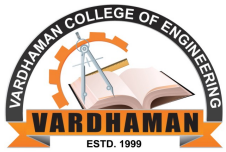

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

Affiliated to **JNTUH,** Approved by **AICTE,** Accredited by **NAAC** with **A++** Grade, **ISO 9001:2015** Certified

Kacharam, Shamshabad, Hyderabad - 501218, Telangana, India

www.vardhaman.org

CURRICULUM

For

Bachelor of Technology

Artificial Intelligence and Machine Learning

Under

Choice Based Credit System (CBCS)

B. Tech. - Regular Four-Year Degree Program

(For batches admitted from the Academic Year 2022 - 2023)

&

B. Tech. - Lateral Entry Scheme

(For batches admitted from the Academic Year 2023 - 2024)

October 2022

Vision of the Institution:

To be a pioneer institute and leader in engineering education to address societal needs through education and practice.

Mission of the Institution:

- To adopt innovative student centric learning methods.
- To enhance professional and entrepreneurial skills through industry institute interaction.
- To train the students to meet dynamic needs of the society.
- To promote research and continuing education.

Vision of the Department:

To be a leading source of competent computer engineers and meeting the needs of industry and society at large.

Mission of the Department:

- Facilitate learning in advanced technologies adopting innovative methods.
- Associate continuously with industry to design and implement experiential curriculum.
- Promote Research and Development through Special Interest Groups (SIGs).
- Provide a platform for harnessing entrepreneurial and leadership qualities.

Program Educational Objectives(PEOs):

PEO1: Graduate will establish himself/herself as effective professionals by solving real-world problems using investigative and analytical skills along with the knowledge acquired in the field of Computer Science and Engineering.

PEO2: Graduate will demonstrate his/her ability to adapt to a rapidly changing environment in advanced areas of Computer Science and scale new heights in their profession through lifelong learning.

PEO3: Graduate will prove his/her ability to work and communicate effectively as a team member and /or leader to complete the task with minimal resources, meeting deadlines.

PEO4: Graduate will embrace the professional code of ethics in the profession while deliberately being part of projects, which contributes to the society at large, without disturbing the ecological balance.

Program Outcomes(POs):

PO1:Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: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.

PO3: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.

PO4: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.

PO5: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.

PO6: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.

PO7: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.

PO8:Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9:Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: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.

PO11: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.

PO12: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.

Program Specific Outcomes(PSOs):

Graduates will be able to,

PSO1: To collect requirements, analyze, design, implement and test software Systems.
PSO2: To analyze the errors and debug them accordingly.

Programme Curriculum Structure
B. Tech – Artificial Intelligence and Machine Learning

Regulations: VCE-R22

I Year I Semester										
Induction Program (Phase – I)										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8001	Matrices and Calculus	BS	3	1	0	4	40	60	100
2	A8008	Engineering Chemistry	BS	3	0	0	3	40	60	100
3	A8010	English for Skill Enhancement	HS	2	0	0	2	40	60	100
4	A8402	Digital Electronics	ES	3	0	0	3	40	60	100
5	A8501	Problem solving through C	ES	3	0	0	3	40	60	100
6	A8009	Engineering Chemistry Laboratory	BS	0	0	2	1	40	60	100
7	A8011	English Language and Communication Skills Laboratory	HS	0	0	2	1	40	60	100
8	A8502	Problem Solving through C Laboratory	ES	0	0	2	1	40	60	100
9	A8302	Computer Aided Drawing	ES	0	0	2	1	40	60	100
10	A8021	Social Innovation	ES	0	0	2	1	40	60	100
Total				14	01	10	20	400	600	1000

I Year II Semester										
Induction Program (Phase – II)										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8002	Ordinary Differential Equations and Vector Calculus	BS	3	1	0	4	40	60	100
2	A8006	Applied Physics	BS	3	0	0	3	40	60	100
3	A8204	Basic Electrical Engineering	ES	2	0	0	2	40	60	100
4	A8505	Data Structures	ES	3	0	0	3	40	60	100
5	A8701	Foundations of Data Science	ES	2	0	0	2	40	60	100
6	A8007	Applied Physics Laboratory	BS	0	0	2	1	40	60	100
7	A8205	Basic Electrical Engineering Laboratory	ES	0	0	2	1	40	60	100
8	A8301	Engineering Workshop	ES	0	0	2	1	40	60	100
9	A8507	Data Structures Laboratory	ES	0	0	2	1	40	60	100
10	A8508	Python Programming Laboratory	ES	0	0	2	1	40	60	100
11	A8022	Engineering Exploration	ES	0	0	2	1	40	60	100
Total				13	1	12	20	440	660	1100

Programme Curriculum Structure
B. Tech – Artificial Intelligence and Machine Learning

Regulations: VCE-R22

II Year I Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8005	Computer Oriented Statistical Methods	BS	3	1	0	4	40	60	100
2	A8509	Discrete Mathematical Structures	ES	3	0	0	3	40	60	100
3	A8601	Object Oriented Programming	PC	3	0	0	3	40	60	100
4	A8510	Operating Systems	PC	3	0	0	3	40	60	100
5	A8702	Artificial Intelligence	PC	3	0	0	3	40	60	100
6	A8602	Object Oriented Programming Laboratory	PC	0	0	2	1	40	60	100
7	A8512	Operating Systems Laboratory	PC	0	0	2	1	40	60	100
8	A8801	Data Visualization Laboratory	PC	0	0	2	1	40	60	100
9	A8023	Engineering Design Thinking	PW	0	0	2	1	40	60	100
Total				15	01	08	20	360	540	900
Mandatory Courses (Non-Credit)										
10	A8032	Environmental Science and Technology	MC	2	0	0	0	-	100	100

II Year II Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8013	Business Economics and Financial Analysis	HS	3	0	0	3	40	60	100
2	A8514	Database Management Systems	PC	3	0	0	3	40	60	100
3	A8515	Formal Languages and Automata Theory	PC	3	0	0	3	40	60	100
4	A8516	Design and Analysis of Algorithms	PC	3	0	0	3	40	60	100
5	A8703	Machine Learning	PC	3	0	0	3	40	60	100
6	A8517	Database Management Systems Laboratory	PC	0	0	2	1	40	60	100
8	A8704	Machine Learning Laboratory	PC	0	0	2	1	40	60	100
7	A8705	IoT and Drones Laboratory	PC	0	1	2	2	40	60	100
9	A8024	Product Realization	PW	0	0	2	1	40	60	100
Total				15	01	08	20	360	540	900
Mandatory Courses (Non-Credit)										
10	A8031	Gender Sensitization	MC	2	0	0	0	-	100	100
11	A8033	Universal Human Values 2: Understanding Harmony	MC	2	0	0	0	-	100	100

Programme Curriculum Structure
B. Tech – Artificial Intelligence and Machine Learning

Regulations: VCE-R22

III Year I Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8519	Computer Networks	PC	3	0	0	3	40	60	100
2	A8520	Software Engineering	PC	3	0	0	3	40	60	100
3	A8706	Natural Language Processing	PC	3	0	0	3	40	60	100
4	A8526	Data Mining	PC	3	0	0	3	40	60	100
5		Professional Elective – I	PE	3	0	0	3	40	60	100
6	A8708	Natural Language Processing Laboratory	PC	0	1	2	2	40	60	100
7	A8528	Data Mining Laboratory	PC	0	0	2	1	40	60	100
8	A8521	Computer Networks Laboratory	PC	0	0	2	1	40	60	100
9	A8525	RUST Programming(Skill Development)	HS	0	0	2	1	40	60	100
Total				15	01	08	20	360	540	900
Mandatory Courses (Non-Credit)										
10	A8035	Research Methodology	MC	2	0	0	0	-	100	100

III Year II Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8522	Cloud Computing and Virtualization	PC	3	0	0	3	40	60	100
2	A8806	Big Data Analytics	PC	3	0	0	3	40	60	100
3	A8710	Knowledge Representation and Reasoning	PC	3	0	0	3	40	60	100
4		Professional Elective – II	PE	3	0	0	3	40	60	100
5		Professional Elective – III	PE	3	0	0	3	40	60	100
6	A8524	Cloud Computing and Virtualization Laboratory	PC	0	0	2	1	40	60	100
7	A8807	Big Data Analytics Laboratory	PC	0	0	2	1	40	60	100
8	A8012	Advanced English Communication Skills Laboratory	PC	0	0	2	1	40	60	100
9	A8041	Mini-Project/ Internship	HS	0	0	4	2	40	60	100
Total				15	00	10	20	360	540	900
Mandatory Courses (Non-Credit)										
10	A8034	Indian Constitution	MC	2	0	0	0	-	100	100

Programme Curriculum Structure
B. Tech – Artificial Intelligence and Machine Learning

Regulations: VCE-R22

IV Year I Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8707	Deep Learning	PC	3	0	0	3	40	60	100
2	A8711	Soft Computing	PC	3	0	0	3	40	60	100
3		Professional Elective – IV	PE	3	0	0	3	40	60	100
4		Professional Elective – V	PE	3	0	0	3	40	60	100
5		Open Elective – I	OE	3	0	0	3	40	60	100
6	A8709	Deep Learning Laboratory	PC	0	0	2	1	40	60	100
7	A8712	Soft Computing Laboratory	PC	0	0	2	1	40	60	100
8	A8042	Project Work Phase – I	PW	0	0	6	3	100	-	100
Total				15	0	10	20	380	420	800

IV Year II Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1		Professional Elective – VI	PE	3	0	0	3	40	60	100
2		Open Elective – II	OE	3	0	0	3	40	60	100
3		Open Elective – III	OE	3	0	0	3	40	60	100
4	A8043	Project Work Phase - II	PW	0	0	22	11	40	60	100
Total				09	0	22	20	160	240	400

Programme Curriculum Structure
B. Tech – Artificial Intelligence and Machine Learning

Regulations: VCE-R22

List of Professional Electives

Professional Elective - I		
Domain	**Course Code**	**Title of the Course**
Network Security	A8607	Information Security
Business Analytics	A8352	Operations Research
Image Processing	A8662	Image Processing
Emerging Trends in Machine Learning	A8751	Optimization Techniques in Machine Learning

Professional Elective - II		
Domain	**Course Code**	**Title of the Course**
Network Security	A8652	Cyber Security
Business Analytics	A8852	Business Intelligence
Image Processing	A8663	Computer Vision
Emerging Trends in Machine Learning	A8752	Predictive Analytics

Professional Elective - III		
Domain	**Course Code**	**Title of the Course**
Network Security	A8653	Web and Database Security
Business Analytics	A8854	Time Series Analysis
Image Processing	A8664	Pattern Recognition
Emerging Trends in Machine Learning	A8753	Generative AI

Programme Curriculum Structure
B. Tech – Artificial Intelligence and Machine Learning

Regulations: VCE-R22

List of Professional Elective (Cont.)

Professional Elective - IV		
Domain	**Course Code**	**Title of the Course**
Network Security	A8654	Cloud Security
Business Analytics	A8855	Retail and Customer Analysis
Image Processing	A8665	Video Processing Analytics
Emerging Trends in Machine Learning	A8754	Federated Machine Learning

Professional Elective - V		
Domain	**Course Code**	**Title of the Course**
Network Security	A8655	IoT Security
Business Analytics	A8856	Web and Social Media Analytics
Image Processing	A8666	Augmented Reality and Virtual Reality
Emerging Trends in Machine Learning	A8755	Cognitive Computing

Professional Elective - VI		
Domain	**Course Code**	**Title of the Course**
Network Security	A8656	Blockchain Technology
Business Analytics	A8857	Ethics and Privacy in Analytics
Image Processing	A8667	Optical Character Recognition
Emerging Trends in Machine Learning	A8657	Prompt Engineering

List of Open Electives

#	Course Code	Title of the Course
1	A8181	Smart Cities
2	A8182	Disaster Management
3	A8183	Environmental Pollution Management
4	A8155	Green Building and Sustainability
5	A8224	Electric Vehicles
6	A8281	Solar Energy and Applications
7	A8282	Energy Storage Systems
8	A8283	Power Generation Systems
9	A8381	Hybrid Vehicles
10	A8382	Fundamentals of Robotics
11	A8383	3D Printing
12	A8402	Digital Electronics
13	A8481	Basic Electronics
14	A8482	Principles of Communication Engineering
15	A8483	Fundamentals of IoT
16	A8484	Introduction to Embedded Systems
17	A8510	Operating Systems
18	A8514	Database Management Systems
19	A8520	Software Engineering
20	A8607	Information Security
21	A8608	Java Programming
22	A8651	Ethical Hacking
23	A8652	Cyber Security
24	A8656	Blockchain Technology
25	A8658	Robotic Process Automation
26	A8681	E-Commerce
27	A8682	Full Stack Development
28	A8702	Artificial Intelligence
29	A8781	Computer Organization and Architecture
30	A8851	Data Science for Engineers
31	A8081	Mathematical Programming
32	A8082	Transform Calculus
33	A8083	Numerical Techniques
34	A8084	Entrepreneurship Development
35	A8085	Logistics and Supply Chain Management

List of Open Electives (Cont.)

#	Course Code	Title of the Course
36	A8086	Management Science
37	A8087	Human Resource Management
38	A8088	Organizational Behaviour
39	A8089	Intellectual Property Rights
40	A8090	Professional Practice, Law & Ethics
41	A8091	National Cadet Corps (NCC)

I YEAR I SEMESTER

Course Structure

A8001 - Matrices and Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the solution of system of linear equations, eigen values and eigen vectors, functions of several variables, multiple integrals. In addition, this course can be applied in many areas of engineering such as computer graphics, cryptography, wireless communication and animation.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8001.1. Solve system of linear equations using rank of a matrix.
A8001.2. Examine the nature of quadratic form using eigen values and eigen vectors.
A8001.3. Evaluate improper integrals using Beta and Gamma Functions.
A8001.4. Examine the extremum of a function of several variables.
A8001.5. Make use of multiple integrals to find the area and volume of a solid.

3. Course Syllabus

Theory of Matrices: Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss- Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

Eigen Values and Eigen Vectors: Linear Transformation and Orthogonal Transformation, Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem. Rank, index, signature and nature of quadratic forms up to three variables using eigen values.

Calculus: Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series, Definition of Improper Integral: Beta and Gamma functions and their applications.

Multivariable Calculus (Partial Differentiation and applications): Definitions of Limit and Continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

Multivariable Calculus (Integration): Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Change of variables (Cartesian to polar), Evaluation of Triple Integrals. Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

4. Books and Materials

Text Books:

1. Grewal, B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.
2. Jain, R.K. and Iyengar, S.R.K. Advanced Engineering Mathematics, 3rd Edition, Narosa Publishing House, 2011.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V. Higher Engineering Mathematics, 32nd Reprint, McGraw Hill Education (India) Pvt Ltd, 2018.

Course Structure

A8008 - Engineering Chemistry

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course emphasizes a strong background of Chemistry, infused with an orientation towards the applied chemistry and materials technology. A course that focuses on the general applications of chemical principles to the analysis and evaluation of engineering problems as water and its treatment for various purposes, engineering materials as plastics, fibres, elastomers, composites, non-conventional energy sources, batteries and fuel cells.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8008.1. Apply the knowledge of electrochemical series to protect different metals from corrosion.

A8008.2. Analyze the hardness and other impurities present in the water for industrial and domestic applications.

A8008.3. Evaluate the behaviour of different engineering materials.

A8008.4. Analyze the different types of fossil fuels, characteristics and their applications.

A8008.5. Compare the materials to study various physical and chemical properties.

3. Course Syllabus

Battery Chemistry & Corrosion:

Batteries: Classification – Primary battery (dry cell and lithium cell) and Secondary battery (Lithium-ion cell and lead acid battery). Fuel cells – Hydrogen-Oxygen fuel cell– Engineering applications, Solar cells - Introduction and applications of Solar cells. **Corrosion and Its Control:** Causes and effects of corrosion – Theories of Corrosion – Chemical corrosion – oxidation corrosion, Electrochemical theory of corrosion - mechanism. Types of corrosion – Galvanic corrosion – Concentration cell corrosion (Pitting corrosion and Waterline corrosion). Factors affecting the rate of corrosion, Pilling-Bedworth rule, corrosion

control methods – cathodic protection – sacrificial anodic – impressed current cathodic protection.

Water and its treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness, Numerical problems. Boiler troubles: sludges, scales and caustic embrittlement. Internal treatment of boiler feed water – Calgon conditioning – Phosphate conditioning – Colloidal conditioning – Softening of water by ion exchange processes. Potable water – its characteristics. Desalination of water – Reverse osmosis. Sewage – Steps involved in treatment of sewage.

Polymeric Materials: Terminology, Types of Polymerization – Addition and Condensation polymerization with examples. Characteristics of Plastics, fibres and elastomers. Plastics: Thermo- plastic resins & Thermosetting resins. Preparation, properties and engineering applications of Polyvinyl chloride and Teflon. Fibers: Preparation, properties and engineering applications of Nylon-6,6 and Dacron. Elastomers: Natural rubber and its vulcanization, Artificial rubbers - Buna-S and Butyl rubber. Conducting Polymers: Classification, mechanism of conduction in trans - polyacetylene – applications.

Energy Sources: Introduction, Calorific value of fuel – HCV, LCV- Dulongs formula – Numerical Problems. Classification- solid fuels – coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, Cracking and its types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition, characteristics and applications of LPG and CNG, Biodiesel – Transesterification, advantages

Engineering Materials:

Nanomaterials: Introduction, Chemical synthesis by sol-gel, precipitation, solvo-thermolysis and thermolysis methods. Applications of nanomaterials in Industry and Engineering.

Graphene: Isolation, Structure and strength, applications in Computer, Electrical and Electronic Devices.

Alloys: Definition – Purpose of alloying, Types of alloys – Ferrous Alloys (Stainless steel, Nichrome, Alnico), Non-ferrous alloys (solder, brass and bronze).

Portland cement: Chemical constituents, Setting and Hardening and applications of cement.

4. Books and Materials

Text Books:

1. Rama Devi. B, Aparna. P, Prasanta Rath, Engineering Chemistry, 2nd Edition, Cengage

Publications, 2022.

2. Jain and Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publication Company, 2015.

Reference Books:

1. Shikha Agarwal, Engineering Chemistry, Cambridge University Press, Delhi, 2015.
2. Shashi Chawla, Engineering Chemistry, Dhanpatrai and Company (P) Ltd. Delhi, 2011.
3. Thirumala Chary. M, Laxminarayana. E and Shashikala. K, A text book of Engineering Chemistry, Pearson Publications, 2021.

Course Structure

A8010 - English for Skill Enhancement

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	2	40	60	100

1. Course Description

Course Overview

This course has been designed to develop linguistic and communicative competencies among engineering students. The Reading and Writing skills of the students are honed during the sessions using the prescribed textbook. Additional focus is laid on grammar and vocabulary. In addition, the students are encouraged to read texts which are aimed at developing their comprehension skills.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8010.1. Build competence in grammar for effective communication.
A8010.2. Acquire suitable vocabulary required for achieving communicative competence.
A8010.3. Utilize academic reading skills to comprehend different texts effectively.
A8010.4. Develop effective writing skills for academic purposes.
A8010.5. Demonstrate basic proficiency in professional correspondence.

3. Course Syllabus

'Toasted English' by R.K.Narayan

Vocabulary : Word Formation - Prefixes and Suffixes; Synonyms and Antonyms; Conjunctions

Grammar : Identifying Common Errors in Writing with Reference to Articles and Prepositions

Reading : Techniques for Effective Reading

Writing : Sentence Structures -Use of Phrases and Clauses in Sentences- Types of sentences; Punctuation; Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

'Appro JRD' by Sudha Murthy

Vocabulary : Homophones, Homonyms and Homographs

Grammar : Identifying Common Errors in Writing with reference to Tenses, Noun-pronoun Agreement and Subject-verb Agreement

Reading : Sub-Skills of Reading – Skimming and Scanning

Writing : Essay writing; Precis writing

Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al

Vocabulary : Words Often Confused; Idioms

Grammar : Misplaced Modifiers

Reading : Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice

Writing : Letter Writing: Letter of Request, Letter of Inquiry, Letter of Apology, Letter of Complaint.

'Art and Literature' by Abdul Kalam

Vocabulary : Standard Abbreviations in English

Grammar : Redundancies and Clichés in Oral and Written Communication

Reading : Survey, Question, Read, Recite and Review (SQ3R Method)

Writing : Information Transfer; Letter of Application and Resume/CV writing; Email writing- format, style and etiquette.

Chapter entitled 'Go, Kiss the World' by Subroto Bagchi

Vocabulary : Technical Vocabulary and their Usage

Grammar : Identify the errors with reference to Active and Passive Voice; Reported speech

Reading : Reading Comprehension: Exercises for Practice.

Writing : Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

4. Books and Materials

Text Books:

1. English: Language, Context and Culture by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

Reference Books:

1. Raman, Meenakshi and Sharma, Sangeeta, Technical Communication- Principles and Practice, 3rd Edition, Oxford University Press, New Delhi. Print, 2015.
2. Muralikrishna C. and Sunita Mishra, Communication Skills for Engineers, 2nd Edition, Pearson, 2011
3. Ashraf Rizvi M, Effective Technical Communication, 2nd Edition, McGraw Hill Education, 2017
4. Swan, Michael, Practical English Usage, Oxford University Press. Fourth Edition, 2016.
5. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary, 2nd Edition, Sage Publications India Pvt. Ltd.

Course Structure

A8402 - Digital Electronics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course aims to teach students the fundamentals of digital electronics. Starting from learning the basic postulates of Boolean algebra, to cover map method for simplifying Boolean expressions, to outline the formal procedures for the analysis and design of combinational and sequential circuits, to design combinational and sequential programmable devices. These digital components are the basic building blocks from which more complex digital systems are constructed.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8402.1. Apply fundamental theorems and properties of Boolean algebra to simplify a Boolean function.
A8402.2. Apply the map method to obtain simplified and optimized logical expressions.
A8402.3. Build combinational circuits using logic gates for real time digital systems.
A8402.4. Analyze the behaviour of latches and flipflops for designing sequential logic. .
A8402.5. Make use of programmable logic devices in the design of digital systems.

3. Course Syllabus

Boolean Algebra and Logic Gates: Introduction, basic definitions, axiomatic definition of Boolean algebra, basic theorem and properties, Boolean functions, canonical and standard forms, digital logic gates.

Gate-Level Minimization: The map method, two-variable, three-variable and four-variable K-maps, sum-of-products, product-of-sums simplification, don't-care conditions, NAND and NOR implementation.

Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, magnitude comparator, decoders, encoders, multiplexers, demulti-

plexers.

Synchronous Sequential Logic: Sequential circuits, storage elements – latches and flip-flops, analysis of clocked sequential circuits. **Registers and Counters:** Registers, shift registers, ripple counters, synchronous counters.

Memory and Programmable Logic: Random-Access Memory, read-only memory, programmable logic array, programmable array logic.

