke Gox v.Cormack, “Information Retrieval: Implementing and Evaluating Search Engines”, MIT Press, 2016.
3. Big Data Security and Privacy Handbook:100 Best Practices in Big Data security and Privacy”, 2016.