

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.TECH. ARTIFICIAL 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.

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

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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 Lab	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Lab	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 Measurements 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 Lab	ES	4	0	0	4	2
8.	AD8261	Data Structures Design Lab	PC	4	0	0	4	2
TOTAL				30	20	0	10	25

SEMESTER III

SI. 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

SI. 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	2	14	23

SEMESTER V

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	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 Lab	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	CATEGORY	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 Lab	PC	4	0	0	4	2
7.	AD8611	Artificial Intelligence - II Lab	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

SI. 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 Lab	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

SI. 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

SI. 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

SI. 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

SI. No	COURSE CODE	COURSE TITLE	CATEG ORY	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

SI. No	COURSE CODE	COURSE TITLE	CATEG ORY	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 and AI	PE	3	3	0	0	3

SEMESTER VIII, ELECTIVE - V

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	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

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 Undergraduate 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.

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 conduction 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 – H₂-O₂ 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:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. PrasantaRath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

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
(Common to all branches of B.E. / B.Tech Programmes)

L	T	P	C
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 viscometry.
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 (8TH 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- newspapers- **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 charts, 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/ talks 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.

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, ECOSYSTEMS AND BIODIVERSITY

14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of 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 ENVIRONMENTAL POLLUTION

8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

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 SOCIAL ISSUES AND THE ENVIRONMENT

7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, 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 POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – 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. Dharmendra S.Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 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.

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, Fundamentals 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 Technologyll, Fourth Edition, Elsevier, 2010.
5. Mittle,Mittal, Basic Electrical Engineeringll, 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.

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, foundry 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. Necaie, "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

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.

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 PERIODS: 45**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

TOTAL PERIODS(PRACTICAL): 30

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.

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.

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

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.

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.

	L	T	P	C
HS8381 INTERPERSONAL SKILLS/LISTENING&SPEAKING	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 presentations.

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 acquaint 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. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. 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.
5. 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 modeling
- 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 HOURS

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 database
- Determine the serializability of any non-serial schedule using concurrency techniques
- Apply the data model and querying in Object-relational and No-SQL databases.

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

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

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/>)

- 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 modeling, 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 Object 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

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.

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.

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

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

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

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

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

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

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

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

UNIT V

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