4. Books and Materials

Text Books:

1. M. Morris Mano, Michael D. Ciletti (2017), Digital Design With an introduction to the Verilog HDL, 6thEdition, Pearson Education/ PHI, India

Reference Books:

1. Ronald J Tocci, Ronald J Tocci, Neal S Widmer , Gregory L Moss , Digital Systems - Principles an Applications , 10th Edition, Pearson Education International
2. Charles H RothJr, Larry L Kinney, Fundamentals of Logic Design,6th Edition, Cengage Learning

Course Structure

A8501 - Problem Solving through C

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

As an introductory course common to all branches, the student will be able to learn problem solving skills using 'C ' programming language, which is a pre-requisite to learn many other programming Languages. The purpose of this course is to provide the basic programming methodology in C. This course will enable the students to learn programming skills necessary to implement all the basic mathematical, scientific and real world applications. C is a structured high-level programming language. The student can write programs using structures, functions and pointers. The course enables to perform file operations to store data permanently. This course will give the foundation for a beginner to develop computer programmes effectively.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8501.1. Identify various building blocks to write a C program.
A8501.2. Use control statements for solving a given problem.
A8501.3. Write programs using arrays and strings to store and manipulate sequential data.
A8501.4. Build programs with functions and structures for solving a complex problem.
A8501.5. Make use of Pointers and Files to store and retrieve data efficiently.

3. Course Syllabus

Algorithms, Flowcharts and Introduction to C : Algorithms- Definition, characteristics and examples. Flowcharts- Definition, Symbols and examples. Structure of a C Program, Identifiers, Variables, Constants and Data Types. Operators-Arithmetic, Relational, Logical, Assignment, increment and decrement, Conditional, Bitwise and Special Operators. Evaluation of Expressions, Precedence of Arithmetic operators, Type conversions, Operator precedence and Associativity. Formatted input and output.

Control Statements: Conditional Statements- if, if else, nested if, else if ladder and switch statements. Iterative or Loop statements- while, do while and for statements. Jump statements- break, continue and goto statements.

Arrays and Strings : Arrays: Introduction, One Dimensional Arrays - Declaration and initialization, Reading and Writing. Two Dimensional Arrays - Declaration and initialization, Reading and Writing. Strings: Introduction, Declaration and initialization, Reading and writing, string handling functions, handling two dimensional strings, Command line arguments.

Functions, Structures and Unions: Functions- Introduction, Function definition and Function call, Categories of functions, Recursion, Limitations of recursive functions, Passing Arrays to functions, Common Preprocessor Directives. Structures- Definition, Declaration and Initialization, accessing structure members, Array of Structures, Arrays with in structures, Structures and functions , size of structures , Unions- Definition, Declaration and Initialization, accessing Union members.

Pointers and Files : Pointers-Declaration, Initialization, Pointer to Pointer, Pointer Arithmetic, Parameter Passing Techniques, Pointer to Arrays, Pointers to Structures. Files- Introduction, defining, opening and closing a File, Input - Output operations on Files, Random Access in files.

4. Books and Materials

Text Books:

1. Byron Gottfried., Programming with C, 4th Edition (Schaum's Outlines), New Delhi,Mc GRAW HILL Edition, 2018.
2. E Balagurusamy., Programming in ANSI C, 8th Edition, Tata McGRAW HILL, New Delhi, 2019.

Reference Books:

1. Yeshvanth Kanethkar., Let Us C,5th Edition,BPB Publications, New Delhi,India, 2017.
2. B.A. Forouzan and R.F. Gilberg., Computer Science: A Structured Programming Approach Using C, 3rd Edition, Thompson Learning, 2007.
3. P. Padmanabham., C & Data structures, 3rd Edition, B.S. Publications, 2016.
4. Jeri R. Hanly and Elliot B.Koffman.,Problem solving and Program Design in C, 7th Edition,Pearson Publication, 2016.

Course Structure

A8009 - Engineering Chemistry Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

The Chemistry Laboratory conducts fundamental studies of highway materials to understand mechanisms. It provides students with a practical approach towards the various techniques used in engineering application. Practical awareness is inculcated and students are trained both quantitatively and qualitatively during the lab sessions to enhance their understanding and problem solving abilities.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8009.1. Apply the instrumental techniques to find out the concentrations or equivalence points of solutions.

A8009.2. Analyze the impurities present in the water using volumetric analysis.

A8009.3. Make use of different titrations to measure various properties of chemical species.

A8009.4. Analyze the importance of temperature and pressure on physical properties like viscosity and surface tension of liquids.

A8009.5. Calculate the yield of synthetic drugs by maintaining specific reaction conditions.

3. List of Experiments

1. Estimation of amount of ferrous ion in a given solution by permanganometry.
2. Estimation of amount of ferrous ion in given solution by dichrometry.
3. Estimation of hardness of water by complexometry using EDTA.
4. Determination of chloride content in water by argentometry.
5. Estimation of amount of hydrochloric acid in a given sample by conductometry.
6. Estimation of amount of acetic acid in a given sample by conductometry.

7. Estimation of amount of hydrochloric acid in a given sample by potentiometry.
8. Estimation of amount of Fe^{+2} in a given sample by potentiometry.
9. Estimation of Mn^{+2} in a given sample by colorimetry.
10. Estimation of Cu^{+2} in a given sample by colorimetry.
11. Determination of viscosity of a given fluid by Ostwald's viscometer.
12. Determination of surface tension of a given liquid by using stalagmometer.
13. Preparation of Aspirin.
14. Preparation of Nylon 6

4. Laboratory Equipment/Software/Tools Required

1. Digital Conductometer
2. Digital Potentiometer
3. Digital Colorimeter
4. Electrical Water Heater
5. Wall Mount Distillation Plant
6. Analytical/Digital Weighing Balance
7. Ostwald's Viscometer
8. Stalagmometer
9. Stopwatch
10. Thermometer
11. RB Flask condenser
12. Magnetic Stirrer
13. Pipette
14. Burette
15. Beaker

5. Books and Materials

Text Books:

1. Ramadevi. B and Aparna. P, Lab manual for Engineering chemistry, S Chand Publications, New Delhi, 2022.

Reference Books:

1. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
2. Ahluwalia. V.K, College Practical Chemistry, Narosa Publications Ltd. New Delhi, 2007.

Course Structure

A8011 - English Language and Communication Skills Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course is designed to cater to the needs of students in developing their oral communication skills. It begins with an introduction to Phonetics to make them understand the received pronunciation and to help them speak with neutral accent and appropriate intonation. This course incorporates listening skills and draws exercises of listening comprehension from various general and business contexts. The speaking exercises in this course will help the students to present their ideas in different situations, besides helping them to develop team spirit by participating in pair/ group activities.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8011.1. Acquire the received pronunciation and speak in a neutral accent.
A8011.2. Use contextual vocabulary for lucid spoken communication.
A8011.3. Comprehend accent of different varieties of English.
A8011.4. Develop skills for professional presentations.
A8011.5. Demonstrate the ability to communicate by enhancing listening skills

3. Course Syllabus

CALL Lab: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening; Introduction to Phonetics – Speech Sounds – Vowels and Consonants

ICS Lab: Spoken vs. Written language- Formal and Informal English; Ice-Breaking Activity and JAM Session- Self Introduction, Importance of Non Verbal Communication; Situational Dialogues: Introducing Others – Greetings – Taking Leave.

CALL Lab: Past Tense and Plural Marker Rules, Structure of Syllables; Listening to Monologues and Dialogues

ICS Lab: Pair Activity: Asking and giving directions; Exchanging information, Making Requests and Seeking Permissions and Justifying Opinions.

CALL Lab: Stress pattern in sentences; Weak and Strong Forms; Neutralization of Mother Tongue Interference; Listening to Group Conversation
ICS Lab: Describing Place, Person and Event

CALL Lab: Intonation; Listening for Specific Information
ICS Lab: Group activity: Agreeing and/or disagreeing, Suggesting, Speculating, Comparing and contrasting; Telephone Etiquette; Introduction to Group Discussion

CALL Lab: Differences between British and American Pronunciation; Listening for General Comprehension of the Content
ICS Lab: Introduction to Interview Skills; Mock Interviews; Structured Presentations; Extempore Presentations

4. Books and Materials

Reference Books:

1. Brook-Hart, Guy, Cambridge English Business Benchmark- Upper Intermediate Business Vantage (with CD), 2nd Edition, South Asian Edition, Cambridge University Press, 2019.
2. Hancock, M., English Pronunciation in Use Intermediate, Cambridge University Press. Print, Cambridge, 2009.
3. Mohanraj, J., Let Us Hear Them Speak, 1st Edition, Sage Texts Print, New Delhi, 2015
4. Exercises in Spoken English, Parts I-III CIEFL, Oxford University Press, 1997.

Course Structure

A8502 - Problem Solving through C Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

As an introductory course common to all branches, the student will be able to learn problem solving skills using 'C' programming language, which is a pre-requisite to learn many other programming Languages. The purpose of this course is to provide the basic programming methodology in C. This course will enable the students to learn programming skills necessary to implement all the basic mathematical, scientific and real world applications. C is a structured high-level programming language. The student can write programs using structures, functions and pointers. The course enables to perform file operations to store data permanently.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8502.1. Use various programming constructs of C to solve a given problem.
A8502.2. Make use of arrays, pointers and structures to organize data.
A8502.3. Develop applications using functions for code reuse.
A8502.4. Write programs using files for storing and accessing data.

3. List of Experiments

1. Variables and Expressions
   a. Write a C program for Swapping of two numbers using a third variable
   b. Write a C program for the simple and compound interest.
   c. Write a C program to evaluate the expressions. (Finding y=m*x+c, displacement).
2. Operators
   a. Write a C program to implement increment, decrement and Bitwise operators
   b. Write a C program to find the greatest of 3 numbers using conditional operator.
3. Conditional Statements-I
   a. Write a C program for finding the max and min from the three numbers.

b. Write a C program to Check the given year is leap year or not.

c. Write a C program to find the roots of a quadratic equation. .

4. Conditional Statements-II

a. Write a C program to check the given number is power of 2 or not using bit wise operators.

b. Write a C program to read 3 subject Marks. Calculate and display the grade of a student based on the percentages.

c. Write a C Program to perform Arithmetic Operations using switch statement.

5. Iterative Statements-I

a. Write a C program to find sum of n natural numbers (1+2+3....+n).

b. Write a C program to find factorial of a given number.

c. Write a C program to print Fibonacci numbers.

d. Write a C program to find reverse of the given number.

e. Write a C program to Check if the binary representation of a positive number is palindrome or not. For example, 101, 11, 11011, 1001001 are palindromes. 100, 110, 1011, etc., are not palindromes.

6. Iterative Statements-II

a. Write a C program to read a password until it is correct. For wrong password print "Incorrect password" and for correct password print "Correct password" and quit the program. The correct password is 1234.

b. Write a C program to check the given number is prime or not.

c. Write a C program to find the GCD of given two numbers.

d. Write a C program to print the output in various triangle patterns using Nested for loop.

e. Write a C Program to find the sum of the series Geometric Progression.

7. Arrays

a. Write a C program to find the largest and smallest number among a list of integers.

b. Write a C Program to read an array of n elements and find the mean, variance and standard deviation.

c. Given an integer array of election votes having candidate IDs, write a program to find the winner of the election.

8. Multi Dimensional Arrays

a. Write a C program to find Addition of two Matrices.

b. Write a C program to find Multiplication of two Matrices.

9. Strings

a. Write a C program to demonstrate the string handling functions.

b. Write a C program to Check whether a given string is palindrome or not.

c. Write a C program to concatenate three strings.

d. Write a C program to count the lines, words and characters in a given text.

10. Functions

a. Write a C program to find the factorial of a given number using non-recursive and recursive function

b. Write a C program to find the nth term of a Fibonacci series using recursive function.

c. Write a c program to compute x power y.

11. Structures

a. Write a C program to create a Student structure containing name, rollNo and grade as structure members. Display the name, rollNo and grade of a student.

b. Write a C program to create a Book structure containing name, author and pages as structure members. Display the name, author and pages of a Book.

c. Write a C Program to Create a Student structure containing name, rollNo and grade as structure members. Display the name, rollNo and grade of n students by using array of structures concept.

12. Structures

a. Write a C Program to Add Two Complex Numbers by Passing Structure to a Function

b. Write a C Program to Add Two Distances (in inch-feet system) using Structures

13. Pointers

a. Write a C program to swap two integers using following methods.

i) Call by Value ii) Call by Reference

b. Write a C program to demonstrate pointer arithmetic.

c. Write a C Program to Check the given string is palindrome or not using pointer.

d. Write a C program to print n cities names using pointers and strings.

14. Files

a. Write a C program to merge two files into a third file.

b. Write a C program to reverse the contents of a file.

c. Write a C Program to use random access functions in files.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open Source/ Freeware)
2. GCC Compiler (Open source / Freeware).

Course Structure

A8302 - Computer Aided Drawing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course covers the essential core topics for working with the AutoCAD software, orthographic projections for points, lines, planes and solids in different positions, the development of lateral surfaces and the isometric projections. The students are able to create simple solid models of various domain applications.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8302.1. Illustrate various menu bars and tool bars on AutoCAD interface.
A8302.2. Differentiate first angle and Third angle projection system based on representation of orthographic views.
A8302.3. Create orthographic views of points, lines, planes and solids using appropriate tools.
A8302.4. Develop the lateral surface areas of regular solids by construction methods.
A8302.5. Model 3-dimentional views of simple objects using isometric coordinates.

3. Course Syllabus

Introduction to AutoCAD: File menu of AutoCAD with New, Open, Save, Save as and Close, Basic 2D commands like Line, Circle, Ellipse, Multi Line, Construction Line, Polyline, Point, Donut, Ellipse, Polygon, Rectangle, Arc, Erase, Snap, Redraw, Regenerate, Zoom, Pan.

Editing of AutoCAD Drawing: Modify Properties of Drawing Entity, Copy, Move, Rotate, Mirror, Offset, Array, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer, Fillet.

Orthographic Projections-I: Orthographic projections of Points, Lines and planes inclined to one plane and inclined to both the principal planes.

Orthographic Projections-II: Orthographic projections of regular solids-prism, cylinder, pyramid and cone inclined to one of the reference plane.

Isometric Projections: Isometric coordinates, Isometric Scale, Isometric Views of Lines, Planes and solids. Conversion of Isometric View to Orthographic Views and Vice-versa.

4. Laboratory Equipment/Software/Tools Required

1. PC installed with operating system (Windows)
2. Auto CAD software

5. Books and Materials

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., "Engineering Drawing", 53rd Edition, Charotar Publishing House, 2019.
2. K. Balaveera Reddy et al, "Computer Aided Engineering Drawing",2nd Edition,CBS Publications, 2015.

Reference Books:

1. Narayana, K.L. & P Kannaiah, "Text book on Engineering Drawing" , 3rd Edition, Sci-Tech Publishers, 2020.
2. Basant Agrawal B. and Agrawal C. M., "Engineering Graphics", 3rd Edition, TMH Publication, 2020.
3. Shah, M.B., Rana B.C., "Engineering Drawing and Computer Graphics", 2nd Edition, Pearson Education,2009.

Course Structure

A8021 - Social Innovation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Social Innovation is an open-ended course to develop social connectedness in engineering students through social awareness and social consciousness. This can be done through live field exposure along with faculty led conceptual presentations, real case reviews, self-study assignments, literature and field survey. Through this course, the students are expected to use their engineering knowledge to provide innovative solutions to existing social problems. This course also develops critical thinking ability among the students to develop sustainable solutions.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8021.1. Develop awareness on social issues faced by local regions.
A8021.2. Identify the mind set of human Race and interpret the societal issues as simple, complicated, and complex problems.
A8021.3. Identify the need statement along with its main causes and effects.
A8021.4. Develop an innovative and sustainable solution for social issues by thinking critically and creatively.

3. Course Syllabus

Introduction to Social Innovation: Core definitions, core elements and common features of social innovation, a typology of social innovation, Awakening social consciousness.

Create Mindsets and Wicked Problems: Seven mindsets – Empathy, Optimism, Iteration, Creative confidence, making it, embracing ambiguity, Learning from failures. Distinguish between simple, complicated, and complex problems; describe the characteristics of wicked problems, breakdown a given problem by unpacking its complexity.

Critical and Creative Thinking for Social Innovation: Definition, engineering thinking and learning, distinguish between creativity and innovation. Models of Creative thinking. [Appreciative Inquiry (AI), Asset Based Community Development (ABCD) and Concept of Bricolage.

Process of Social Innovation: Community study, develop questionnaire, identifying the causes of a particular problem, identify needs, record your learning's, generate ideas, select promising ideas, prototyping, and testing.

Social Innovation across Four Sectors: The non-profit sector, public sector, the private sector, the informal sector, links between and cross sectors. Stages of Innovation: Social organizations and enterprises, social movements, social software and open source methods, common patterns of success and failure.

4. Books and Materials

Text Books:

1. Robin Murray, Julie Caulier-Grice, Geoff Mulgan, "The open book of social innovation: Ways to Design, Develop and Grow Social Innovation", The Young Foundation, 2010.
2. Julie Caulier-Grice, Anna Davies, Robert Patrick & Will Norman, The Young Foundation (2012) Social Innovation Overview: A deliverable of the project: "The theoretical, empirical and policy foundations for building social innovation in Europe" (TEPSIE), European Commission – 7th Framework Programme, Brussels: European Commission, DG Research.

Reference Books:

1. Geoff Mulgan, "Social Innovation: What it is, Why it matters and How it can be accelerated", The Young Foundation, 2007.
2. Asset Based Community Development (ABCD) Model – http://www.nurturedevelopment.org/asset-based-community-development/
3. Diana Whitney & Amanda Trosten-Bloom, "The Power of Appreciative inquiry – A Practical Guide to Positive Change", 2nd Edition, Berrett-Koehler Publishers, Inc, 2010.

I YEAR II SEMESTER

Course Structure

A8002 - Ordinary Differential Equations and Vector Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with ordinary differential equations of first and higher order and Laplace transforms, vector calculus. In addition, this course can be applied in many areas of engineering such as wireless communication, signal processing, robotics and animation.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8002.1. Solve ordinary differential equations of first and higher order.
A8002.2. Make use of ordinary differential equations to solve engineering problems.
A8002.3. Apply Laplace transforms to solve ordinary differential equations.
A8002.4. Determine divergence and curl of a vector point function.
A8002.5. Make use of vector integral theorems to evaluate area, surface area and volumes

3. Course Syllabus

First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

Ordinary Differential Equations of Higher Order: Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x) and xV(x), method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Cauchy-Euler equation. Applications: L-C-R Circuits.

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

Vector Differentiation: Vector point functions and scalar point functions, Gradient, Directional derivatives, Divergence and Curl, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

Vector Integral Calculus: Line integral, work done, Surface integrals, Volume integrals. Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem (without proof) and their applications.

4. Books and Materials

Text Books:

1. Grewal, B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.
2. Jain, R.K. and Iyengar, S.R.K. Advanced Engineering Mathematics, 3rd Edition, Narosa Publishing House, 2011.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V. Higher Engineering Mathematics, 32nd Reprint, McGraw Hill Education (India) Pvt Ltd, 2018.

Course Structure

A8006 - Applied Physics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Applied Physics course introduces the fundamental aspects of physics with applications to modern scientific world and focuses on recent trends in science and technology. This interdisciplinary knowledge which includes quantum computing, semiconductors, lasers, wave optics, optical fibers and nanomaterials encourage an understanding of technological applications of Physics. It's importance as a subject of social and industrial relevance enable the students to solve various engineering problems.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8006.1. Analyze the properties of quantum computers by quantum physics.
A8006.2. Apply wave property of light to study different optical phenomenon.
A8006.3. Interpret the charge carrier dynamics in semiconductors.
A8006.4. Develop communication systems by means of lasers and optical fibers.
A8006.5. Analyze the principles of nanoscience and technology for electronic applications.

3. Course Syllabus

Quantum Mechanics and Quantum Computing: Introduction to quantum physics, Blackbody radiation, Photoelectric effect, de-Broglie hypothesis, G.P. Thomson experiment, Concept of wave function, Heisenberg uncertainty principle, Time independent Schrödinger wave equation, One-dimensional potential box, Introduction to quantum computing, Bits and qubits, Classical and quantum logic gates, Interference and quantum entanglements, quantum teleportation and cryptography, IBM quantum, Application of quantum computers.

Wave optics: Waves and wavefronts, Huygens' principle, Superposition of waves, Constructive and destructive interference, Interference of light by Wavefront splitting – Young's double slit experiment, Amplitude splitting – Newton's rings, Diffraction: Fraunhofer and Fresnel diffraction, Diffraction of light at single slit, Diffraction grating – Intensity distribution of light.

Semiconductors and Devices: Intrinsic and extrinsic semiconductor, Density of states, Fermi-Dirac distribution function, Carrier concentration in intrinsic semiconductor, Direct and indirect bandgap semiconductor, Structure, Working principle and Characteristics of P-N junction diode, Hall effect, Light Emitting Diode (LED) and Solar cell.

Lasers and Optical fibers: Introduction to lasers, Einstein's coefficients, three and four level laser systems, Ruby laser, He-Ne laser, Semiconductor laser, Applications of lasers, Introduction to optical fibers, Structure of optical fiber, Total internal reflection, Step index and Graded index optical fibers, Acceptance angle - Numerical aperture, Optical fibers in communication System, Applications of optical fibers.

Nanoscience: Introduction of nanomaterials, Surface area to Volume ratio, Quantum confinement, Top-down fabrication: Ball milling and Chemical Vapor Deposition (CVD) methods, Bottom-up fabrication: Sol-Gel and Combustion methods, Characterization techniques: X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Applications of nanomaterials.

4. Books and Materials

Text Books:

1. Pandey, B. K. and Chaturvedi, S., Engineering Physics, 1st Edition, New Delhi: Cengage Learning India Pvt. Ltd, 2013
2. Bernhardt, Chris., Quantum computing for everyone, MIT Press, 2019.

Reference Books:

1. Palanisamy, P.K, Engineering Physics, 1st Edition, Scitech Publications, 2013
2. David Halliday, Jearl Walker, Robert Resnick, David G. Rethwisch, William D. Callister, Engineering Physics, 6th Edition, Wiley India Pvt Ltd, 2006
3. Brij Lal and Subrahmaniyam, A textbook of Optics, 23rd Edition, S Chand, 2006.

Course Structure

A8204 - Basic Electrical Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	2	40	60	100

1. Course Description

Course Overview

Basic Electrical Engineering course serves as a theoretical foundation aimed at enriching students' understanding of electric circuits, DC and AC machines, while fostering analytical abilities. This course delves into the foundational concepts and methodologies integral to Electrical Engineering, covering various aspects such as electrical circuits, network theorems, and operational principles of key components including DC machines (motors and generators), Transformers, Induction motors, and Synchronous generators.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8204.1 Apply DC circuit principles, network reduction techniques, and theorems to solve Complex DC circuits.

A8204.2 Analyze single-phase AC circuits using sinusoidal waveforms, average and RMS values, and j-notation.

A8204.3 Analyze 1-phae transformer principles, construction, EMF equation, and no-load and on-load conditions.

A8204.4 Analyze the operation and characteristics of DC generators and motors, including EMF and torque equations.

A8204.5 Evaluate the construction, operation, and torque characteristics of three-phase induction motors and synchronous generators.

3. Course Syllabus

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law, KVL and KCL, Types of sources, Source transformation, Network reduction techniques (Series, Parallel and Star-Delta), Mesh and Nodal analysis, Superposition theorem, Thevenin's and Norton's theorems (DC Excitation only) - Numerical problems.

AC Circuits: Representation of sinusoidal waveforms, Average & RMS value, Peak factor, Form factor, j- notation, Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series circuits only) - Numerical problems.

Single Phase Transformers: Working principle and constructional details, Types-Core and Shell type transformers, EMF equation, Transformer operation on NO load and ON load Conditions - Numerical problems on EMF equation.

DC Machines: D.C. Generators - Construction, Principle of operation, E.M.F. equation, Methods of excitation - Separately excited and Self-excited generators- Numerical problems on EMF equation. D.C Motors – Principle of operation, Concept of Back E.M.F., Torque equation, Torque-Speed characteristics of DC Shunt motor - Conceptual description only.

AC Machines: Generation of rotating magnetic fields, Construction and working of a three-phase Induction motor, Concept of slip, Torque production- Starting and Running torques, Torque-Slip characteristics - Numerical problems on slip. Construction of Synchronous generator-Salient pole and Non-salient pole generators, Working principle of synchronous generator, No-Load Characteristics - Conceptual description only.

4. Books and Materials

Text Books:

1. William Hart Hayt, Jack Ellsworth Kemmerly, Steven M. Durbin(2007), Engineering Circuit Analysis, 9th Edition, McGraw-Hill Higher Education, New Delhi, India.
2. B.L. Theraja, A.K. Theraja, A text book of Electrical Technology,(Vol 1&2), S. Chand Publishers, New Delhi.

Reference Books:

1. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 3rd Edition, Tata Mc-Graw Hill, 2010.
2. D.C. Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill, 2009.
3. L.S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.

Course Structure

A8505 - Data Structures

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Data Structures is a course for an engineering graduate to improve the programming skills using C Language. It is a logical model of organizing data, used in designing and implementing efficient algorithms. Data structures are important as they are implemented in every software application. This course covers various operations on Singly Doubly Linked Lists. The linear data structures stacks and queues are implemented using both arrays and linked lists. The course also includes fundamental terminology of non-linear data structures like Trees and Graphs which are especially used to handle large amount of data. The course will also enable the use of appropriate searching and sorting method in handling collection of elements.

Course Pre/co-requisites

A8501 - Problem Solving through C

A8502 - Problem Solving through C Laboratory

2. Course Outcomes (COs)

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

A8505.1. Select appropriate sorting and searching technique for a given application.
A8505.2. Use various forms of linked lists to perform operations on data efficiently.
A8505.3. Build applications using stack data structure for real time applications.
A8505.4. Construct various forms of Queues to solve a real time problem.
A8505.5. Make use of nonlinear data structures for organizing data.

3. Course Syllabus

Searching and Sorting: Asymptotic Notations, Time Complexity and Space Complexity of algorithms, Introduction to Searching, Linear search and Binary search. Introduction to Sorting, Bubble sort, Selection sort, Insertion sort, Merge Sort and Quick sort.

Dynamic Memory Allocation and Linked Lists: Introduction, Dynamic Memory Allocation Functions: malloc, calloc, free and realloc. Self-Referential Structures. Linked List-

Introduction, Basic Terminologies, Linked Lists versus Arrays, Operations on Singly Linked Lists and Doubly Linked Lists. (Create, insert, delete, reverse, display and count).

Stacks: Introduction, Array and Linked List representation of Stacks, Operations on Stack using Array and Linked List. Applications of Stacks: Infix to Postfix conversion, Evaluation of Postfix Expression.

Queues: Introduction, Array and Linked List representation of Queues, Operations on Queue using Array and Linked List. Circular Queue and Deque implementation using arrays.

Trees and Graphs: Introduction to Trees, Basic Terminologies, Representation of Binary Tree and Tree Traversal Techniques- Pre order, In order and Post order. Introduction to Graphs, Graph Terminology, Directed Graphs, Non Directed Graphs, Representation of Graphs.

4. Books and Materials

Text Books:

1. Reema Thareja., Data Structures Using C, 2nd Edition, Oxford University Press, New Delhi India, 2014.

Reference Books:

1. Samanta Debasis., Classic Data Structures, 2nd Edition, Prentice Hall of India, New Delhi, India, 2012.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed., Fundamentals of Data Structure in C, 2nd Edition, University Press, India, 2008.

Course Structure

A8701 – Foundations of Data Science

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	2	40	60	100

1. Course Description

Course Overview

Data Science is exponentially growing field which consists of a set of tools and techniques used to extract useful information from Data. This course helps students, to provide strong foundation for data science and application area, related to it and understand the underlying core concepts and emerging technologies in data science.The term "Artificial Intelligence (AI)" has also become ubiquitous in everyday applications from virtual assistants to self-driving cars. So Here Fundamentals of Artificial Intelligence , Machine Learning and its Algorithms are also discussed.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8701.1. Analyze and interpret data using an ethically responsible approach
A8701.2. Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.
A8701.3. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges.
A8701.4. Identify the need and applications of artificial intelligence in real time.
A8701.5. Explain the features of machine learning to apply on real world problems.

3. Course Syllabus

Introduction: What is Data Science, Where Do We See Data Science, How Does Data Science Relate to Other Fields, The Relationship between Data Science and Information Science, Computational Thinking, Skills for Data Science, Tools for Data Science, Issues of Ethics, Bias, and Privacy in Data Science.

Data Collection and Data Pre-Processing: Introduction, Data Types-Structured Data, Unstructured Data, Challenges with Unstructured Data, Data Collections- Open Data, Social Media Data, Multimedia Data, Data Storage and Presentation, Data Pre-processing-

Data Cleaning, Data Integration, Data Transmission, Data Reduction, Data Discretization.

Exploratory Data Analytics: Introduction, Data Analysis and Data Analytics, Descriptive Analysis- Variables, Frequency Distribution, Measures of Centrality, Dispersion of a Distribution. Diagnostic Analytics-Co-relations Predictive Analytics, Perspective Analytics, Exploratory Analysis, Mechanistic Analysis- Regression.

Introduction to AI Tools: : Definition of AI, Why AI, Difference between Symbolic and Non-Symbolic Representation, Research Focusses of Artificial Intelligence. History of AI:Turing Test, Chinese Room. Applications of AI:Natural Language Processing, Intelligent Retrieval from Databases, Expert Systems, Neural Architectures. Objectives of AI, Criticism of AI, Future of AI.

Introduction to Machine Learning: Types of Human Learning,What is Machine Learning,How do machines learn,Well posed learning problem. Types of Machine Learning:Supervised Learning, Unsupervised Learning, Reinforcement Learning, Comparison:Supervised, Unsupervised Learning and Reinforcement Learning. Applications of Machine Learning, Tools in Machine Learning, Issues in Machine Learning.

4. Books and Materials

Text Books:

1. Chirag Shah, "A Hands on Introduction to Data Science", Cambridge University Press 2020
2. Rajendra Akerkar., Introducion to Artifical Intelligence, PHI, 2nd Edition, 2014
3. Amit Kumar Das, Saikat Dutt, Subramanian Chandramouli., Machine Learning, Pearson India Education Services, 1st Edition, 2018.

Reference Books:

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
3. Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.

Course Structure

A8007 - Applied Physics Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Applied Physics Laboratory covers the concepts of semiconductors, communication systems and wave optics. These experiments have number of applications and are valuable tool in the arsenal of engineers across multiple domains. This course also makes students familiar with the instrumental methods and various electrical properties of semiconducting devices. This basic knowledge will enable the scientific fervor to solve various engineering problems.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8007.1. Evaluation of properties of light radiation by wave optics.
A8007.2. Interpret the principles of semiconductors.
A8007.3. Determine the properties of laser light and estimate losses in optical fibre.
A8007.4. Analyze the VI characteristics of LED and solar cell.
A8007.5. Apply resonance principle to calculate frequency of AC supply.

3. List of Experiments

1. Determination of the wavelength of Sodium light by Newton's rings method.
2. Determination of wavelengths of spectral lines of Mercury (Hg) source using diffraction grating.
3. Determination of threshold voltage and study the V-I characteristics of LED.
4. To Study the V-I characteristics of PN junction diode under Forward and Reverse bias conditions.
5. Verification of the type of semiconductor material by estimating the density of majority carriers using Hall Effect.
6. Determination of the energy bandgap of a given semiconductor.
7. Determination of quality factor of solar cells and it's V-I Characteristics.

8. Determination of the wavelength of a given source of Laser light using plane transmission grating.
9. Evaluation of the numerical aperture (NA) and transmission losses of a given optical fiber.
10. Evaluation of frequency (n) of an AC supply, using Sonometer.

4. Laboratory Equipment/Software/Tools Required

1. Newton's Ring kit
2. Spectrometer
3. Regulated power supply (DC and AC)
4. Hall Effect Setup
5. Light Emitting Diode Kit
6. Solar cell Kit
7. Sonometer Setup
8. Semiconductor Laser Source
9. Plane diffraction grating
10. Optical fiber trainer kit
11. Meters - Ammeter, Voltmeter, Digital Multimeter
12. Diodes, Resistors, Capacitors, Bread Board

5. Books and Materials

Text Books:

1. Sushil Kumar Jain, Majeet Singh, Applied Physics Experiments, JBC Press, 2013

Reference Books:

1. S B Mal, Er. Ashish Jesuja Practical Physics for Engineering Students of B.Tech, JBC Press, 2015
2. Applied Physics Laboratory Manual, Department of Physics, VCE 2022

Course Structure

A8205 - Basic Electrical Engineering Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

The Basic Electrical Engineering Laboratory provides students with practical hands-on experience to deepen their understanding of electric circuits, DC and AC machines, and to foster the development of analytical skills. This course delves into the fundamental concepts and methodologies underpinning Electrical Engineering, covering various aspects such as electrical circuits, network theorems, and the principles and operating conditions of DC machines (motors and generators), Transformers, Induction motors, and Alternators. Through practical applications and experimentation, students engage in active learning to solidify their comprehension and proficiency in the field of Electrical Engineering.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8205.1. Analyze and demonstrate the application of Ohm's Law and Kirchhoff's Laws in DC and AC circuits.

A8205.2. Demonstrate practical application and evaluation skills by analyzing and verifying Superposition, Thevenin's, and Norton's theorems in provided circuits.

A8205.3. Analyze and interpret the torque-speed and performance characteristics of DC motors to evaluate their operational efficiency.

A8205.4. Analyze the open-circuit, short-circuit, and performance test results of transformers and AC machines to assess their key parameters and operational characteristics.

3. List of Experiments

1. Verification of Ohm's Law.
2. Verification of KVL and KCL.
3. Verification of Super position theorem.
4. Verification of Thevenin's theorem.
5. Verification of Norton's theorem.

6. Calculations and Verification of Impedance, Voltage and Current of series RL and series RC circuits.
7. OC and SC Tests on Single Phase Transformer.
8. Measurement of transformation ratio of Single Phase Transformer.
9. Torque-Speed Characteristics of a DC Shunt Motor.
10. Torque-Speed Characteristics of 3-phase Induction Motor.
11. Performance Characteristics of a Separately Excited DC Motor.
12. No-Load Characteristics of a Three-phase Alternator.

4. Laboratory Equipment/Software/Tools Required

1. Bread Boards, Resistors of different values, Regulated Power Supply.
2. 1-Phase Transformer, DC Machines, 3-phase Induction Motor, Alternator.
3. Voltmeter, Ammeter, Tachometer, Rheostats and Watt meters (LPF and UPF).

Course Structure

A8301 - Engineering Workshop

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Engineering Workshop is an establishment of space and facility where the students acquire the knowledge on different materials, equipment, tools and workshop practices that are the core methods of engineering industry. This course is of prime importance which makes the learner competent in handling practical work in all types and trades of engineering. It also develops the skills with dignity of labour, precision, safety at work place, team working innovative ideas in making and development of right attitude.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8301.1. Identify the trade based materials and tools to prepare the models.
A8301.2. Illustrate each trade and tool by hands on training in making the models.
A8301.3. Apply different workshop practice methods towards workshop models.
A8301.4. Analyze the trade based operations in the process of product development.
A8301.5. Develop a progressive product towards a societal need.

3. Course Syllabus

PART – A (Demonstration)

1. CNC Machining.
2. Additive Manufacturing with one Model.
3. Power Tools, Plastic Moulding, Metal Casting.
4. Welding (TIG/MIG, Gas Welding), Brazing.

PART - B (Practical)

1. Fitting : L - Fit / V - Fit / Square – Fit / Semi Circular - Fit.
2. Carpentry : Cross Lap Joint / Dovetail Joint / T – Lap Joint / Corner Lap Joint.
3. House wiring : Series / Parallel / One Bulb One Switch / Tube Light / Two-way switch.

4. Welding : Butt Joint / Lap Joint / T Joint .
5. Foundry : Single Piece / Multi Piece.
6. Tin Smithy : Open Scoop / Funnel / Rectangular Tray / Cylindrical
7. Plumbing : Pipe Threading / Pipe Joints.

Note: Minimum one experiment from each Trade with total of 12 Experiments

4. Laboratory Equipment/Software/Tools Required

1. Fitting : Bench vise, Hacksaw frame, Calipers, Files, Try Square
2. Carpentry : Carpentry vise, Chisels, Saws, Wooden Hammer, Try Square
3. House wiring : Wiring Bundles, Socket Pins, Tester, Poker, and Cutting Plier
4. Welding : Welding M/c, Safeguards, Chipping Hammer, Electrode Holder
5. Foundry : Wooden patterns, Riddle, Riser, Runner, Gate cutter, Rammers
6. Tin Smithy : Wire Gauge, Snips, Pliers, Steel rule, Soldering kit, Nylon Hammers.
7. Plumbing : Pipe Wrench, Pipe Cutter, Pliers, Pipe Die Set
8. Additional : Model Joints and Electric Boards

Course Structure

A8507 - Data Structures Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Data Structures laboratory course provides implementation of linear and nonlinear data structures to organize data efficiently. Data structures are important as they are implemented in every software application. This course covers various operations on Singly Linked Lists and Doubly Linked Lists. The linear and nonlinear data structures are implemented using both arrays and linked lists. The course will also enable the use of appropriate searching and sorting method in handling collection of elements. The course is basis for data structures implementation in various programming languages.

Course Pre/co-requisites

A8501 – Problem Solving through C

A8502 – Problem Solving through C Laboratory

2. Course Outcomes (COs)

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

A8507.1. Implement various searching and sorting techniques on a given data.
A8507.2. Organize data efficiently using linked lists.
A8507.3. Perform various operations on data structures using arrays and linked lists.
A8507.4. Write programs to traverse tree using linked list.

3. List of Experiments

1. Write a C Program to Implement Linear Search and Binary Search.
2. Write a C Program to Implement Bubble Sort and Selection Sort.
3. Write a C Program to Implement Insertion Sort and Quick Sort.
4. Write a C Program to Implement Merge Sort.
5. a) Write a C program to Read an array of integers whose size will be specified interactively at rum time and print those elements.
   b) Write a C program to Illustrate Self Referential Structures.
6. Write a C program to implement Singly Linked List Operations: Creation, Insertion, Deletion, Reverse, Count and Traversal.

7. Write a C program to implement Doubly Linked List Operations: Creation, Insertion, Deletion, Count and Traversal.
8. Write a C program to implement Stack operations using Arrays.
9. Write a C program to implement Stack operations using Linked List
10. a) Write a C Program to implement to convert an expression from Infix to Postfix.
    b) Write a C Program to Evaluate arithmetic expression.
11. a) Write a C program to implement Queue operations using Arrays.
    b) Write a C program to implement Queue operations using Linked List.
12. Write a C program to implement Circular Queue operations using Arrays.

13. Write a C program to implement Deque operations using Arrays.
14. Write a C Program to Implement Traversals on Binary Tree using linked list.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open Source/ Freeware)
2. GCC Compiler (Open source / Freeware).

Course Structure

A8508 - Python Programming Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

As an introductory course common to all branches, the student will be able to learn problem solving skills using 'PYTHON' programming language, which is a pre-requisite to learn many other programming Languages. The purpose of this course is to provide the basic programming methodology in Python. This course will enable the students to learn programming skills necessary to implement all the basic mathematical, scientific and real world applications. Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. This course will give the foundation for a beginner to develop computer programmes effectively.

Course Pre/co-requisites

A8502 - Problem Solving through C Laboratory

2. Course Outcomes (COs)

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

A8508.1. Use expressions and control statements for solving a given problem.
A8508.2. Build programs on sequence of characters using string operations and built in functions.
A8508.3. Implement fundamental data structures for manipulating data.
A8508.4. Build user defined functions and modules to improve code reusability.

3. Course Syllabus

Introduction to Python Programming: Introduction to Python, Features of Python, Identifiers, Reserved Words, Data Types, Variables and Constants, Input / Output Statements, Type Casting, Operators, Operator Precedence and Associativity, Expressions Evaluation.

Control Statements: Conditional Statements –if, if-else, if-elif-else. Iterative Statements –for, while. Jump / Transfer Statements –break, continue, pass.

Strings and Operations: String definition, Slicing, Mathematical Operations on Strings, Checking Membership, Comparison, Formatting Strings, Built in Functions and Methods.

Data Structures and Operations: Sequence, Lists, Tuple, Set and Dictionary – Definition, operations and functions.

Functions and Modules: Introduction, Function Definition, Function call, Type of Arguments, Return Statement, Recursive Functions, Lambda function, Range, Modules.

4. List of Experiments

1. Introduction to Python Lab : Installation and Simple Output Display.
   a) Write a python program to read a string "Python Programming" and display it on the screen.
   b) Write a python program to read integer, float & string values and display them on the screen..
2. Programs using Input Output Statements, Variables and Expressions.
   a) Write a python program to read a float value and convert Fahrenheit to Centigrade.
   b) Write a python program to find the area of triangle.
   c) Write a python program to read the Marks in 4 Subjects and Display the average. .
3. Programs using various operators in Python.
   a) Write a python program for demonstrating the usage of comparison operators
   b) Write a python program to swap / interchange two numbers.
   c) Write a python program for demonstrating the usage of unary, shift, logical, membership and identity operators. .
4. Programs using Conditional Statements.
   a) Write a python program to check a given number is Even or Odd.
   b) Write a python program to find the greatest of 3 integer numbers.
   c) Write a python program to demonstrate nested if statement.
5. Programs using Iterative Statements.
   a) Write a Python program to reverse the digits of a given number.
   b) Write a Python program to find the factorial of a given number.
   c) Write a python program to display factors of a given integer number.
6. Programs using Iterative Statements.
   a) Write a python program to print Fibonacci numbers.
   b) Write a python program to display all prime numbers between 0 to n.
7. Programs using Strings and Its Operations. Write a program that asks the user to enter a string and perform the following:
   i) The total number of characters in the string.
   ii) Repeat the string 10 times.
   iii) The first character of the string. iv) The first three characters of the string.
   v) The last three characters of the string. vi) The string in backwards.
   vii) The seventh character of the string if exist otherwise display a message "Not exist".
   viii) The string with its first and last characters removed.

ix) The string into capital case. x) The string with everya replaced with ane.
xi) The string with every letter replaced by a space.

8. Programs using Python Data Structures (Lists).Write a Python program to perform following operations on a list of integers.
   i) Print the total number of items in the list.
   ii) Print the last item in the list. iii) Print the list in reverse order.
   iv) Print Yes if the list contains a 5 and No otherwise.
   v) Print the number of occurrences of a element in the list.
   vi) Remove the first and last items from the list and sort the remaining items.
   vii) Print how many integers in the list is less than a given value.
   viii) Print the average of the elements in the list.
   ix) Print the largest and smallest value in the list.
9. Programs using Python Data Structures (Dictionary).
   a) Write a python program for demonstrating the creation of dictionary, accessing dictionary elements, modifying dictionary elements, finding length and possible operations.
   b) Write a python program to create a dictionary of students with keys as roll numbers and values as names. Perform operations like insert, update and modify student data.
10. Programs using Python Data Structures (Tuples and Set).
    a) Write a python program to demonstrate various operations on tuples.
    b) Write a python program to demonstrate various operations on sets. .
11. Programs using User Defined Functions.
    a) Write a python program to find factorial of a given number using function.
    b) Write a python program to find factorial of a given number using Recursive function.
12. Programs using Modules.
    a) Write a Python program to display the date and time using the Time module.
    b) Write a Python program that prints the calendar of a particular month.

5. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. Python and Python IDE (Open Source/ Freeware)

6. Books and Materials

Text Books:

1. Reema Thareja., Python Programming using Problem solving Approach. Oxford University Press, New Delhi India, 2017.

Reference Books:

1. Timothy A Budd. Exploring Python, Tata McGraw Hill Education Private Limited. New Delhi India, 2011.
2. Mark Lutz., Learning Python,5th Edition,O'Reilly, USA, 2015.

Course Structure

A8022 - Engineering Exploration

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This Course provides an opportunity for freshman students to learn in new ecosystem and is one of the unique outcomes of innovative education ecosystem in digital era of our nation. The focus of this course is on Engineering Design Process, Problem Solving, Multi-disciplinary skills, Ethics and Data Acquisition and Analysis. This course is co-designed and co-taught by faculty members drawn from multiple engineering disciplines; it follows Project Based Learning (PBL) pedagogy with need statements covering broad themes of environmental, educational, smart appliances, smart agriculture, industrial needs etc. are used by students to carve out problem definitions by linking Sustainable Development Goals defined by United Nation. Students work in teams to solve identified problems and serves as a platform for peer learning and push students in Multi-disciplinary design thinking in first year itself.

Course Pre/co-requisites

A8021 - Social Innovation

2. Course Outcomes (COs)

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

A8022.1 Compare and contrast the contributions of different types of engineers in the development of a product, process, or system.

A8022.2 Apply the common engineering design process to solve complex problems and arrive at viable solution.

A8022.3 Explore various contemporary software and hardware tools to provide solutions for the problems.

A8022.4 Apply skills needed for successful teamwork including the basics of project management and written and oral communication.

A8022.5 Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

3. Course Syllabus

Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.

Engineering Design Process: Design Cycle, Multidisciplinary facet of design, Importance of analysis in engineering design, general analysis procedure, generation of multiple solution, decision matrix, Concepts of reverse engineering and general mechatronics system.

Introduction to Open-source Platforms: Open-source hardware & software tools, Development (Arduino) of Programming (Tinker CAD Tools) and its Essentials, Introduction to Sensors, Transducers and Actuators and its Interfacing with Open-Source H/W & S/W tools.

Engineering Ethics: Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers. Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment.

Project Management & Tools: Introduction, Significance of teamwork, Importance of communication in engineering profession, Checklist, Timeline, Gantt Chart, Significance of documentation.

4. Laboratory Equipment/Software/Tools Required

1. Open-source Hardware: Microchip ATmega328P (UNO/NANO/MEGA).
2. I/O Peripherals: LCD, Keypad, DC/Servo Motor, Switch, 7-Segment LED modules, GSM, GPS etc.
3. Sensor Tool Kit:Digital RED/WHITE/GREEN/BLUE Light Module, IR, Analog Sound, Soil Moisture, LM35 Analog Linear Temperature, MQ7 Analog Carbon Monoxide etc.
4. Open-source Software: Arduino IDE Version 1.8.5.

5. Books and Materials

Text Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, Exploring Engineering: An Introduction to Engineering and Design, Academic Press, 3rd Edition, 2012.
2. Byron Francis, Arduino: The Complete Beginner's Guide, Create space Independent Publishers, 2016.

3. M. Govindarajan, S. Natarajan & V. S. Senthil Kumar, Engineering Ethics, 1st Edition, Phi Learning, 2009.

Reference Books:

1. Neerparaj Rai, Arduino Projects for Engineers, 1st Edition, BPB Publications, 2016.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, 2nd Edition, McGraw-Hill Education, 2016.
3. W. Richard Bowen, Engineering Ethics – Outline of an aspirational approach, Springer London.

II YEAR I SEMESTER

Course Structure

A8005 - Computer Oriented Statistical Methods

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

This course provides a solid undergraduate foundation in both probability distributions and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the field of multidisciplinary engineering applications. The mathematical skills sustained from this course form a suitable base to analytical and theoretical concepts encountered in engineering profession.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8005.1. Identify an appropriate probability distribution for a given discrete or continuous random variable and compute probabilities.

A8005.2. Make use of probability distributions to analyze and solve a given problem.

A8005.3. Interpret correlation coefficient in context and study regression analysis and apply statistical methods for analyzing experimental data.

A8005.4. Inspect scientific hypothesis and estimate confidence intervals at different levels.

A8005.5. Compute P-value of a test statistics using component of hypothesis test.

3. Course Syllabus

Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Baye's Rule. **Random Variables and Probability Distributions:** Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions.

Discrete and Continuous Distributions: Discrete Distributions: Binomial Distribution, Poisson Distribution, Continuous Distribution: Uniform Distribution, Normal Distribution,

areas under the Normal Curve, applications of the Normal Distribution.

Correlation and Regression: Scatter diagram, Positive and Negative correlation, limits for coefficient of Correlation, Karl Pearson's coefficient of correlation, Spearman's Rank correlation, Regression Analysis-Concept, least square fit of a linear regression, two lines of regression, Properties of regression coefficients.
Fundamental Sampling Distributions: Random Sampling, some Important Statistics, Sampling Distributions, Sampling Distribution of means and the Central Limit Theorem, t - Distribution, F-Distribution.

Estimation and Testing of Hypothesis for Large samples: Point estimation, Maximum error estimate, Interval Estimation, Introduction to Hypothesis, Level of significance, one tailed and two tailed test, Test concerning one mean and one proportion, Two means and two Proportions.

Testing of Hypothesis for Small samples: Test for single mean, difference of means and paired t-test, Test for ratio of variances (F-test), Chi-square test for goodness of fit and independence of attributes.

4. Books and Materials

Text Books:

1. Gupta,S.C. and Kapoor,V. K.Fundamentals of Mathematical statistics, 10th Revised Edition, S Chand & Sons, New Delhi, 2000.
2. Grewal, B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.

Reference Books:

1. T.T. Soong, Fundamentals of Probability and Statistics For Engineers, John Wiley & Sons, Ltd, 2004.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations
3. Iyengar, T.K.V. Probability and Statistics, S Chand Publications, 2015.

Course Structure

A8509 - Discrete Mathematical Structures

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course will provide the Mathematical fundamentals needed to understand computer applications. This course will be begun by covering the mathematical concepts necessary in the study of propositional and predicate logic. Next, it covers the concepts of relations and ordering to study and construct the lattices. Further, it discusses the concepts of algebraic systems like semi groups and groups. Then move on to the recurrence relations which helps in writing efficient code. Finally, it covers the topics of graph theory to analyze the complex structures using the concepts of planar, Euler graphs and chromatic number.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8509.1. Identify the importance of statements and predicate calculus in deriving valid inferences.
A8509.2. Use relations and ordering methods to identify the relationship among the elements in the system.
A8509.3. Select suitable algebraic systems to find solutions for real time problems..
A8509.4. Apply the concepts of counting, inclusion and exclusion principle to solve portioning problems in computer algorithms
A8509.5. Examine Graph concepts, Recurrence relations and computing methods to solve complex problems with improved efficiency

3. Course Syllabus

Propositional Logic: Statements and Notation, Connectives, Well-formed formulas, Tautologies, Equivalence of formulas and Tautological implications, Rules of Inference, Consistency of Premises, Direct and Indirect method of proof, Predicates, the statement functions, Variables and Quantifiers (Single and Multiple), Free and Bound Variables.

Relations and Ordering: Basics of Relations, Relation Matrix and Digraphs, Properties

of Binary Relations on a Set, Equivalence Relations, Partial Ordering Relations, Hasse diagrams. Lattices as Partially Ordered Sets, Definitions and Examples, Properties of Lattices, Some Special Lattices.

Algebraic Structures: Algebraic Systems: Definitions and Examples, Simple algebraic systems and General properties. Semi groups and Monoids: Definitions and Examples. Groups and subgroups: Definitions and Examples.

Elementary Combinatorics: Basics of Counting, Combinations and Permutations with Repetitions and Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems (Without Proofs), The Principle of Inclusion- Exclusion for two and n-sets.

Recurrence Relations and Graph Theory: Recurrence Relations- Solving Recurrence Relations by Substitution, The method of characteristic Roots, Solutions of Linear Homogeneous and Inhomogeneous recurrence relations. Basic Concepts of Graphs, Adjacency Matrix, Isomorphism and Subgraphs, Planar Graphs, Euler Circuits, Hamiltonian graphs, Graph Coloring, Chromatic Numbers.

4. Books and Materials

Text Books:

1. J. P. Trembly, R. Manohar., Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, India,2008.
2. Joe L. Mott, Abraham Kandel, Theodore P. Baker., Discrete Mathematics for Computer Scientists and Mathematicians, 2nd Edition, Prentice Hall of India Learning Private Limited, New Delhi, India,2009.

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 7th Edition, Tata McGraw Hill, India, 2017.

Course Structure

A8601 – Object Oriented Programming

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive coverage of theory and practice of OOP concepts using Java. The course focuses on different aspect of core Java Environment suitable to write efficient, maintainable, and portable code for real world application. It provides strong foundation on OOP Principles, Packages, and Interfaces and also illustrates Exception Handling and Multithreaded mechanisms. The course provides In depth knowledge to implement Collection framework. Emphasis on AWT and Swing concepts used for GUI applications is given with event handling. The course plays a vital role in developing front-end interface for Mini and Major Projects.

Course Pre/co-requisites

A8501 - Problem Solving through C

A8505 - Data structures

2. Course Outcomes (COs)

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

A8601.1 Make use of various constructs to write a console application.
A8601.2 Apply principles of OOP to develop real time applications.
A8601.3 Examine the applications for Exception Handling and Multithreading.
A8601.4 Implement Collection Framework and Streams to organize and manipulate data efficiently .
A8601.5 Build GUI applications using Swings and event handling.

3. Course Syllabus

Introduction to OOP and Java: Need for OOP paradigm-Difference between Procedural and Object Oriented Programming, OOP Concepts, Java Buzz Words, A Simple Java Program , JVM, Data Types, Variables, Type conversions and Casting, Operators, Control statements and Arrays. Encapsulation-Class, Objects, Methods and Constructors, this keyword, static keyword, Overloading-Methods and Constructors, Argument passing, String class and StringBuffer.

Inheritance, Packages and Interfaces: Inheritance Basics, Using super, Inheritance types, Method Overriding, Dynamic Method Dispatch, Abstract classes, final keyword. Defining and implementing interfaces, Extending interfaces. Packages and Interfaces-Defining a Package, Finding Packages and Class path, Access Protection and Importing Packages.

Exception Handling and Multithreading: Exception-Handling Fundamentals, Exception Types, Using try catch, throw throws and finally keywords, Built-in Exceptions, Creating own exception subclasses. Multithreading: Life cycle of a thread, creating threads, thread priorities, Synchronizing threads, Inter thread Communication.

Collections Framework and Streams: Collections Hierarchy, Collection classes-ArrayList, LinkedList, HashSet, TreeSet, HashMap and TreeMap. Streams Hierarchy, File Streams-FileInputStream and FileOutputStream, FileReader and FileWriter, Performing read, write operations on Files and Serialization. Utilities- StringTokenizer, Arrays class.

Swings and Event Handling: Delegation Event Model, Event Sources, Event Classes, Event Listener Interfaces, Handling Mouse and Keyboard Events, Layout Managers-FlowLayout, BorderLayout, GridLayout and CardLayout. Swings: JFrame, JPanel, JComponent, JLabel and ImageIcon, JTextField, JTabbedPane, Swing Buttons, JScrollPane, JComboBox, JTable.

4. Books and Materials

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, Tata McGraw-Hill Education, 2019.

Reference Books:

1. Y. Daniel Liang, Introduction to Java Programming-Comprehensive Version, 10th Edition, Pearson Education, 2018.
2. Kathy Sierra, Bert Bates , OCA Java SE 8 Programmer, 1st Edition, McGraw-Hill Education, 2017.

Course Structure

A8510 - Operating Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Operating Systems is a graduate-level introductory course that teaches the concepts in operating systems like abstractions, mechanisms, and various services provided. This course deals with Process Management & Synchronization, Inter process communication, Memory Management, Virtual Memory, File & Disk Management and Deadlock handling methods. Using these concepts, the student will be able to understand the internal working of various operating systems. The course provides the concepts and terminology required for advanced courses.

Course Pre/co-requisites

A8506 - Computer Organization

2. Course Outcomes (COs)

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

A8510.1. Identify the services provided by the operating system for user and system.
A8510.2. Examine the concepts of IPC and Synchronization for process cooperation
A8510.3. Make use of Memory Management techniques for efficient use of main memory.
A8510.4. Select File and Disk Management methods for effective storage and access.
A8510.5. Identify a Deadlock Handling Method in allocating resources among processes.

3. Course Syllabus

Operating Systems Overview and Process Management: Definition, Operating System Types, Operating System operations, Operating system services, System calls and System Programs. Process concepts- Process, Process State Diagram, PCB and Operations on processes, Process Scheduling- Scheduling Criteria, Scheduler Types and Scheduling Algorithms.

Process Synchronization: Inter Procee Communication- Pipes, Message Passing and Shared Memory. Concept of Synchronization, Critical section problem, Peterson's solution,

Semaphores, Classic problems of Synchronization-The Bounded Buffer Problem, The Readers –Writers Problem, Dining - Philosophers Problem.

Memory Management: Introduction to Memory Management, Swapping, Contiguous Memory Allocation, paging, segmentation, virtual memory, demand paging, Page-replacement algorithms, allocation of frames, thrashing.

File and Disk Management: Concept of a file – File Attributes, File Types, Access Methods, Directory Structures, File System Implementation, Directory Implementation, File Allocation methods, and Free-Space management. Introduction to Magnetic Disks, Disk Structures, Disk Scheduling, Swap Space Management.

Deadlocks: System Model, Deadlock Characterization-Necessary Conditions, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance - RAG Algorithm, Banker's Algorithm, Detection- Single Instance ofa Resource type, Multiple Instances of a resource type, recovery from deadlock.

4. Books and Materials

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne., Operating System Concepts, 8th Edition, Wiley India Private Limited, New Delhi,2009.

Reference Books:

1. William Stallings., Operating Systems, Internals and Design Principles, 5th Edition, Pearson Education, India, 2006.
2. Sumitabha Das., Your Unix the Ultimate Guide, Tata Mc Graw Hill, New Delhi, India, 2007.
3. T.Chan., Unix System Programming using C++, PHI, India,1996.

Course Structure

A8702 – Artificial Intelligence

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This is an undergraduate course to acquire the ability to design intelligent solutions to problems in a variety of domains and business applications such as natural language Processing, text mining, and robotics, reasoning and problem-solving. AI will focus on problem solving, reasoning, planning and gaming. Through learning problem solving skills can be acquired. The course enables to choose data science domain to implement machine learning and deep learning applications.

Course Pre/co-requisites

A8508-Python Programming Laboratory
A8509-Discrete Mathematical Structures

2. Course Outcomes (COs)

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

A8702.1. Apply AI techniques to solve game playing theorem proving and machine learning.
A8702.2. Apply the propositional logic to AI designs .
A8702.3. Learn different playing and reinforcement learning techniques .
A8702.4. Examine the role of searching strategies in AI environment.
A8702.5. Analyse the constraint satisfaction problems for problem solving.

3. Course Syllabus

Introduction: Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

Adversarial Search : Games, Optimal decisions in games, The minimax algorithm, Alpha–Beta pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking search for CSPs, Knowledge-Based Agents, The wumpus world.

Propositional Logic: Inference and proofs, Proof by resolution, Horn clauses and definite clauses. First-Order Logic : Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning ,Graphs, Analysis of Planning approaches, Hierarchical Planning.

Reinforcement learning: Introduction, passive Reinforcement learning, active Reinforcement learning, Generalization in reinforcement learning. Robotics: Introduction, Robot Hardware, Robot Perception, planning to move, moving Robotic Software Architectures.

4. Books and Materials

Text Books:

1. Stuart J.Russel, Peter Norvig, Artificial Intelligence – A Modern Approach, 3rd Edition, Pearson Education, 2009.

Reference Books:

1. E.Rich and K.Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2008.
2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Pearson Education Private Limited, India, 2001.
3. George F. Luger , Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th Edition, Pearson, 2008.
4. Shivani Goel, Artificial Intelligence, 4th Edition, Pearson Education Private Limited, India, 2009.

Course Structure

A8602 – Object Oriented Programming Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive coverage of theory and practice of OOP concepts using Java. The course focuses on different aspect of core Java Environment suitable to write efficient, maintainable, and portable code for real world application. It provides strong foundation on OOP Principles, Packages, and Interfaces and also illustrates Exception Handling and Multithreaded mechanisms. The course provides In depth knowledge to implement Collection framework. Emphasis on AWT and Swing concepts used for GUI applications is given with event handling. The course plays a vital role in developing front-end interface for Mini and Major Projects.

Course Pre/co-requisites

A8501 - Problem Solving through C

A8505 - Data structures

2. Course Outcomes (COs)

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

A8602.1 Make use of various constructs to write a console application.
A8602.2 Use principles of OOP to develop real time applications.
A8602.3 Examine the applications for Exception Handling and Multithreading.
A8602.4 Implement Collection Framework to organize data efficiently.
A8602.5 Build GUI applications using Swings.

3. List of Experiments

1. Implement Control statements
   a) Read the marks of a student in 4 subjects and find grade.
   b) Program to check a number is Armstrong or not.
   c) Program to display prime numbers from m to n.
2. Implement OOP First principle-Encapsulation
   a) Define a class Rectangle with data member's length and width. Write methods to find perimeter and area of a rectangle.(class and object).
   b) Create a class Account with data members name, acno and balance. Use appropriate

methods to perform various operations like deposit, withdraw, and balance check.

c) Create a class Student with appropriate data and methods using constructor.

3. Implement OOP Second principle–Polymorphism and Arrays.

   a) Create overloaded methods to find volume of Sphere, Cylinder and Cone.

   b) To sort given list of elements in ascending order.

   c) Read two matrices of size mxn, pxq, perform the multiplication of matrices.

4. Implement programs using Java String Class.

   a) Check a string is palindrome or not.

   b) Given a string and a number n , return a string made of n repetitions of the last n characters of the string.

   repeatEnd("Hello",3) "llollollo ,

   repeatEnd("Hello",2) "lolo" ,

   repeatEnd("Hello",1) "o"

   c) A "triple" in a string is a character appearing three times consecutively. Write a program to return number of triples in the given string, the triples may overlap.

   countTriple("abcXXXabc") 1 ,

   countTriple("xxxabyyyycd") 3 ,

   countTriple("a") 0

   d) Read array of City names and Sort in dictionary order.(Ascending order).

5. Implement OOP Third principle-Inheritance.

   a) Declare a class called Employee having employee-id and employee-name as members. Extend class Employee to have a sub class called Salary having designation and monthly-salary as members.

   Define the appropriate constructors and methods, use this and super keywords, display the employees drawing salary more than 30000.

   b) Write a Java program that create an abstract base class Shape with two members base and height, a member function for initialization and a function to compute shapeArea(). Derive two specific classes Triangle and Rectangle which override the function shapeArea(). Write a driver classes (main) to display the area of the triangle and rectangle.(Use super keyword).

6. Implement Packages and Interfaces.

   a) Create a Package Measure; in which store a class named Convertor that contains methods to convert mm to cm, cm to m and m to km. Define a class Need-Convertor that imports the Convertor class, now store Need-Convertor outside the package Measure. Perform path settings accordingly.

   b) Write a Java program that implements an interface Student which has two methods displayGrade() and attendance(). Implement two classes PG-Student and UG-Student

with necessary inputs of data.

7. Implement Exception Handling.
   a) Read two integers as strings Num1 and Num2 to perform division. The program throw a Number Format Exception if Num1 or Num2 cannot be converted to integers and If Num2 is Zero throw an Arithmetic Exception. Display the exception message.
   b) In the CustomExceptionTestclass, the age is expected to be a positive number. It would throw the user defined exception NegativeAgeException if the age is assigned a negative number.
8. Develop applications on Multithreaded Programming.
   a) Create a multithreaded java program by creating a subclass of Thread and then creating, initializing, and staring two Thread objects from your class. The threads will execute concurrently and display "Java is object oriented" in console window.
   b) Write a program to implement thread synchronization using synchronized block and synchronized method.
   c) Implement the concept of Bounded Buffer problem using Inter thread communication.
9. Implement Collection Framework
   a) Use an ArrayList to manage Employee objects for insertion, display and remove.
   b) Use HashSet to organize list of products and perform operations on them.
10. Implement Collection Framework.
    a) Use a HashMap to access student names using roll number. Perform insert , delete and update operations using rollno.
    b) Use Arrays class to perform the manipulation on array.
11. Implement Mouse and Key events.
    a) Implement MouseListener and MouseMotionListener to handle various mouse events.
    b) Implement KeyListener to handle key events.
12. Develop GUI applications using Swings.
    a) Create a Simple login window to validate a user with name and password.
    b) Using CardLayout design a user interface to access the Programs and Courses offered by the College and use appropriate event handling.
13. Develop GUI applications using Swings.
    a) Create a user interface to insert employee details, Display the data in Text Area.
    b) Create a JTable to display various fields of Student data like RollNo, Name, Branch,Year, Percentage etc.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. JDK (Open Source/Freeware)

Course Structure

A8512 - Operating Systems Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Operating Systems Laboratory is a graduate-level introductory course used to work with various system calls provided in UNIX for Process Management, IPC, Synchronization. This course enables to use utilities for process, memory and file management. The course also allows to write shell script for simulation of UNIX commands and to run own script code. This course provides an environment to practice console based used interface which helps in server side code execution.

Course Pre/co-requisites

A8502- Problem Solving through C Laboratory

A8508- Python Programming Laboratory

2. Course Outcomes (COs)

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

A8512.1. Make use of Unix utilities and System calls for Process, Memory and File Management.
A8512.2. Establish communication among processes using IPC.
A8512.3. Write Shell script to simulate Unix commands and run own script.
A8512.4. Implement the services like Page replacement algorithm and deadlock handling methods

3. List of Experiments

1. Practice commands - like mkdir, rmdir, cat,nl, ls, cp, mv, rm, man.
2. Practice commands - like wc, uniq, comm, cmp, diff, ln, unlink, chmod, du, df.
3. Practice commands - head, tail, sort, grep, egrep, fgrep, cut, paste, join.
4. Process Management System calls fork (), exec () and wait ().
5. a) Two-way Communication using Pipes.
   b) Process Communication using FIFOs.
6. Implement Shared Memory form of IPC.
7. Implement Message Queue form of IPC.
8. Implement Semaphore form of IPC.
9. Simulate cp, head and tail commands.

10. Shell Script programs using Conditional statements.
11. Shell Script programs using Iterative statements.
12. Program to implement FIFO AND LRU Page replacement algorithms.
13. Program to implement FCFS and SSTF Disk Scheduling algorithm.
14. Program to implement Banker's algorithm for Deadlock avoidance.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. GCC Compiler (Open source/ Freeware)

5. Books and Materials

Text Books:

1. Sumitabha Das., Your Unix the Ultimate Guide, Tata Mc Graw Hill, New Delhi, India, 2007.
2. T.Chan., Unix System Programming using C++, PHI, India,1996.

Reference Books:

1. Randal K. Michael, Mastering Unix Shell Scripting 2nd Edition, Wiley, India,2008.

Course Structure

A8801 - Data Visualization Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	40	60	100

1. Course Description

Course Overview

This course is all about addressing today's data-driven world, in visualizing the data graphically. Though its foundations are rooted in statistics, many advanced fields of science are practicing it to explore large volumes of data and to throw deeper insights into the data. The main aim of this course is to give a better understanding of data and make sense of hidden information. Visualizing enormous data using graphics can run all possible unknown stories about data. The course uses some of the open source data Visualization tools.

Course Pre/co-requisites

A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

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

A8801.1 Apply Python libraries to extract data for visualization.
A8801.2 Analyze and select an appropriate plotting for a given data set.
A8801.3 Examine the various graphs on a given data set.
A8801.4 Evaluate the effective utilization of joint plots and heat maps on a given dataset.
A8801.5 Prepare better managing, indexing, and plotting over the index, hierarchical sorting.

3. Course Syllabus

Introduction: Importance of Data Visualization, Visualization Plots-Bar, Pie, His- togram, Box, Line, scatter plots. Working with data: Creating Python-Lists, Tuples, Data Frames. Creating a CSV file, loading a csv file into python Data Frame.

Correlation: Importance of each plot, Correlation-Importance of correlation of variables.

Matplotlib plotting: Visualization of IRIS data-line, Bar, Pie, Histogram, Box, Scatter plots, correlation plots-Heatmaps.

Seaborn plotting: Visualization of Titanic Data-Strip, Box, Swarm, Joint plots, correlation plots-Heatmaps.

Managing, Indexing and Plotting: Using pandas for Data Analysis, Index sorting, Hierarchial indexing, plotting with pandas.

List of Programs for Practice

Plot Various graphs on the following data sets.

1. Students Performance in Exams.
2. 2018 Airplane Flights – Predicting prices of airline flights.
3. E-Learning Student Reactions.
4. Uber Traffic Data Visualization.
5. factors-affecting-campus-placement.
6. Human Resources Data Set.

4. Laboratory Equipment/Software/Tools Required

1. A Computer with Ubuntu Operating System
2. Anakonda, Jupyter Notebook
3. Python 3.X or above version

5. Books and Materials

Text Books:

1. Swapnil Saurav , Data Visualization using Python, Learn and Practice, 2020.

Reference Books:

1. Purna Chandar Rao Kathula., Hands-On Data Analysis And Visualization With Pandas,BPB Publication,2020.
2. https://mksaad.wordpress.com/2020/06/30/datasets-for-visualization.

Course Structure

A8023 - Engineering Design Thinking

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course links the primary fields of engineering, explores the engineering design process from conceptual design and optimal choice evaluation to prototyping for project construction. It also provides insights into particular design challenges within their specific fields of engineering and enables the learners to apply the knowledge in real time - designing, constructing and testing a prototype (actual physical build) to solve a real-world engineering problems. In extent, this course is an excellent roadmap for the design engineers seeking to broaden their engineering knowledge to design concepts to their current work.

Course Pre/co-requisites

A8021 - Social Innovation

A8022 - Engineering Exploration

2. Course Outcomes (COs)

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

A8023.1. Interpret the problem-solving skills and product design skills.
A8023.2. Apply foundational knowledge of the primary fields of engineering and scientific concepts to find sustainable solution.
A8023.3. Customize the HCD model to the traditional engineering design process.
A8023.4. Inspect the design and assess a prototype that solves real engineering problem.
A8023.5. Expound the solutions for identified problems and document the findings/reflections for further design.

3. Course Syllabus

Introduction & Case Studies: Definition of design, design process, different problem types, characteristics of novice and informed designers, enhance negotiation and iteration in design, Recognized organizations for design and innovation, shopping cart case study, benefits of failure in design.

Human Centered Design: Introduction to HCD (Human Centered Design), HCD as a Mindset, personas and scenarios, best practice working with communities.

Development of Specification and prototyping: Definition of specification, three examples of ways to generate specifications, how to manage specifications, functional de- composition, three kinds of prototypes, how prototypes can be used in the design process,how to use prototypes can be used to elicit input from users.

Ideation, Innovation & Creativity in Design: Con- cept Selection, Interpretation of Creativity and Innovation, Brain storming and expanding the design Space, case study using decision matrix.

Design for Robustness: Review the design, Brainstorm potential failure models, List the potential effects of failure & causes for each failure.

4. Laboratory Equipment/Software/Tools Required

1. Computers installed with operating system

5. Books and Materials

Text Books:

1. William C. Oakes, Les L. Leone, and Craig J. Gunn, Engineering Your Future, Okemos, MI: Great Lakes Press, 2004.
2. Crismond, D., Contrasting strategies of beginning and informed designers: One representation of learning progressions in engineering design, 2007.
3. Ryan Jacoby and Diego Rodrigue, Innovation, Growth, and Getting to Where You Want to Go, Design Management Review, Vol. 18 No. 1, Winter, 2007.
4. G.Pahl and W.Beitz, Engineering design: A systematic approach, Springer 2nd Editon.
5. Dean Nieusma, Seeing Social Power: Technology Design for User Empowerment, Great Lakes Press, 2012
6. Avery, C. M., Teamwork is an Individual Skill: Getting Your Work Done When Sharing Responsibility. San Francisco, CA: Berrett-Koehler Publishers, Inc., 2001.
7. Astin, A. W., & Astin, H. S., Leadership reconsidered: Engaging higher education in social change - Battle Creek, MI: W. K. Kellogg Foundation, 2000.

Reference Books:

1. Ali K.Kamrani, Emad Abouel Nasr, Engineering design and Rapid Prototyping, 2nd Edition, Springer, 2010
2. Ken Hurst, Engineering design principles, Elsevier Science, 2nd Edition, 2005.

Course Structure

A8032 - Environmental Science and Technology

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

This course enables the students to engage with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. This course requires that the students should identify and analyze the natural and human-made environmental problems and evaluate the relative risks associated with these problems. It provides the scope to examine alternative solutions for resolving or preventing them. It is essentially a multidisciplinary approach that brings out an appreciation of our natural world and human impact on its existence and irrigational control measures. Its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health, Anthropology, Economics, Statistics, Computers and Philosophy, engineering technology, Integrating sustainable development into their engineering practice.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8032.1. Illustrate the important components of environment.

A8032.2. Identify global environmental problems to come out with best possible solutions.

A8032.3. Make use of environmental laws & environmental ethics for the protection of forest and wildlife..

A8032.4. Apply to maintain harmonious relation between nature and human being and integrating sustainable development goals into their engineering practice.

A8032.5. Analyse the major environmental effects of exploiting natural resources.

3. Course Syllabus

Fundamentals of Environment and Ecology: The multidisciplinary nature of environmental studies, environmental ethics, Global environmental issues, Planetary boundaries, Fundamentals of ecology - ecosystem definition, structure and functions of ecosystem, food

chain and food web, feedback loops, Ecosystem services.

Natural Resources and Management: Classification of resources: Renewable and Non-renewable re- sources. Forest resources: Uses and over exploitation of forests. Dams and their environmental impacts. Water resources: Use and over utilization of surface and ground water, conflicts over water. Energy resources: Renewable energy resources: solar energy, wind energy and geothermal energy. Food resources: Problems with Chemical fertilizers and pesticides. Biofertilizers (organic farming) and their importance. Bio-geo chemical cycles, Socio-ecological systems

Biodiversity and Its Conservation: Introduction and definition. Genetic diversity, species diversity and ecosystem diversity. Values of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option values. Man-wildlife conflicts. In-situ and Ex-situ conservation of biodiversity, Biodiversity Law.

Environmental Pollution and Control: Definition, causes, effects and control measures of Environmental pollution, Air pollution, water pollution, Soil pollution, solid and hazardous waste management, Noise pollution, E-waste, bio-medical waste, Wastewater treatment and emerging pollutants, Standards for Air and Water.

Concept of sustainable development: Sustainable development goals, Carbon footprints, Net-Zero-Emissions, Montreal protocol a success story, Conference of parties (CoP), IPCC, Kyoto protocol, Environmental Acts, Life cycle analysis, Circular Economy, Sustainable Living, Ecological Engineering- ecological restoration, natural and constructed wetlands, nature-based solutions. Case Studies: Mission Kakatiya, Chipko Movement, Water Man of India (Dr. Rajendra Singh), Watershed management.

4. Books and Materials

Text Books:

1. Anubha Kaushik, C.P. Kaushik. Perspectives in Environmental Studies. 6th Edition, New age international publishers, 2018.
2. M. Anji Reddy. Textbook of Environmental Science and Technology, Revised Edition, BS Publications, 2014.

Reference Books:

1. Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses, 2nd Edition, Orient BlackSwan Publishers, 2013.
2. Benny Joseph, Environmental studies, 3rd Edition, McGraw Hill Education (India) Private Limited, 2018.

II YEAR II SEMESTER

Course Structure

A8013 - Business Economics and Financial Analysis

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course addresses the concepts, principles and techniques of Business Economics and Financial Analysis. It covers the fundamentals of Business Economics and its various aspects. Financial analysis gives clear idea about concepts and conventions of accounting, accounting procedures like journal, ledger, trial balance, final accounts and interpretation of financial statements through ratios.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8013.1. Examine the types of business and impact of macroeconomic variables on business.

A8013.2. Analyze interrelationship among various economic variables and its impact.

A8013.3. Classify the market structure to decide the fixation of suitable price.

A8013.4. Apply accounting principles & rules for preparing financial statements.

A8013.5. Analyze financial statements to assess financial health of business.

3. Course Syllabus

Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. **Economics:** Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist.

Demand and Supply Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of

Demand, Law of Demand. Demand Forecasting: Methods of Demand Forecasting.
Supply Analysis: Determinants of Supply, Supply Function and Law of Supply. .

Production, Cost, Market Structures & Pricing: Production Analysis Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.
Cost analysis: Types of Costs, Short run and Long run Cost Functions.
Market Structure: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis (simple problems).

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts (Simple Problems).

Financial Ratios Analysis: Concept of Ratio Analysis, Importance and Types of Ratios-Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

4. Books and Materials

Text Books:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

Reference Books:

1. A.R. Aryasri (2011), Managerial Economics and Financial Analysis, TMH, India.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

Course Structure

A8514 - Database Management Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, query languages like relational algebra, relational calculus and SQL. It also covers essential DBMS concepts such as: Normalization, Transaction Processing, Concurrency Control, Recovery and tree based indexing techniques like ISAM, B+ trees etc which are required for designing an effective database. Students can undertake a semester project to design, build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Pre/co-requisites

A8608 - Java Programming

A8601 - Object Oriented Programming

2. Course Outcomes (COs)

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

A8514.1. Design a database for a given problem using E-R diagrams and Relational Model.
A8514.2. Construct Queries in Relational algebra and SQL for a case study.
A8514.3. Use Normalization techniques to reduce data redundancy in data base.
A8514.4. Select transaction control and recovery methods to keep data base consistent.
A8514.5. Compare various indexing techniques and NoSQL databases for efficient access.

3. Course Syllabus

Introduction and Data Base Design: Introduction to DBMS, applications of DBMS, database systems versus file systems, view of data, Database users and administrators, database system structure. Introduction to Relational database model, database schema, relations, columns and tuples. SQL data types, Database languages, DDL commands, DML commands, DCL commands, TCL commands. Database Design: Introduction to ER model, entities, attributes and entity sets, relationships and relationship sets, additional features of

the E-R model. logical database design: E-R to relational.

SQL Programming: SQL basic operators, SQL set operators-union, intersect and except operators, Integrity constraints in SQL. aggregate operators, GROUP BY, ORDER BY and HAVING Clause, null values, views in SQL, nested queries, SQL joins-inner join, outer join, left outer join, right outer join, storing and retrieving images, storing and retrieving files, Relational algebra operations and basic queries.

Schema Refinement and Normal Forms: Introduction to schema refinement & Normalization, Decomposition and properties of decompositions, functional dependencies, Closure of Attributes set. Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF,5NF. Problems on normalization, Schema refinement in database design. PL/SQL basics for writing triggers, cursors.

Transaction Management: Transaction concept, transaction states, ACID properties, schedules, Serializability-Conflict serializability, View serializability, recoverability. Concurrency control: lock based protocols, timestamp based protocols, deadlocks handling. SQL stored procedures.

Indexing and NoSQL: :Recovery-ARIES recovery algorithm, Log based recovery. File organization techniques, Tree index structures: ISAM and B+ trees. SQL Vs NoSQL, basic CRUD operations using MongoDB.

4. Books and Materials

Text Books:

1. Raghurama Krishnan, Johannes Gehrke., Database Management Systems, 3rd Edition, Tata McGraw-Hill, New Delhi, India, 2014.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan., Database System Concepts, 7th Edition, McGraw- Hill, New Delhi, India, 2019.

Reference Books:

1. Elmasri Navate., Fundamentals of Database Systems, Database System Concepts, 7th Edition, Pearson Education, India,2016.
2. C. J. Date, A. Kannan and S. Swamynathan., An Introduction to Database Systems, 8th Edition, Pearson Education, India, 2015.

Course Structure

A8515 - Formal Languages and Automata Theory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Automata mean that which is self-acting. The word automaton itself, closely related to the word automation, denotes automatic processes carrying out the production of specific processes. Simply stated, automata theory deals with the logic of computation with respect to simple machines, referred to as automata. Through automata, computer scientists are able to understand how machines compute functions and solve problems and more importantly, what it means for a function to be defined as computable or for a question to be described as decidable. Automatons are abstract models of machines that perform computations on an input by moving through a series of states or configurations. The most general and powerful automata is the Turing machine. Turing machine is a model of the computer. A formal language consists of words whose letters are taken from an alphabet and are well-formed according to a specific set of rules. The alphabet of a formal language consists of symbols, letters, or tokens that concatenate into strings of the language.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8515.1 Interpret the core concepts of automata theory to design finite automata for given formal languages.
A8515.2 Identify the relationship between formal languages, automata and regular expression.
A8515.3 Write and simplify context free grammars for formal languages.
A8515.4 Construct push down automata for various formal language constructs.
A8515.5 Model Turing machine to recognize formal languages and computational operations.

3. Course Syllabus

Finite Automata (FA): Introduction, model and behavior, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), lan-

guage of a DFA. Nondeterministic Finite Automata (NFA)-definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Finite Automata with Epsilon Transitions, Eliminating epsilon transitions, Minimization of DFA, Finite automata with output (Moore and Mealy machines)

Regular Expressions (RE): Introduction, algebraic laws for Regular Expressions, Finite Automata and Regular Expressions-from DFA's to Regular Expressions, converting Regular Expressions to Automata. Proving languages to be non-regular -Pumping lemma. Closure properties of regular languages.

Context Free Grammars (CFG): Formal definition, Sentential forms, Leftmost and rightmost derivations, The language of a CFG. Derivation tree or parse tree, Ambiguous Grammar. Simplification of CFG -Removing useless symbols, Null (epsilon) -Productions and unit productions. Normal forms –CNF, GNF. Proving that some languages are not context free -Pumping lemma for CFLs, closure properties of CFLs.

Pushdown Automata (PDA): Definition of the Pushdown Automata, the languages of PDA (acceptance by final state and empty stack), Equivalence of PDA's and CFG's-CFG to Pushdown Automata, Pushdown Automata to CFG. Deterministic PDA and Non-Deterministic PDA.

Turing Machines (TM): Formal Definition and behavior, languages of a TM, TM as accepters, Computable functions: Addition, Subtraction and Multiplication, Types of TMs, Chomsky Hierarchy, Post Correspondence Problem (PCP).

4. Books and Materials

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages and Computation, 3rdEdition, Pearson Education, India.

Reference Books:

1. Daniel I.A. Cohen (2007), Introduction to Computer Theory, 2nd Edition, John Wiley.
2. K.L.P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India.

Course Structure

A8516 - Design and Analysis of Algorithms

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course will provide the program analysis skills needed to develop computer applications efficiently. This course begins with asymptotic notations necessary in the study of time and space complexities. The course covers the various algorithm designs like divide and conquers method to decompose complex problems into small, greedy method to find feasible solution with minimum cost, dynamic programming and back tracking to analyze the complex problems with exponential time complexity. The course also enables to learn branch and bound concepts to study the pruning strategies and cost function. Finally, it covers the topics of NP-Hard and NP-Complete to study the nondeterministic algorithms. After completion of this course the student can develop efficient programs using various algorithm designs and able to analyse the complexities.

Course Pre/co-requisites

A8505 - Data Structures
A8509 - Discrete Mathematical Structures
A8511 - Advanced Data Structures

2. Course Outcomes (COs)

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

A8516.1. Make use of asymptotic notations, divide and conquer techniques to decompose complex problems into small and simple.
A8516.2. Choose Greedy method to find out feasible solutions of problems.
A8516.3. Examine complex engineering problems in finding the optimal solution.
A8516.4. Construct all possible solutions using backtracking methods.
A8516.5. Inspect Branch and Bound techniques and NP complete problems significance in algorithms.

3. Course Syllabus

Introduction, Divide and Conquer: Algorithm definition, Pseudo code Specifications, Performance Analysis-Space Complexity, Time Complexity, Recurrence relations: Substitution, recursion tree and master theorem, Asymptotic Notations-Big-Oh, Omega, and Theta. Divide and Conquer-General Method, Finding Maximum and Minimum, Merge Sort, Quick

sort, Strassen's Matrix Multiplication.

Greedy Method: General Method, Real Knapsack Problem, Job sequencing with deadlines, Minimum-cost spanning trees- Prim's Algorithm and Kruskal's algorithm, Single source shortest Path.

Dynamic Programming: General method, All pairs shortest path, Matrix Chain Multiplication, Optimal Binary search trees, 0/1 Knapsack, the travelling salesman problem.

Back Tracking: The General Method, The n-Queens Problem, Sum of subsets, Graph coloring, Hamiltonian cycles, Knapsack Problem.

Branch and Bound, NP-Hard and NP Complete Problems: General method, applications - Travelling sales person problem, 0/1 knapsack problem LC Branch and Bound solution, FIFO Branch and Bound solution.NP-Hard and NP-Complete Problems - Basic concepts, Non-deterministic algorithms, NP-Hard and NP Complete Classes.

4. Books and Materials

Text Books:

1. Ellis Horowitz. SatrajSahni, Rajasekharam., Fundamentals of Computer Algorithms, 2nd Edition, University Press, New Delhi, 2019.
2. Thomas H. Cormen, Charles E. Leiserson., Introduction to Algorithms, 3rd Edition, Eastern Economy Edition, Prentice Hall India, 2010.

Reference Books:

1. R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai., Introduction to Design and Analysis of Algorithms Astrategic approach, McGraw Hill, India, 2006.
2. Allen Weiss. Data structures and Algorithm Analysis in C++, 2nd Edition, Pearson Education, New Delhi, 2009.

Course Structure

A8703 - Machine Learning

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course will introduce the field of Machine Learning, in particular focusing on the core concepts of supervised and unsupervised learning. In supervised learning we will discuss algorithms which are trained on input data labelled with a desired output, for instance an image of a face and the name of the person whose face it is, and learn a function mapping from the input to the output. Unsupervised learning aims to discover latent structure in an input signal where no output labels are available, an example of which is grouping web-pages based on the topics they discuss. Students will learn the algorithms which underpin many popular Machine Learning techniques, as well as developing an understanding of the theoretical relationships between these algorithms.

Course Pre/co-requisites

A8502 - Problem Solving Through C

A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

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

A8703.1. Identify the various concepts and challenges in machine Learning.
A8703.2. Select modelling and evaluation technique for handling real time data.
A8703.3. Use supervised and unsupervised learning algorithms for a given problem.
A8703.4. Examine supervised and unsupervised learning algorithms for analysing data.
A8703.5. Identify the various concepts of neural network to develop AI based applications.

3. Course Syllabus

Introduction to Machine Learning: Types of Machine Learning, Problems not to be solved using Machine Learning, Applications of Machine Learning, Tools in Machine Learning, Issues in Machine Learning, Machine learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of data, Data Quality & Remediation, Data Pre-Processing..

Modelling and Evaluation: Introduction,Selecting a Model, Training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving performance of a Model, Feature subset selection, Dimensionality Reduction - PCA, SVD,FA, LDA.

Bayesian Concept Learning: Introduction, Bayes' Theorem, Naïve Bayes Classifier, Applications of Naïve Bayes Classifier, Supervised Learning: Classification , Example of Supervised Learning, Classification Model Learning Steps, Common Classification Algorithms: KNN, Decision Tree, Random forest model , Support vector machines. Introduction of Regression: Example of Regression, linear Regression, Multiple linear Regression

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering K-Means, K-Medoid, DBSCAN.

Basics of Neural Network: Introduction, Understanding the Biological Neuron, Exploring the Artificial Neuron, Types of Activation Functions, Early Implementations of ANN, Architectures of Neural Network.

4. Books and Materials

Text Books:

1. G Amit Kumar Das, Saikat Dutt, Subramanian Chandramouli, Machine Learning, Pearson India Education Services, 2019.

Reference Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, 2013.
2. Rudolph Russell, Machine Learning: Step-by-Step Guide to Implement Machine Learning Algorithms with Python, Create Space Independent Publishing Platform, 2018.

Course Structure

A8517 - Database Management Systems Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This practical course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design: E-R modeling, query languages like SQL. Students will be able to implement SQL concepts like joins, nested queries and also PL/SQL concepts like triggers, cursors etc for accessing the database. Students can undertake a semester project to design, build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Pre/co-requisites

A8509 - Discrete Mathematical Structures

2. Course Outcomes (COs)

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

A8517.1. Design a database for a given problem using E-R diagrams and Relational Model.
A8517.2. Construct Queries in SQL for a given case study.
A8517.3. Use PL/SQL concepts to access database in web based/standard applications.
A8517.4. Develop applications with support of database operations in python.

3. List of Experiments

1. a) Practice on SQL data definition language (DDL) commands and data manipulation language (DML) commands to retrieve and modify data.
   b) Practice on SQL DCL and TCL commands.
2. a) Case Study on designing ER diagrams for university database.
   b) Case Study on designing ER diagrams for company database to store information about employees
3. Practice on different types of SQL operators and aggregate operations.
4. a) Practice on queries using Group by, Order by, and Having Clauses.
   b) Practice on queries involving different types of joins.

5. a) Case Study on sailors database queries
   b) Case Study on employee database queries.
6. Practice on different types of SQL built in functions like Date functions, string functions, Numeric and conversion functions, Analytic functions ,storing and retrieving images, files.
7. Practice on queries using Co-related sub Queries and nested queries.
8. Practice on PL/SQL basics for writing programs using programming constructs like variables, operators and conditional, control statements.
9. Practice on PL/SQL programs using cursors.
10. Practice on PL/SQL programs using triggers.
11. Practice on PL/SQL programs involving stored procedures and functions.
12. Practice on performing basic database operations by connecting to database using Python.
13. Case Study in developing a database following all steps in the design of databases elaborating normalization and denormalization.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. MySql (Open Source/ Freeware)

Course Structure

A8704 – Machine Learning Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the practical algorithms for machine learning from a variety of perspectives. We cover topics such as PCA, ID3, Naïve Bayesian classifier, SVM classifier, KNN classifier, Bayesian network, linear and Multiple Regression algorithms, K-means and Agglomerative hierarchal Clustering algorithm.

Course Pre/co-requisites

A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

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

A8704.1. Understand the implementation procedures for the machine learning algorithms.
A8704.2. Design Python programs for various Learning algorithms.
A8704.3. Apply appropriate data sets to the Machine Learning algorithms.
A8704.4. Identify and apply Machine Learning algorithms to solve real-world problems.
A8704.5. Apply various preprocessing techniques on data sets.

3. List of Experiments

1. Demonstrate the Data Pre-Processing techniques by taking real datasets.
2. Demonstrate Feature subset selection and implement dimensionality reduction (PCA) technique.
3. Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering a few test data sets.

5. Write a program to implement the SVM classifier for a sample training data set stored as a .CSV file.
6. Write a program to implement the K-NN classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.
8. Implement a linear Regression algorithm in order to fit data points. Select the appropriate data set for your experiment and draw graphs.
9. Implement multiple linear Regression algorithms in order to fit data points. Select the appropriate data set for your experiment and draw graphs
10. Write a program to implement the K-Means Clustering algorithm and find the SSE of set of clusters.
11. Write a program to implement an agglomerative hierarchal Clustering algorithm.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. Python (Open Source/ Freeware), Jupyter Notebook, Anaconda (Open Source/ Freeware)

Course Structure

A8705 - IoT and Drones Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	1	2	0	15	30	2	40	60	100

1. Course Description

Course Overview

The purpose of the course is to make Understand the importance of IoT and Robotics to students and also to get to know the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and devices will be covered in this course. The key components of networking are also covered to ensure students to connect their devices to the Internet.

Course Pre/co-requisites

A8204 - Basic Electrical Engineering

A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

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

A8705.1. Identify the characteristics, design and communication models of IoT.
A8705.2. Identify the various domain specific applications of IoT.
A8705.3. Describe IoT applications using Raspberry Pi interface.
A8705.4. Identify the characteristics, design and communication models of Drones..
A8705.5. Design and add payloads of Drone.

3. Practice

1. Write a Program using Arduino IDE to blink and 5V LED light.
2. Write a Program using Arduino IDE to create traffic light system with three LEDs (Red, Orange and Green).
3. Write a Program using Arduino IDE to sense the temperature of the room using DHT11 Sensor.
4. Write a Program using Arduino IDE to create automatic street lighting system using LDR Light Sensor
5. Write a Program using Arduino IDE to measure the distance using Ultrasonic sensor.
6. Measure the moisture level in soil using soil moisture sensor.
7. Implement yield monitoring in Agriculture .

8. Installing Ubuntu 19+ OS on the Raspberry Pi 4+ device and explore the features.
9. Implement Raspberry Pi program for Distance Measurement Using Ultrasonic Sensor and displaying on LCD.
10. Connect a single BLDC drone motor with LIPO battery using Electric Speed Controller (EDC) and XT60 connector.
11. Write a program to control all the 4 BLDC motors using Arduino.
12. Using 433Mhz Tx and Rx, design a plastic motors based Remote Control car using ESP8266 Module.
13. Construct drone using Kk2.1 flight control board.
14. Measure the temperature of the drone using DHT11 sensor in Raspberry Pi microcontroller.
15. Write a Raspberry Pi program to measure the battery level (remaining battery level) of the Li-ion battery connected to the BDLC motor sand alert the user if the battery is less than 30.

4. Laboratory Equipment/Software/Tools Required

1. A Computer System with Ubuntu Operating System (Open source / Free Ware)
2. Python(open source/ Freeware)
3. Arduino IDE(open source/ Freeware),Misson Planner(open source/ Freeware)
4. Multimeter, Electric Soldering Kit
5. Breadboards, Raspberry PI 4 -2GB RAM , Type C org power supply from pifoundation,HDMI TO VGA CONVERTER,16GB CALSS 10 MEMORY CARD, Node MCU (ESP8266).
6. Jumper wires (Male-Male, Male-Female, Female-Female) 120 Pieces (20 cm)
7. Resisters pack
8. DHT11 (Digital Humidity and Temperature)sensor
9. LDR (Light Dependent Resistors) Sensor
10. LCD display
11. Ultrasonic Range Finder Module Sensor, IR Sensor, Gas Sensor, Soil Moisture Sensor, Arduino Mega
12. USBcables for Node MCU
13. Red LED Lights , Green LED Lights , Yellow LED
14. BLDC motors, Drone Frames, KK2.1 Flight Control Board, Lights

Course Structure

A8024 - Product Realization

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Making the students socially responsible is the main motto. In this process introducing technological concepts and creating innovating product is carried out for the community. The Product Realization introduces communication with community, planning of product realization, design and development of the product added with skill sets of leadership. This course given an exposure on converting an innovative idea to physical product to meet the need of the community. It improves skill of research paper writing, patent drafting and also developing the skill of preparation of business models.

Course Pre/co-requisites

A8021 - Social Innovation

A8022 - Engineering Exploration

A8023 - Engineering Design Thinking

2. Course Outcomes (COs)

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

A8024.1. Interpret the specifications of product and solve for practical realization.
A8024.2. Analyse the customers mind set and design the product.
A8024.3. Develop Gantt chart to define timeline for product realization.
A8024.4. Conceptualize the terms called product, purchase, production and monitoring of products.
A8024.5. Communicate the process of converting an idea to physical product to the community.

3. Course Syllabus

Theory

Introduction and Planning of Product Realization: Introduction to Product Realization, Need for Product Realization, Product realization process, Case Study of Product Realization for Global Opportunities. Plan and develop the processes needed for product realization, Defining Quality objectives and requirements, establish processes documents.

Needs - verification, validation, monitoring inspection and test activities (inspection nodes) and criteria for product acceptance and record needed. Case study on timeline of Product realization planning (Gantt Chart).

Customer-Related Processes: Product information Enquiries, contracts or order handling Customer feedback including customer complaints, A field survey.

Design and Development: Review verification and validation of each design and development stages, Functional and performance requirements, Information for purchasing, production and service provisions, review and validation, Develop a Design model of the product.

Purchasing, Production and Service Provision: Purchasing information, Vendors evaluation and approval process, Verification of purchased product. Control of production, service provision, validation of processes for production and service provision, Identification and tractability, Customer property and Preservation of product.

Scope of Product Perseverance: Writing proficiency for papers, Patent drafting and development of business model.

Practice

1. Introducing oneself to the steps of Product realization.
2. Case Study to define the necessity.
3. Brainstorming Session on Product Realization in teams.
4. Watching videos on Planning of product realization in real time scenario from R Labs.
5. Verification of the Product specifications which satisfies all the needs.
6. Discussion with Customers about the product and the specifications.
7. Discussion about the finished product and taking feedback.
8. Feedback Analysis and redesign if required.
9. Verification of redesigned product and market study.
10. Discussion on different Purchasing and Services for the product development.
11. Data from the customer for market and feedback of market is acquired.
12. Activity on Observation skills to know how to use one's observation skills in understanding the parameters
13. Brainstorming deliberations on the initial observations and measuring of the product.
14. Familiarization of the respective templates with the help of sample case study.

4. Books and Materials

Text Books:

1. Mileta M Tomovic, Sowping Wang, Product Realization – A Comprehensive Approach, 1st Edition, Spinger, 2009.
2. Stark, John, Product Life Cycle Management, 21st century Paradigm for Product Realisation 2011, Springer.

Reference Books:

1. Verna J. Bowen, Lucy V. Fusco, The Competitive Edge Research Priorities for U.S. Manufacturing, National Academy of Sciences.
2. Renuka Thota, Suren Dwivedi, Implementation of product realization concepts in design and manufacturing courses, University of Louisiana-Lafayette.

Course Structure

A8031 - Gender Sensitization

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

Gender Sensitization is a course that introduces students to different dimensions of gender issues. It is one of the basic requirements for the normal development of an individual and primarily highlights the contribution of both the genders in creation and development of a well balanced society. A curriculum-based approach to bring a change is desired to inculcate sensitivity towards issues concerning the relationship between men and women, caste, declining sex ratio, struggles with discrimination, sexual harassment, new forums for justice, eve-teasing, etc., The need for this sensitivity has been felt and realized through times immemorial and in almost all kinds of human existence, across the globe.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8031.1. Interpret gender sensitization and problems of other genders.
A8031.2. Identify the reasons for the female feticide.
A8031.3. Attain a finer grasp of how gender discrimination works in our society and how to counter it.
A8031.4. Develop sensitivity towards sexual and domestic violence.
A8031.5. Recognize gender sensitivity issues through literature and media.

3. Course Syllabus

Understanding Gender: Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men Preparing for Womanhood. Growing up Male. First lessons in Caste.

Gender Roles and Relations: Two or Many? -Struggles with Discrimination-Gender

Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences Gender Spectrum: Beyond the Binary.

Gender and Labour: Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development Gender and Human Rights-Gender and Mainstreaming.

Gender - Based Violence: The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking Out: Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life. . . ."

Gender and Culture: Gender and Film-Gender and Electronic Media Gender and Advertisement Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

4. Books and Materials

Text Books:

1. Towards a World of Equals: A Bilingual Textbook on Gender". Telugu Akademi, Hyderabad, 2015

Additional Resources:

1. www.worldofequals.org.in

Course Structure

A8033 - Universal Human Values 2: Understanding Harmony

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

Values are individual beliefs that motivate people to act in one way or the other, it has an inherent worth, and it prepares an individual to adapt in the family, community and society. The basic five Human Values: Love, Peace, Truth, Right Conduct and Non-violence are hidden in every human being; they are our candid attributes. These fundamental human values contain mankind's deepest moral aspirations and form the basis of our lives as individuals and as societies. A didactic system based on human values helps in holistic development of students and it aids to their understanding of true happiness which can only be found within, not in the transient outside world. All objects in the world are subjected to change, however, the ideals, virtues and values established in human hearts remain as a perpetual source of inspiration to the humankind. The course is an overview of human values that are universally accepted and it highlights the need to incorporate these values in students so that they can contribute their service to human race fruitfully. It briefly discusses their role in their family, society and nature and sensitises them towards harmonious living.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8033.1. Analyze the process of self-exploration, right understanding, relationships, natural acceptance for achieving ultimate happiness .
A8033.2. Examine human being as a co-existence of self 'I' and the material 'Body'.
A8033.3. Correlate the universal harmonious order in society, undivided society and from family to world family.
A8033.4. Interpret the harmony in nature, holistic perception at all levels of existence.
A8033.5. Analyze professional competence for augmenting universal human order, ethical human conduct for acceptance of human values.

3. Course Syllabus

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, recapitulation from Universal Human Values-1; Self-Exploration what is it? –its content and process; 'Natural Acceptance' and Experiential Validation – as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic human aspiration; Right Understanding, Relationship and Physical facility; Understanding Happiness and Prosperity correctly; Method to fulfill the above Human Aspirations; Understanding and living in harmony at different levels.

Understanding harmony in the Human Being- Harmony in Myself!: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body'-happiness and physical facility; Understanding the body as an instrument of 'I"; Understanding the characteristics and activities of 'I' and harmony 'I"; Understanding the harmony of 'I' with the body: Sanyam and health; Correct appraisal of physical needs, meaning of prosperity in detail; Programs to ensure Sanyam and Health.

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship: Understanding values in human-human relationship; meaning of justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness: Trust and Respect as the foundational values of relationship; Understanding the meaning of Trust; difference between intention and competence; Understanding the meaning of respect, Difference between respect and differentiation; the other salient values in relationship; Understanding harmony in the society; Visualizing a universal harmonious order in society.

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence: Understanding the harmony in the Nature; Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values; Definitiveness of Ethical Human Conduct; Basics for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case studies of typical holistic technologies, management models and productive systems; Strategy for transition from the present state to Universal Human Order.

4. Books and Materials

Text Books:

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

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A. N. Tripathi, 3rd Edition New age Intl. Publishers, New Delhi, 2019.
3. The Story of My Experiments with Truth- by Mohandas Karamchand Gandhi, 1st Edition, Fingerprint Publishing, 2009.

III YEAR I SEMESTER

Course Structure

A8519 - Computer Networks

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The growing importance of Internetworking in recent years and their use in every field has made Computer Networks a central issue for modern systems. The course introduces the basic concepts of networks and some of the issues of Network Security. The main objective of the course is to enable students to know the functions of various layers of a network model. Topics covered in the course include Introduction to networks, physical layer, data link layer, medium access sub layer, network layer, transport layer and application layer includes interfaces.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8519.1. Identify the Reference models and Physical connections for establishing network.
A8519.2. Choose access control and error handling techniques for data link layer.
A8519.3. Examine the various routing and congestion control algorithms for packet transmission.
A8519.4. Choose a transport layer protocol to provide communication services.
A8519.5. Identify application layer protocol for interacting with user and user applications.

3. Course Syllabus

Introduction: Network hardware, Reference models: OSI, TCP/IP, Connection oriented network and connectionless network. The Physical Layer: Guided transmission media, wireless transmission media.

The Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols. The Medium Access Sublayer: Channel allocations problem, multiple access protocols: ALOHA, CSMA, Collision free protocols, Ethernet,

Data Link Layer switching.

The Network Layer: Network layer design issues, Routing Algorithms: Shortest path routing, flooding, distance vector routing, link state routing. Congestion control algorithms, the network layer in the internet: IPv4, Sub-netting, Super-netting, CIDR, NAT and IPv6.

The Transport Layer: Transport service, Transport layer protocols: UDP and TCP, Introduction, The TCP service model, The TCP protocol, The TCP Segment Header, TCP connection establishment, connection release, TCP sliding window, TCP Timer management, TCP Congestion control, Performance issues.

The Application Layer: Domain name system- DNS Name Space, Domain Resource Records, Name Servers. Application Layer Protocols: Simple Network Management Protocol (SNMP), Hyper Text Transfer Protocol (HTTP), File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), Telnet.

4. Books and Materials

Text Books:

1. S.Tanenbaum.,Computer Networks , 6th Edition, Pearson Education/ PHI, New Delhi, India, 2013.
2. Bhavneeth Sidhu., An Integrated Approach to Computer Networks, Khanna Publishing House, India,2019.

Reference Books:

1. William Stallings., Cryptography and Network security, 7th Edition, Pearson Education, India, 2017.
2. Behrouz A. Ferozen., Data communication and Networking, 5th Edition, Tata McGraw Hill, India, 2017.

Course Structure

A8520 - Software Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course acts as a foundation in the field of software engineering and is aimed at helping students develop an understanding of how software systems are developed from basic, by guiding them through the development process, adopting the fundamental principles of system development. The course will orient the students to the different software process models, software requirements engineering process, systems analysis and design as a problem-solving activity, with focus on quality.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8520.1. Identify the design issues and process models to develop a software.
A8520.2. Determine the functional and non functional requirements with appropriate validation for a software product.
A8520.3. Develop software design documents for the given requirements.
A8520.4. Prepare test documents at various stages to validate project.
A8520.5. Illustrate the need of quality management and metrics for product standardization

3. Course Syllabus

Introduction to Software Engineering: The Evolving nature of software engineering, Changing nature of software engineering, Software engineering Layers, The Software Processes,Software Myths. Process Models: A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model, the Unified Process.

Requirements Engineering: Functional and Non-Functional Requirements, The Software requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management.

Design and Implementation: System Modeling: Interaction Models, Structural Models, Behavioral Model, Model Driven Engineering. The Object Oriented Design with UML, Implementation Issues. User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Software Testing Strategies: A Strategic approach to Software Testing, Strategic Issues and Test Strategies for Conventional Software, Validation Testing, Unit Testing , Integration Testing, Regression Testing , The Art of Debugging, White Box Testing - Basic Path Testing, Control Structure Testing. Black Box Testing - Equivalence partitioning, Boundary value analysis, Graph Based testing and state transition testing.

Quality Management: Quality Concepts, Software Quality, Software Quality Dilemma, Achieving Software Quality, Review Techniques, Reviews: A Formal spectrum, Informal Reviews, Formal Technical Reviews. Software Quality Assurance: Background Issues,Elements of Software Quality Assurance, Tasks, Goals and Metrics, Software Reliability,the ISO 9000 Quality Standards.

4. Books and Materials

Text Books:

1. Roger S. Pressman.,Software Engineering, A Practitioner's approach , 7th Edition, McGraw Hill International Edition, New Delhi,2011.
2. Sommerville., Software Engineering, 9th Edition,Pearson education, India.

Reference Books:

1. K. K. Agarval, Yogesh Singh., Software Engineering, 3rd Edition, New Age International Publishers, India,2007.
2. Lames F. Peters, Witold Pedrycz, Software Engineering an Engineering approach,John Wiely & Sons, New Delhi, India,2000.
3. Shely Cashman Rosenblatt., Systems Analysis and Design, 6th Edition, Thomson Publications, India.

Course Structure

A8706 - Natural Language Processing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Natural Language Processing is the art of extracting information from unstructured text. Learn basics of Natural Language Processing, Regular Expressions & text sentiment analysis using machine learning in this course. Natural Language Processing (NLP) is basically how we can teach machines to understand human languages and extract meaning from text. The course covers the phases of NLP processing and uses libraries provided by NLP to analyze the given text document.

Course Pre/co-requisites

A8508 - Python Programming Laboratory
A8703 - Machine Learning

2. Course Outcomes (COs)

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

A8706.1 Identify the structure of words and documents for text preprocessing.
A8706.2 Choose an approach to parse the given text document.
A8706.3 Make use of semantic parsing to capture real meaning of text.
A8706.4 Select a language model to predict the probability of a sequence of words.
A8706.5 Examine the various applications of NLP.

3. Course Syllabus

Introduction to NLP: Origins of NLP, The Challenges of NLP, Phases of NLP, Language and Grammar. Finding the Structure of Words and Documents: Words and Their Components, Issues and Challenges, Morphological Models. Finding the Structure of Documents: Introduction, Sentence Boundary Detection, Topic Boundary Detection, Methods, Complexity of the Approaches, Performances of the Approaches, Features, Processing Stages.

Syntax: Parsing Natural Language, A Data-Driven Approach to Syntax, Stop words, Correcting Words, Stemming, Lemmatization, Parts of Speech (POS) Tagging, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing.

Semantic Parsing: Introduction, Semantic Interpretation: Structural Ambiguity, Entity and Event Resolution, System Paradigms, Word Sense: Simplified Lesk, Supervised: Rules for selecting syntactic relations as features, unsupervised, and Semisupervised: The Yarowsky algorithm, Predicate-Argument Structure: FrameNet , PropBank, The semantic role labeling (SRL) algorithm, content word, Meaning Representation: ATIS, Communica-

tor, GeoQuery , Robocup:CLang.

Language modelling: Introduction, n-Gram Models, Language Model Evaluation, Parameter Estimation, Types of Language Models: Class-Based Language Models, MaxEnt Language Models, Neural Network Language Models Language- Specific Modeling Problems, Multilingual and Crosslingual Language Modeling.

Text Summarization and Information Retrieval:: Question Answering: History, Architectures, Question Analysis, Search and Candidate Extraction, Automatic Summarization: Approaches to Summarization, Information Retrieval: Document Preprocessing, Monolingual Information Retrieval.

4. Books and Materials

Text Books:

1. Daniel M. Bikel Imed Zitouni., Multilingual Natural Language Processing Applications: FromTheory to Practice, IBM Press, 2013..
2. Tanveer Siddiqui, U.S. Tiwary., Natural Language Processing and Information Retrieval, Oxford University, 2008.

Reference Books:

1. Daniel Jurafsky and James H Martin., Speech and Language Processing: An in- troduction to Natural Language Processing, Computational Linguistics and Speech Recognition,2nd Edition, Prentice Hall, 2008.
2. James Allen., Natural Language Understanding,2nd Edition, Cummings publishing company,1995
3. Raj, Pethuru, Handbook of Research on Cloud Infrastructures for Big Data Analytics, IGI Global

Course Structure

A8526 - Data Mining

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides the concepts and techniques in processing gathered data or information,which will be used in various applications. Students will become acquainted with both the strengths and limitations of various data mining techniques like Association, Classification, Cluster and Outlier analysis. Data mining tools predict future trends and behaviours, allowing businesses to make proactive, knowledge-driven decisions.

Course Pre/co-requisites

A8514- Data Base Management Systems.

2. Course Outcomes (COs)

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

A8526.1. Make use of pre-processing techniques on any given raw data.
A8526.2. Build data warehouse schemas for enterprise applications.
A8526.3. Perform market basket analysis using association rule mining.
A8526.4. Utilize classification techniques for analysis and interpretation of data.
A8526.5. Identify appropriate clustering and outlier detection techniques to handle complex data.

3. Course Syllabus

Introduction to Data Mining: Data mining, Knowledge Discovery process, Data Mining Functionalities-Kinds of Patterns, Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Dissimilarity of Numeric Data-Distance measures, Data Pre-processing: Major Tasks in Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data Warehouse and OLAP: Data Warehouse basic concepts, Differences between Operational Database Systems and Data Warehouses, Multi tiered Architecture, Data Warehouse Models, Schemas for Multidimensional Data Models, Typical OLAP Operations, Data Warehouse Design Process, OLAP Servers.

Association Analysis: Basic Concepts, Market Basket Analysis, Apriori Algorithm, FP-growth, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel Associations and Multidimensional Associations.

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Metrics for Evaluating Classifier Performance, Ensemble Methods, Multilayer Feed-Forward Neural Network, Support Vector Machines, k-Nearest- Neighbor Classifiers.

Cluster Analysis: Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Partitioning Methods-k-Means, k-Medoids, Hierarchical Methods-AGENES, DIANA, BIRCH, Density-Based Method-DBSCAN, Outlier Analysis: Types of Outliers, Challenges of Outlier Detection, and Overview of Outlier Detection Methods.

4. Books and Materials

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei., Data Mining: Concepts and Techniques,3rd Edition,Morgan Kaufmann/Elsevier, 2012.

Reference Books:

1. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar., Introduction to Data Mining, 2nd Edition,Pearson Education India, 2021.
2. Margaret H Dunham., Data Mining Introductory and Advanced Topics,2nd Edition,Pearson Education India, 2006.
3. Amitesh Sinha., Data Warehousing, Thomson Learning, India, 2007.

Course Structure

A8708 - Natural Language Processing Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	1	2	0	0	30	2	40	60	100

1. Course Description

Course Overview

Natural Language Processing is the art of extracting information from unstructured text. Learn basics of Natural Language Processing, Regular Expressions & text sentiment analysis using machine learning in this course. Natural Language Processing (NLP) is basically how we can teach machines to understand human languages and extract meaning from text. The course covers thephases of NLP processing and uses libraries provided by NLP to analyze the given text document.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

A8508 - Python Programming

A8703 - Machine Learning

2. Course Outcomes (COs)

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

A8708.1.	Demonstrate proficiency in using popular NLP libraries and tools such as NLTK, SpaCy, and scikit-learn.
A8708.2.	Develop a number of pre-processing methods for a given corpus using tool WordNet.
A85708.3.	Evaluate different texts for the purpose of creating programs.
A8708.4.	Develop text classification models using machine learning algorithms to categorize text into predefined classes or categories.
A8708.5.	Build applications using various NLP techniques for a given corpus.

3. List of Experiments

1. a. Write a program to Tokenize Text to word using NLTK.
   b. Write a program to Tokenize Text to Sentence using NLTK
2. a. Write a program to remove numbers, punctuations, and whitespaces in a file.
   b. Write a program to Count Word Frequency in a file
3. Write a program to Tokenize and tag the sentence using Morphological Analysis in NLP.

4. a. Write a program to get Synonyms from WordNet.
   b. Write a program to get Antonyms from WordNet.
5. a. Write a program to show the difference in the results of Stemming and Lemmatization.
   b. Write a program to Lemmatizing Words Using WordNet.
6. a. Write a program to print all stop words in NLP.
   b. Write a program to remove all stop words from a given text.
7. a. Write a Python program to find Jaccard distance between two strings using python.
   b. Write a Python program to find Find Edit distance between two strings using python.
8. a. Write a Python program to apply Collocation extraction word combinations in the text.Collocation examples are “break the rules,” “free time,” “draw a conclusion,” “keeps in mind,”“get ready,” and so on.
   b. Write a Python program to extract Relationship that allows obtaining structured in- formation from unstructured sources such as raw text. Strictly stated, it is identifying relations (e.g., acquisition, spouse, employment) among named entities (e.g., people, organizations, locations).For example,from the sentence “Mark and Emily married yesterday,” we can extract the information that Mark is Emily’s husband.
9. Write a program to print POS and parse tree of a given Text.
10. Write a program to print bigram and Trigram of a given Text.
11. Implement a case study of NLP application.

4. Laboratory Equipment/Software/Tools Required

1. A computer System with Ubuntu Operating System.
2. Python 3.x or above version
3. Jupyter Notebook or Pycharm IDE.

Course Structure

A8528 - Data Mining Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

The goal of this Laboratory is to help students learn to work with Pentaho Data Integration (Kettle) tool and WEKA tool for data mining techniques and develop data cubes and perform OLAP operations. Students will be able to perform data preprocessing, classification, clustering, association, attribute selection, and visualization using WEKA tool. Students will be able to perform various data transformations using kettle Pentaho data integration tool and interpret received results.

Course Pre/co-requisites

A8517- Database Management Systems Laboratory

A8704- Machine Learning Laboratory

2. Course Outcomes (COs)

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

A8528.1. Apply various preprocessing Techniques using WEKA tool for the given datasets.

A8528.2. Develop various data integration and transformations using Kettle Pentaho tool.

A8528.3. Build data Cubes and perform OLAP Operations.

A8528.4. Apply appropriate association and classification techniques to interpret data and provide valid conclusions.

A8528.5. Apply clustering techniques, compare the results, and write effective reports.

3. List of Experiments

1. Installation and Introduction to Weka Tool.
2. Preprocessing Data Using Weka Tool
   a) File conversion from Excel to ARFF
   b) Opening File from Local file system.
   c) Opening File from website.
3. a) Installation, Introduction to Kettle Pentaho data Integration Tool.
   b) Opening the Pentaho data Integration IDE and create a New repository.

c) Connect to the Created Repository.

d) create an ODBC CONNECTION.

4. Developing transformations Using Kettle Pentaho data Integration Tool.
   a) Transform CSV file input into XML file output.
   b) Transform CSV file Input into excel file output.
   c) Transform Access to Excel.
   d)Transform Excel file input into MS-Access file output.
   e) Transform Sql server input to MS-ACCESS/MS-Excel.
5. Developing Flow Control Transformation using kettle Pentaho
   a) Transform Access file/sql server file into excel file by control data flow.
6. SQL server Analysis service for Data Analytics.
   a) Create data source connection.
   b) Create data source view.
   c) Create OLAP Cube in SQL Server Analysis Server.
7. SQL server Analysis service for Data Analytics.
   a) Perform OLAP operations on DATACUBE.
8. Implement Association Rule Mining – Apriori: Trace the results of using the Apriori algorithm on the grocery store example with support threshold s=33.34 percentage and confidence threshold c=60 percentage . Show the candidate and frequent item-sets for each database scan. Enumerate all the final frequent item-sets. Also indicate the association rules that are generated and highlight the strong ones, sort them by confidence. Using WEKA, Load a dataset described with nominal attributes, run the Apriori algorithm to generate association rules.

   TransactionID Items

   T1 HotDogs, Buns, Ketchup

   T2 HotDogs, Buns

   T3 HotDogs, Coke, Chips

   T4 Chips, Coke

   T5 Chips, Ketchup

   T6 HotDogs, Coke, Chips
9. a) Implement Association Rule Mining FP-tree and FP-Growth:

   i) Use the transactional database from the previous exercise with same support threshold and build a frequent pattern tree (FP-Tree). Show for each transaction how the tree evolves.

   ii) Use Fp-Growth to discover the frequent item-sets from this FP-tree.

   b) Using WEKA, Load a dataset described with nominal attributes, run the FP -growth algorithm to generate association rules.

10. Giving the following database with 5 transactions and a minimum support threshold of 60 percentage and a minimum confidence threshold of 80 Percentage, Find all frequent item-sets using:
    i) Apriori and
    ii) FP-Growth.
    iii) Compare the efficiency of both processes.
    iv) List all strong association rules that contain "A" in the antecedent (Constraint).
    v) Can we use this constraint in the frequent item-set generation phase?
    TransactionID Items T1 K, A, D, B T2 D, A C, E, B T3 C, A, B, E T4 B, A, D
11. Implement Classification:
    a) Build Base line classification models using Zero R and One R
    b) Generate Decision Tree using J48, Use BuysComputer.arff database.
    c) Using WEKA, Simple CLI, generate error on training data using J48.
12. Implement Naïve Bayes algorithm Classification using J48, Use employee.arff database.
13. Implement Clustering: create an iris file containing at least 15 instances, load it into Weka, and apply k-Means clustering to it. Also cluster the instances without Weka, and compare the results. Pick different initial cluster centroids and compare the results.
14. Develop an Integrated project on data preprocessing.
15. Develop an Integrated project on data mining techniques.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open Source/ Freeware)
2. WEKA Tool (Open Source/Freeware)

5. Books and Materials

Text Books:

1. Jiawei Han, Jian Pei, Hanghang Tong (2023), Data Mining: Concepts and Techniques, 4th Edition, Elsevier, India.

Reference Books:

1. Maria Carina Roldan, Pentaho Data Integration Beginner's Guide, Packt Publishing, New Delhi.
2. Ian H. Witten, Eibe Frank, Mark A. Hall, Christopher J. Pal, Data Mining: Practical Machine Learning Tools and Techniques,4th Edition,Morgan Kaufmann Series, 2016.

Course Structure

A8521 - Computer Networks Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

The goal of this laboratory is to help students learn to design local area network and implement various design issues of all layers. Students will be able to learn new simulation tool NS2, along with new scripting language TCL. Students will be able to establish and implement different networks which provide data transmission among them for both Wired and Wireless networks using NS2 tool.

Course Pre/co-requisites

A8502- Problem Solving through C Laboratory

A8508- Python Programming Laboratory

2. Course Outcomes (COs)

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

A8521.1. Design Local Area Network for a given configuration.
A8521.2. Implement error and flow control , routing protocols in layers.
A8521.3. Develop programs using encryption and decryption for data security
A8521.4. Use network simulator and packet tracer to design networks.

3. List of Experiments

1. Connect Computers in Local Area Network.
2. Implement a) Bit-Stuffing b) Character Stuffing.
3. Implement CRC and Error handling techniques.
4. Implement Sliding- Window protocols.
5. Implement distance vector routing algorithm for obtaining routing tables at each node.
6. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
7. Implement data encryption and data decryption.
8. Installation of NS2 tool.
9. Design client-server model using NS2.
10. Design a sample topology using NS2.

11. Implement Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) between pair of systems using NS2.
12. Design wireless network using NS2.
13. Design a network using loop constraint.
14. Design a Network using Packet Tracer.

4. Laboratory Equipment/Software/Tools Required

1. A Computer System with Ubuntu Operating System.
2. C-Compiler.
3. NS2 Tool (Open Source).

5. Books and Materials

Text Books:

1. S.Tanenbaum.,Computer Networks , 6th Edition, Pearson Education/ PHI, New Delhi, India, 2013.
2. Bhavneeth Sidhu., An Integrated Approach to Computer Networks, Khanna Publishing House, India,2019.
3. http://www.isi.edu/nsnam/ns/tutorial
4. www.cisco.com

Reference Books:

1. William Stallings., Cryptography and Network security, 7th Edition, Pearson Education, India, 2017.
2. Behrouz A. Ferozen., Data communication and Networking, 5th Edition, Tata McGraw Hill, India, 2017.

Course Structure

A8525 - RUST Programming

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Rust is a modern, system-level programming language designed to offer high levels of performance, reliability and productivity. This course enables students to install Rust and then familiarize with RUST basic concepts like variables, data types, method syntax, enums, and more. This course also helps students to know how the unique Ownership Principles of Rust impact the language. Data Handling, Pattern Matching, and Error Handling are also covered in this course. The course also demonstrates use of generic types and traits, File I/O, Iterators and Closure. Students will learn basics of RUST programming language and how to use Rust to successfully bridge the performance and safety gap with this useful guide.

Course Pre/co-requisites

A8501 - Problem Solving through C
A8601 - Object Oriented Programming
A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

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

A8525.1. Create a Rust project and write basic rust programs, including proper Cargo configuration.
A8525.2. Translate a design into a working Rust program.
A8525.3. Use structs, enums and traits as intended in the construction of Rust programs.
A8525.4. Handle different types of erros and use genric types,traits

3. Course Syllabus

Introduction to RUST: rustup, cargo, rust functions, command line arguments and tools. Variables, Mutability, Data types, tuples, arrays, vectors, slices comments, functions, statements, expressions, control statements, pointers: raw pointers, references, boxes, Strings, Like Types,Type aliases.

RUST ownership principles: Ownership, moves,Copy types,shared ownerships,RUST ownership models : Memory allocation, clone and copy,data races.

Structs, Enums and Pattern Matching: Using structs, initializing structs, update,named field structs, tuple structs, unit-like structs, imps, generic structs.Enums, match statement,option enum, enums with data and memory, Patterns: literals,wild cards,variables in patterns,tuple and struct patterns, array and slice patterns.

Error Handling and Generic types and traits: Error handling in RUST,panic, recoverable and unrecoverable errors,generic structs, generic functions, Trait objects, default methods, sub traits.

Input and Output: I/O traits, File I/O operations, operator overloading, Iterators and Closures, smart pointers, concurrency.

4. List of Experiments

1. Write a RUST program to display "hello world" message.
2. Write a RUST program to demonstrate variables, mutability and type references.
3. Write a program to demonstrate Rust Type Casting
4. Write a RUST program to perform basic arithmetic operations on two given numbers using arithmetic operators.
5. Write a RUST program to calculate student grades to a subject based on their overall score.
   a. if the score is above 90, assign grade A
   b. if the score is above 75, assign grade B
   c. if the score is above 65, assign grade C
6. Write a RUST program to print all prime numbers from 1 to n using for loop.
7. Write a program to demonstrate the usage of functions in RUST to find sum of two numbers. Pass two values as parameters.
8. Write a program to create a vector of strings and access the elements. Display all elements in sorted order.
9. Write a RUST program to demonstrate different ways of creating iterators.
10. Write a RUST program to perform all strings operations like creation of string,slicing of stirng etc.
11. Write a RUST program to demonstrate recoverable errors using panic, except .
12. Write a RUST program to demonstrate about result enum and option enum.
13. Write a RUST program to demonstrate data movement and ownership rules in Rust
14. Write a RUST program to demonstrate ownership in functions.
15. Demonstrate Building and Running Project with Cargo in Rust
16. Write a program to demonstrate Defining, Implementing and Using a Trait in Rust
17. Write a RUST program to demonstrate about pattern matching.
18. Implement Generic struct and Generic Functions in Rust.
19. Write a RUST program for performing following FILE operations:
    a) Opening a file
    b) Reading from a file

c) Writing to a file
d) Removing a file
e) Appending to a file

20. Build a multithreaded web server using RUST.

5. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. Rust (Open Source/ Freeware)

6. Books and Materials

Text Books:

1. Jim Blandy, Jason Orendorff, Leonora F . S. Tindall, Programming Rust, 2nd Edition,O'Reilly Publications Media, 2021.

Reference Books:

1. Steve Klabnik and Carol Nichols, The Rust Programming Language, 2nd Edition,No Starch Press, Inc, 2022.

Course Structure

A8035 - Research Methodology

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

Research is an art of scientific investigation. Research is an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison, and experiment. This course will help students to understand the research process, tools, and importance of ethics. Also, this course helps students to write technical reports.

Course Pre/Co-requisites

This course has no core requisites/pre-requisites

2. Course Outcomes (COs)

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

A8035.1. Identify an appropriate research problem in their suitable domain.
A8035.2. Explain the concepts and procedures of sampling, data collection, analysis, and reporting.
A8035.3. Analyze the complex issues inherent in selecting a research problem, research design, and implementing a research project.
A8035.4. Construct a well-structured research paper and scientific presentations.
A8035.5. Express the importance of research ethics in the scientific community.

3. Course Syllabus

Research Methodology: Introduction, meaning, objectives, motivation, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, research process, criteria of good research. **Defining a Research Problem:** Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs, basic principles of experimental designs.

Measurement and Scaling: Measurement in research, measurement scales, sources of error in measurement, techniques of developing measurement tools, scale classification bases, scaling techniques.

Data Collection: Collection of primary data, observation method, interview method, collection of secondary data, selection of appropriate method for data collection, case study

method.

Interpretation and Report Writing: Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation, mechanics of writing a research report, precautions for writing research reports. **Research Tools and Techniques:** Methods to search required information effectively, reference management software like Zotero, Mendeley and EndNote, LaTeX (writing paper, thesis, report, bibliography), BEAMER for presentation, software for detection of plagiarism. ethical issues related to publishing, plagiarism and self-plagiarism.

4. Books and Materials

Text Books:

1. C.R. Kothari, Gaurav Garg "Research Methodology: Methods and Techniques" 4th Edition, New Age International, 2018
2. Ranjit Kumar "Research Methodology a step-by step guide for beginners", 3rd Edition, SAGE Publications Ltd, 2011.

Reference Books:

1. Trochim, Research Methods: the concise knowledge base, Atomic Dog Publishing, 2005
2. Fink A "Conducting Research Literature Reviews: From the Internet to Paper" Stage Publications, 2009

III YEAR II SEMESTER

Course Structure

A8522 - Cloud Computing and Virtualization

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). In IaaS main stream Cloud infrastructure services and related vendor solutions are covered in detail. The course also covers the Cloud migration and security model. Students will gain hands-on experience on virtual box and advanced open source tools like Azure, Open stack and Eucalyptus. Themajor motto of this course is to not just stick with the academic portion but also to encourage students to for cloud certifications to brighten their future endeavours in IT sectors.

Course Pre/co-requisites

A8510 – Operating Systems

2. Course Outcomes (COs)

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

A8522.1. Demonstrate cloud services, architecture and layers in cloud environment.
A8522.2. Identify the cloud migration model and challenges of integration in cloud sectors.
A8522.3. Make use of virtualization concepts in cloud.
A8522.4. Select cloud storage, privacy approaches for efficient implementation of cloud.
A8522.5. Implement IaaS / PaaS service on a public cloud using any open source tool.

3. Course Syllabus

Introduction to Cloud Computing: Cloud Computing in a Nutshell- Roots of Cloud Computing – Layers and Types of Clouds– Desired Features of a Cloud– Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers,Challenges and Risks, Hybrid.

Broad Approaches to Migrating into Cloud: Broad Approaches to Migrating into the Cloud: The Seven-Step Model of Migration into a Cloud - The Challenges of SaaS Paradigm Approaching the SaaS Integration Enigma, the Integration Methodologies, SaaS Integration Products and Platforms SaaS Integration Services, Businessesto-Business Integration (B2Bi) Services SaaS Integration Appliances, Managing Cloud Resources, Maintaining Connections.

Data Centre Technology and Virtualization: Virtualization Technology Overview,Public Cloud and Infrastructure Services:Private Cloud and Infrastructure Services, Distributed Management of Virtualization, Virtual Machines Provisioning And Manageability: VM Provisioning Process, Virtual Machine Migration Services-Migrations Techniques,VM Provisioning And Migration In Action, VM Life Cycle and VM Monitoring, VM Dynamic Management Using Open Nebula.

Secure Distributed Data Storage in Cloud Computing: Cloud Storage: From LANs To WANs, Existing Commercial Cloud Services Technologies For Data Security In Cloud Computing: Database Outsourcing And Query Integrity Assurance Data Integrity in Untrustworthy Storage, Multimedia Data Security Storage, Data Privacy and Security Issues, Content Level Security—Pros and Cons .

Workflow Engine for Clouds: Introduction, Workflow Management Systems and Clouds, Architecture of Workflow Management Systems, Utilizing Clouds for Workflow Execution, Salesforce Workflow Model, Aneka Workflow Model, A Classification of Scientific Applications And Services In The Cloud: Saga-Based Scientific Applications That Utilize Clouds.

4. Books and Materials

Text Books:

1. RajkumarBuyya, James Broberg, Andrzej Goscinski., Cloud Computing: Principles and Paradigms, Wiley, 2013.
2. Barrie Sosinsky., Cloud Computing Bible, 1st Edition,Wiley India, 2011.

Reference Books:

1. Tim Malhar, S.Kumaraswammy, S.Latif., Cloud Security and Privacy, 1st Edition, O'Reilly Media, Inc.,2009.

Course Structure

A8806 - Big Data Analytics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The key objective of this course is to familiarize the students with most important information technologies used in manipulating, storing, and analyzing big data with low latency. Big data analytics is the use of advanced analytic techniques against very large, diverse data sets that include structured, semi-structured and unstructured data, from different sources, and sizes. Through this course the students comprehend and appreciate how Hadoop open-source software frame work stores and processes big data in a distributed fashion on large clusters of commodity hardware. The course gives insights of the modern big data tools like Cassandra, MongoDB, Pig and Hive that allows users to make better and faster decisions.

Course Pre/co-requisites

A8514 - Database Management Systems.

A8804 - Data Analytics.

2. Course Outcomes (COs)

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

A8806.1. Identify the fundamental concepts of big data analytics.
A8806.2. Analyze the Hadoop environment and apply HDFS commands on file management tasks.
A8806.3. Utilize optimization techniques of MapReduce Programming to process massive amounts of data in parallel.
A8806.4. Make use of NoSQL databases like MangoDB and Cassandra to stock log data to be pulled for analysis.
A8806.5. Identify appropriate modern tools like Pig and Hive for complex data flow and analysis.

3. Course Syllabus

Introduction to Big Data: Classification of Digital Data, Characteristics of Data, Definition of Big Data, Challenges with Big Data, Definitional Traits of Big Data, Traditional Business Intelligence (BI) versus Big Data, Coexistence of Big Data and Data Warehouse, Realms of Big Data, Big Data Analytics, Classification of Analytics, Challenges of Big Data, Terminologies Used in Big Data Environments, Few Top Analytics Tools.

The Big Data Technology Landscape: NoSQL (Not Only SQL), Types of NoSQL Databases, SQL versus NoSQL, Introduction to Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, Hadoop Overview, Hadoop Distributors, HDFS (Hadoop Distributed File System), Working with HDFS commands, Interacting with Hadoop Ecosystem.

Mapreduce Programming: Processing Data with Hadoop, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression, Managing Resources and Applications with Hadoop YARN.

Cassandra: Features of Cassandra, CQL Data Types, Keyspaces, CRUD Operations, Collection Types, Table Operations. MONGODB: Features of MongoDB, RDBMS vs MongoDB, Data Types in MongoDB, MongoDB Query Language, CRUD operations, Count, Limit, Sort, and Skip.

PIG: The Anatomy of Pig, Pig Philosophy, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes of Pig, Relational Operators, Eval Functions, Word Count using Pig. HIVE: Introduction to Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL): DDL, DML, Partitions, Pig versus Hive.

4. Books and Materials

Text Books:

1. Seema Acharya, Subhashini Chellappan. Big Data and Analytics, 2nd Edition, Wiley IndiaPrivate Limited, New Delhi, 2019.

Reference Books:

1. Tom White. Hadoop - The Definitive Guide, 4th Edition, O'Reilly Publications, India, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman. Big Data for Dummies, John Wiley & Sons, Inc., 2013.

Course Structure

A8710 - Knowledge Representation and Reasoning

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	30	3	40	60	100

1. Course Description

Course Overview

Knowledge representation is the process of encoding knowledge in a format that can be used by computers. Reasoning is the process of using that knowledge to solve problems. There are many different ways to represent knowledge, and many different ways to reason with it.

Course Pre/co-requisites

A8702: Artificial Intelligence

2. Course Outcomes (COs)

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

A8710.1 Analyze theoretical and practical issues in symbolic knowledge representation and reasoning.

A8710.2 Apply the capabilities of specific knowledge representation formalisms for specific tasks.

A8710.3 Make effective use of techniques specific to specific knowledge representation problems and formalisms.

A8710.4 .Make effective use of special-purpose languages for commonsense reasoning, ontologies, planning, reasoning about actions, constraint programming.

A8710.5 Handle uncertain or incomplete knowledge based problems.

3. Course Syllabus

Theory

The Key Concepts: Knowledge, Representation, Reasoning, Why knowledge representation and reasoning, Role of logic Logic: Historical background, Representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity Amidst diversity

Ontology: Ontological categories, Philosophical background, Top-level categories, describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time

Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation

Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change Con-

texts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.

Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic, Fuzzy logic, Nonmonotonic Logic, Theories, Models and the world, Semiotics Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, Accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition

Text Books:

1. Knowledge Representation logical, Philosophical, and Computational Foundations by John F. Sowa, Thomson Learning..

Reference Books:

1. Knowledge Representation and Reasoning by Ronald J. Brachman, Hector J. Levesque, Elsevier.

Course Structure

A8524 - Cloud Computing and Virtualization Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). In IaaS main stream Cloud infrastructure services and related vendor solutions are covered in detail. The course also covers the Cloud migration and security model. Students will gain hands-on experience on Virtual Machines, Storage, IAM Users, access controls, Virtual Private Cloud and RDS

Course Pre/co-requisites

A8510 - Operating System

A8519 - Computer Networks

2. Course Outcomes (COs)

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

A8524.1. Create and Configure Virtual machines and Lambda Service.
A8524.2. Implement IAM for user management and access control
A8524.3. Create and manage S3 buckets with proper configurations.
A8524.4. Set up and Configure Virtual Private Clouds (VPCs) and Subnets.
A8524.5. Deploy and manage Relational Database using RDS.

3. List of Experiments

1. Create the following instances using AWS EC2
   i. Linux
   ii. Windows
2. File transfer from Local system to AWS Linux machine and Windows machine.
3. Implement the following
   i. Launch the Windows Server from AWS and make as Web Server.
   ii. Launch the Amazon Linux Server from AWS and make as Web Server.
4. Implement the following
   i. Launch the Linux machine and add 5 GB of additional volume to the Linux machine.
   ii. Launch the Windows Server and then add 5 GB of additional volume.

5. Create and manage IAM users, Groups and Polices.
6. Create and configure Amazon S3 and implement Versioning feature.
7. Implement Life cycle management to the uploaded object.
8. Launch the Web Server using Public subnet and Database Server using Private subnet. Connect the Database Server using Bastion Server.
9. Implement and the schedule tasks with AWS Lambda.
10. Connect MySQL Relational Database using Amazon RDS.
11. Create tables and update in dynamo DB.
12. Athena use Netflix Data Set
13. Create and configure Virtual machines using Azure.
14. Create and manage users and groups in Azure AD, including user attributes, group memberships, and roles.
15. Create, configure and manage Azure SQL Databases.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. AWS and Azure free tier account

5. Books and Materials

Text Books:

1. AWS Certified SysOps Administrator Official Study Guide: Associate Exam by Stephen Cole (Author), Gareth Digby (Author), Chris Fitch (Author), Steve Friedberg (Author), Shaun Qual .
2. AWS Certified Solutions Architect Official Study Guide: Associate Exam by Joe Baron .
3. Azure Study & Lab Guide For Beginners Paperback by Harinder Kohli.

Reference Books:

1. Learning Aws - Second Edition: Design, build, and deploy responsive applications using AWS by Amit Shah Aurobindo Sarkar .
2. Mastering Aws Lambda by Yohan Wadia Udita Gupta.
3. Hands-On Labs: AZ-900: Microsoft Azure Fundamentals Based on Real - World Case Studies - Lab Guide,2023.

Course Structure

A8807 - Big Data Analytics Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

The key objective of this course is to familiarize the students with most important information technologies used in manipulating, storing, and analyzing big data with low latency. The course gives insights of the modern big data tools like Cassandra, MongoDB, Pig and Hive that allows users to make better and faster decisions.

Course Pre/co-requisites

A8517 - Database Management Systems Laboratory

A8805 - Data Analytics Labortory

2. Course Outcomes (COs)

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

A8807.1. Implement HDFS commands on file management tasks.
A8807.2. Use of MapReduce Programming to process massive amounts of data in parallel.
A8807.3. Use NoSQL databases like MangoDB and Cassandra to stock log data to be pulled for analysis.
A8807.4. Implement Pig programs for complex data flow and analysis.
A8807.5. Implement Hive programs for complex data flow and analysis.

3. List of Experiments

1. Hadoop Environment setup:
   Write the steps to download, install and configure the Hadoop framework on Ubuntu Linux and Windows operating systems.
2. Hadoop HDFS Commands:
   Implement the following file management tasks in Hadoopframework using Cloudera: Adding files and directories, Retrieving files, Deleting files
3. MapReduce Programming:
   Develop a WordCount Java programand implement in Hadoop MapReduce framework using Cloudera.
4. MapReduce Programming:
   Develop a MapReduce program to search for a specific keyword in a file. Develop a

MapReduce program to sort data by student name (value).

5. Cassandra:
   Implement keyspace operations to group column families together for the given application data.
   Implement CRUD operations on the given dataset using Cassandra.
6. Cassandra:
   Design a table/column family and perform various collection types Set, List and Map using Cassandra.
   Design a table/column family and perform Alter table commands using Cassandra.
7. MongoDB: Implement a program with basic commands on databases and collections using MongoDB.
   Implement CRUD operations on the given dataset using MongoDB.
8. MongoDB:
   Perform Count, Limit, Sort, and Skip operations on the given collections using MongoDB.
9. Pig Latin commands:
   Implement Relational operators –Loading and Storing, and Diagnostic operators - Dump, Describe, Illustrate & Explain on the given database in Hadoop Pig framework using Cloudera.
   Develop a Pig Latin program to implement Filtering, Sorting operations on the given database.
10. Pig Latin commands: Implement Grouping, Joining, Combining and Splitting operations on the given database using Pig Latin statements.
    Perform Eval Functions on the given dataset.
    Develop a WordCount program using Pig Latin statements.
11. Hive commands: Implement Data Definition Language (DDL) Commands for databases in Hadoop Hive framework using Cloudera.
    Implement Data Definition Language (DDL) Commands for tables in Hive.
12. Hive commands :
    Implement Data Manipulation Language (DML) Commands for tables in Hive.
    Perform data partitioning to split the given larger dataset into more meaningful chunks.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. Cloudera-Hadoop (Open Source/ Freeware), Virtual Box(Open Source/ Freeware)

5. Books and Materials

Text Books:

1. Seema Acharya, Subhashini Chellappan. Big Data and Analytics, 2nd Edition, Wiley

IndiaPrivate Limited, New Delhi, 2019.

Reference Books:

1. Tom White. Hadoop - The Definitive Guide, 4th Edition, O'Reilly Publications, India, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman. Big Data for Dummies, John Wiley & Sons, Inc., 2013.

Course Structure

A8012 - Advanced English Communication Skills Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This Lab focuses on grooming the students professionally and empowering them through language development. This course facilitates them to hone their vocabulary and listening skills enabling them to prepare for competitive examinations. This course also polishes the students' presentation skills in different professional contexts besides developing proficiency in reading and writing. Further, they would be outfitted to communicate their ideas relevantly in group discussions and develop proficiency in preparing for interviews, thus making students ready for industry.

Course Pre/co-requisites

A8010 - English for Skill Enhancement
A8011 - English Language and Communication Skills Laboratory

2. Course Outcomes (COs)

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

A8012.1. Improve comprehensive skills in listening and reading.
A8012.2. Develop effective technical writing skills and e- correspondence.
A8012.3. Build communication skills in different socio-cultural and professional contexts.
A8012.4. Organize the dynamics of group discussion for effective participation.
A8012.5. Analyze strategies to succeed in interviews.

3. Course Syllabus

Theory

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills Laboratory **Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub-skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice.

Activities on Writing Skills: Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing –Writing a Letter of Application –Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.

Activities on Presentation Skills: Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation.

Activities on Group Discussion (GD): Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do's and Don'ts - GD Strategies – Exercises for Practice.

Interview Skills: Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

4. Laboratory Equipment/Software/Tools Required

1. Audio Visual Equipment (Public Address System, LCD Projector and Camcorder).
2. One PC with latest configuration for the teacher.
3. Delta's key to the Next Generation TOEFL, Test: Advanced Skill Practice.
4. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
5. Oxford Advanced Learner's Dictionary, 10th Edition.
6. Cambridge Advanced Learner's Dictionary.
7. Lingua TOEFL CBT Insider, by Dreamtech.

5. Books and Materials

Text Books:

1. M. Ashraf Rizvi, Effective Technical Communication, 2nd Edition, McGraw Hill Education, 2018.
2. Suresh Kumar E, Engineering English, 1st Edition, Orient BlackSwan Pvt. Ltd, 2015.
3. Bailey, Stephen, Academic Writing: A Handbook for International Students (5th Edition), Routledge, 2018.
4. Koneru, Aruna, Professional Communication, McGraw Hill Education (India) Pvt. Ltd, 2016.

Reference Books/Additional Resources:

1. Meenakshi Raman & Sangeeta Sharma, Technical Communication, 3rd Edition, Oxford University Press, 2015.
2. Paul V. Anderson, Technical Communication, 8th Edition, Cengage Learning pvt. Ltd., New Delhi. 2013.
3. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart, English Vocabulary in Use Series. Cambridge University Press, 2017.
4. Sen, Leela, Communication Skills, PHI Learning Pvt Ltd., New Delhi, 2009.

5. Elbow, Peter, Writing with Power. Oxford University Press,1998.
6. Goleman, Daniel, Emotional Intelligence: Why it can matter more than IQ. Bloomsbury Publishing,2013.

Course Structure

A8034 - Indian Constitution

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

This course enables the students to understand the constitution of India as the Supreme law of India. The student will also gain knowledge about the parliament of India and how it functions. This course will survey the basic structure and operative dimensions of the Indian constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian constitution.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8034.1. Identify the important components of Indian Constitution.
A8034.2. Apply the fundamental rights in right way and become a more responsible citizen.
A8034.3. Illustrate the evolution of Indian Constitution.
A8034.4. Identify the basic structure of Indian Constitution.
A8034.5. Relate the basic concepts of democracy, liberty, equality, secular and justice.

3. Course Syllabus

Evolution of Indian constitution: Indian independence act 1947, formation of constituent assembly of India, committees of the constituent assembly, constitution of India drafting committee, brief study about Indian Constitution drafting committee Chairman, time line of formation of the constitution of India.

Structure of the constitution of India: Parts, schedules, appendices, constitution and government, constitution and judiciary.

Preamble to the constitution of India: Brief study about sovereignty, socialist, secularism, democracy, republic, justice (political justice, social justice, economic justice), liberty, equality, fraternity, unity & integrity.

Acts: Salient Features, Provisions of the acts: Right to education act, right to information act, anti-defection law, Jan Lokpal bill.

Fundamental rights: Right to equality, right to freedom (freedom of speech and expression, right to practice any profession etc.), right against exploitation, right to freedom of religion, cultural & education rights, right to property, right to constitutional remedies

4. Books and Materials

Text Books:

1. Dr. Durga das basu.Introduction to the constitution of India, 21st Edition, Lexis Nexis books publication Ltd, 2013.

Reference Books:

1. Subhash C. Kashyap, Our Constitution, National Book Trust, New Delhi, 2011.
2. Arun K Thiruvengadam, The Constitution of India, 1st Edition, Hart publishing India, 2017.

IV YEAR I SEMESTER

Course Structure

A8707- Deep Learning

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course builds the knowledge on deep neural learning in the aspect of artificial intelligence that depends on data representations rather than task- specific algorithms. It helps the students to demonstrate supervised, semi-supervised, and unsupervised learning. A convolution deep learning neural network is built using Keras to show how deep learning is used in specialized neural networks. Applications of deep learning will help to recognize and process text, images and speech applications. Introduction of various deep learning models such as RNNs, Encoders and Generative models will help to relate to real time projects.

Course Pre/co-requisites

A8508 - Python Programming Laboratory
A8703 - Machine Learning

2. Course Outcomes (COs)

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

A8707.1 Identify the need of neural networks and deep learning for a given problem.
A8707.2 Build a CNN model on the real time data.
A8707.3 Model sequence classification applications using RNN.
A8707.4 Build a deep learning model using encoders.
A8707.5 Make use of generative models in various creative tasks.

3. Course Syllabus

Theory

Introduction : Introduction Deep Learning Architectures Historical trends in Deep Learning, Challenges motivating Deep Learning, gradient Based Learning, Hidden Units, Architecture Design, Back Propagation

Convolution Neural Networks : The convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Convolution Networks and the History of Deep Learning

Sequence Modeling : Recurrent And Recursive Nets Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures,Long Short Term Memory Networks.

Auto Encoders : Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders,Contractive Encoders. Applications of Auto encoders

Deep Generative Models : Boltzmann Machines, Deep Belief networks, Deep Boltzmann Machine, Generative Stochastic Networks, Generative Adversarial networks, evaluating Generative Models Networks.

4. Books and Materials

Text Books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Jeff Heaton., Deep Learning and Neural Networks, Heaton Research Inc, 2015.

Reference Books:

1. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G., H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw Hill Education,2004

Course Structure

A8711 - Soft Computing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Neural networks provide a model of computation drastically different from traditional computers. This course will cover basic neural network architectures, learning algorithms and back propagation methods for applications in pattern recognition, image processing, and computer vision. This course also provide the fuzzy logic fundamentals needed to understand uncertainty theory. This course will be begun by covering the fuzzy sets and membership concepts that are necessary in the study of fuzzy expert system. It covers the concepts of fuzzification and defuzzification to study and construct the fuzzy rule base systems for real time applications. This course will Provide an overview of soft computing techniques like particle swarm optimization , Genetic algorithm and Rough sets.

Course Pre/co-requisites

A8707: Deep Learning
A8702: Artificial Intelligence

2. Course Outcomes (COs)

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

A8711.1 Develop intelligent systems leveraging the paradigm of soft computing techniques.
A8711.2 Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
A8711.3 Recongnize the feasibility of applying a soft computing methodology for a particluar problem.
A8711.4 Design the methodolgy to solve the optimization problmes using Fuzzy logic, genetic algorithms and nueral networks.
A8711.5 Design hybrid systems to revise the principles of soft computing in various applications.

3. Course Syllabus

Introduction: Introduction to Soft Computing, Evolutionary Computing, Hard Computing Vs. Soft Computing, Soft Computing Methods, Fundamentals of Artificial Neural Network: Model of Biological Neuron, Mathematical Model of Neuron, ANN Architecture, Learning Rules, Learning Paradigms, Perceptron Network, Adaline and Madaline Networks, Applications of Neural Network, Associative Memory.

Classical Sets and Fuzzy Sets: Crisp Sets, Fuzzy Sets: History and Origin, Fuzzy Sets: Basic Concepts, Paradigm Shift, Representations of Fuzzy Sets, Alpha-cuts, Basic Opera-

tions on Fuzzy Sets, Fuzzy Complements, Intersections, and Unions, Extension Principle for Fuzzy Sets, Intuitionistic Fuzzy Sets, Operations on Intuitionistic Fuzzy Sets, Alpha–Beta Cuts. Crisp Relations, Fuzzy Relations, Binary Fuzzy Relations, Intuitionistic Fuzzy Relations Intuitionistic Fuzzy Relations, Intuitionistic Fuzzy Relations, Classical Logic and Fuzzy Logic: Logic, Interval Analysis, Fuzzy Numbers, Fuzzy Logic, Fuzzy Rule-Based Systems: Linguistic Variables and Linguistic Hedges, Rule-Based Systems, Conventional Programs Versus Rule-Based Systems, Fuzzy Propositions, Fuzzification and Defuzzification.

Genetic Algorithms: History of Evolutionary Computing, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm. History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, GA Operators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi - level Optimization.

Particle Swarm Optimization: I particles moves, particle swarm optimization, variable length PSO, applications of PSO, case studies. Artificial Bee Colony algorithms - ABC basics, ABC in optimization, multi-dimensional bee colony algorithms, applications of bee algorithms, case studies.

Rough Sets: Fundamentals of Rough Set Theory, Rough Approximations, Properties of Approximations, Measures of Accuracy, Topological Characterization of Imprecision, Rough Membership Function Attribute Reduction, Approximation of Classification, Dependency of Knowledge.

4. Books and Materials

Text Books:

1. B K Tripathy | J Anuradha, Soft Computing Advances and Applications:, CENGAGE Learning, 2015.

Reference Books:

1. J.S.R. Jang, C.T. Sun and E. Mizutani., Neuro-Fuzzy and Soft Computing, Pearson Education, 2004
2. N.P.Padhy., Artificial Intelligence and Intelligent Systems, Oxford University Press, 2005.

Course Structure

A8709 - Deep Learning Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course builds the knowledge on deep neural learning inthe aspect of artificial intelligence that depends on data representations rather than task- specific algorithms. It helps the students to demonstrate supervised, semi-supervised, and unsupervised learning. A convolution deep learning neural network is built using Keras toshow how deep learning is used in specialized neural networks. Applications of deep learning will help to recognize and process text, images and speech applications. Introduction of various deep learning models such as RNNs, Encoders and Generative models will help to relate to real time projects.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

A8508 - Python Programming A8703 - Machine Learning

2. Course Outcomes (COs)

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

A8709.1. Make use of Gradient descent learning mechanism in Artificial neural network (ANN)
A8709.2. Build Convolutional Neural Network (CNN) architectures for image classification and object detection
A8709.3. Construct Recurrent Neural Networks (RNN) models for sequence prediction
A8709.4. Build Autoencoders for unsupervised learning task
A8709.5. Make use of generative adversarial network (GAN) to generate plausible data

3. List of Experiments

1. Create neural network class and initialize those weights and biases
2. Implement all activation functions in Neural Network
3. Implement Loss function for Neural network.
4. Implement Forward Propagation and Backward Propagation.
5. Program to Train and Test a neural network.
6. Train and test the Convolution neural network using the heart disease dataset, preprocess it.
7. Implement Convolution neural network for image classification.

8. Train and test the recurrent neural network using the heart disease dataset, pre-process it.
9. Implement Facial recognition using neural network.
10. WriteImplement Object detection using neural network

4. Laboratory Equipment/Software/Tools Required

1. A computer System with Ubuntu Operating System.
2. Anaconda Python, Spider, Jupyter Notebook, pycharm Keras , Tensorflow IDE:Pycharm

Course Structure

A8712 – Soft Computing Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Neural networks provide a model of computation drastically different from traditional computers. This course will cover basic neural network architectures, learning algorithms and back propagation methods for applications in pattern recognition, image processing, and computer vision. This course also provides the fuzzy logic fundamentals needed to understand uncertainty theory. This course will be begun by covering the fuzzy sets and membership concepts that are necessary in the study of fuzzy expert system. It covers the concepts of fuzzification and defuzzification to study and construct the fuzzy rule base systems for real time applications. This course will Provide an overview of soft computing techniques like particle swarm optimization, Genetic algorithm and rough sets.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

A8707: Deep Learning

2. Course Outcomes (COs)

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

A8712.1. Recognize the fesability of apply a soft compuitng methodology for a particular problem.
A8712.2. Apply Fuzzy logic and reasoning to handle uncertainity and solve engineering problems.
A8712.3. Apply genetic algorithms to combnational optimization problems.
A8712.4. Apply nueral networks to pattern classification and regression problems
A8712.5. Use effectively existing software tools to solve real problems using a soft computing.

3. List of Experiments

1. Performing Union, Intersection and Complement operations
2. Implementation of De-Morgan's Law
3. Plotting various membership functions.
4. Using fuzzy toolbox to model tips value.
5. Implementation of Fuzzy Inference System.

6. Simple fuzzy set operations
7. Using Hopfield network with no self-connection
8. Generation of ANDNOT function using McCulloch-Pitts neural net.
9. Finding weight matrix and bias of Hebb Net to classify two dimensional input patterns
10. Perceptron net for AND function with bipolar inputs and targets
11. Finding weight matrix of Hetero-Associative neural net for mapping of vectors
12. Generation of XOR function using back propagation algorithm

4. Laboratory Equipment/Software/Tools Required

1. A computer System with Ubuntu Operating System.
2. C/C++/python Compiler

Professional Electives

Course Structure

A8607– Information Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Information security is the practice of protecting information by mitigating risks across computer systems. The course introduces the technical and policy foundations of information network security. This course explains the inner workings of cryptographic systems and how to correctly use them in real-world applications.

Course Pre/co-requisites

A8519 - Computer Networks.

2. Course Outcomes (COs)

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

A8607.1 Recognize various security threats, services, mechanisms, and classical encryption techniques.
A8607.2 Apply classical encryption algorithms (Substitution and Transposition ciphers) and DES, AES algorithms to encrypt plain text.
A8607.3 Explain various key management techniques, exemplifying RSA and Diffie-Hellman.
A8607.4 Examine the problems of authentication techniques (SHA, Digital signature).
A8607.5 Analyze different symmetric key distribution and understanding of various authentication applications

3. Course Syllabus

Introduction to Information Security: Computer security concepts, OSI security architecture,security attacks, security services, security mechanisms, a model for network security.Classical Encryption Techniques: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques.

Block Cipher and Data Encryption Standards: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles, tools used for DES.Advanced Encryption Standards: Advanced Encryption Standard, Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Key Expansion, tools used for AES.Blowfish Algorithm,International Data Encryption Algorithm(IDEA).

Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, extended Euclid's algorithm. Public-Key Cryptography

and RSA: Principles of Public key crypto Systems, RSA algorithm, Diffie-Hellman Key Exchange.

Hash Functions: Cryptographic Hash Functions, Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA). Digital Signature: Digital Signature Requirements, Attacks and Forgeries, Properties.

Key Management and Distribution : Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security Email Security:Pretty Good Privacy (PGP).

4. Books and Materials

Text Books:

1. William Stallings, Cryptography and network security: principles and Practice Upper Saddle River: Pearson, 6th edition.

Reference Books:

1. Forouzan, Behrouz A., and Debdeep Mukhopadhyay. Cryptography and network security (Sie).McGraw-Hill Education, 2011.
2. AtulKahate., Cryptography and Network Security, 2nd edition, Tata Mc-Grawhill, India,2008.

Course Structure

A8352 - Operations Research

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course builds foundation of basic concepts of operations research and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in different fields. The mathematical modeling skills sustained from this course acquaint the students with the knowledge of various tools and techniques which helps in optimal utilization of the scarce resources of an organization

Course Pre/co-requisites

A8001: Matrices and Calculus

A8003: Probability Distributions and Statistics

2. Course Outcomes (COs)

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

A8352.1 llustrate operations research features, models, methods, applications, advantages and limitations

A8352.2 Build mathematical models to obtain optimum solution for various real world problems

A8352.3 Develop operational policies for efficient management of personnel, materials, machines, production, distribution, and service systems, optimizing service rate and server count to minimize queuing and service

A8352.4 Evaluate various alternatives available to aid in decision making situations

A8352.5 Choose the best strategies to maximize the profit thereby minimizing loses in the presence of a competitor.

3. Course Syllabus

Introduction to Operation Research: Basic definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem, Formulation and Graphical solution of Linear Programming Problem, Simplex Method, Artificial variables Techniques, Big -M method.

Transportation Problem: Formulation, Solution, Unbalanced Transportation problem. Finding basic feasible solutions, North-West corner rule, Least cost method and Vogel's

approximation method, Optimality test – MODI method. ASSIGNMENT MODEL: Formulation, Hungarian method for optimal solution, solving unbalanced problem.

Sequencing Models: Solution of Sequencing Problem, Processing n Jobs through two machines, Processing n Jobs through three machines, Processing two Jobs through m machines, Processing n Jobs through m Machines. QUEUING THEORY: Introduction, Single Channel, Poisson arrivals, exponential service times with infinite population and finite population models

Replacement and Inventory Models:
Replacement Models: Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value, Replacement of items that fail suddenly, individual replacement policy, group replacement policy. Inventory Models: Inventory costs, Models with deterministic demand model: (a) Demand rate uniform and production rate infinite, (b) Demand rate non-uniform and production rate infinite.

Game Theory: Competitive game, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle, Rectangular games without saddle point, mixed strategy for 2 X 2 games

4. Books and Materials

Text Books:

1. J K. Sharma , Operations Research – Theory and Applications, 6th Edition, Trinity Press Ltd New Delhi, India.
2. Frederick S Hillier; Gerald J Lieberman, Introduction to Operations Research,10th Edition, McGraw- Hill , New York.

Reference Books:

1. Hamdy Abdelaziz Taha , Operations Research: an Introduction, 9th Edition, Pearson, Boston.
2. Prem Kumar Gupta and D S Hira, Operations Research, Revised edition, S. Chand Publishing, New Delhi, India.
3. P ShankaraIyer, Operations Research, 1st Edition, Tata McGraw Hill, Publishing Company, NewDelhi, India.

Course Structure

A8662 - Image Processing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Visual information plays an important role in almost all areas of our life. Today, much of this information is represented and processed digitally. Digital image processing is ubiquitous, with applications ranging from television to tomography, from photography to printing, from robotics to remote sensing. This course introduces digital image processing concepts such as Image fundamentals, Image enhancement in spatial and frequency domain, various image transformation techniques in spatial and frequency domain, segmentation, image filtering and color image processing. The primary goal of this course is to lay a solid foundation for students to study basic image processing functionalities in detail so that they can design real life applications based on their learning.

Course Pre/co-requisites

A8001 -Matrices and Calculus
A8703 -Machine Learning

2. Course Outcomes (COs)

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

A8662.1 Identify fundamental concepts of Digital Image Processing.
A8662.2 Experiment on images using Open CV for reading, writing and arithmetic operations.
A8662.3 Apply image transforms DFT, FFT, Walsh, HADAMARD, DCT on images.
A8662.4 Examine images by applying filters in spatial and frequency domain.
A8662.5 Illustrate the imaging techniques to practical cases,such as multimedia,segmentation and image compression.

3. Course Syllabus

Fundamentals of Image Processing: Image acquisition, image model, sampling, quantization, relationship between pixels, distance measures,connectivity and image geometry. Introduction to OpenCV, image reading and operations.

Image Transforms and Image Enhancement(Spatial Domain Methods): Fourier transform, DFT, DFT-properties, FFT, WALSH transform, HADAMARD transform, DCT. Image Enhancement(Spatial Domain Methods):Histogram Processing ,definition, equalization, matching, local enhancement, use of histogram statics for image enhancement, Arithmetic and logical operations, pixel or point operations, size operations, Smoothing filters-mean, median, mode filters, sharpening spatial filtering.

Image Enhancement (Frequency Domain Methods): Design of low pass, high pass, edge enhancement, smoothening filters in frequency domain. Butter worth filter, sharpening frequency domain filters, homomorphic filters in frequency domain..

Image Segmentation and Compression: Detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation, use of motion in segmentation. Image Compression: Introduction, Lossy and Lossless compression, Huffman coding, Arithmetic coding.

Color Image Processing: Fundamentals,models,pseudo color image, color transformation,Fundamentals of image compression,image compression models, and color image compression.

4. Books and Materials

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods., Digital Image Processing, Pearson Education, New Delhi, 2008.

Reference Books:

1. Anil K. jain., Fundamentals of digital image processing, Pearson Education.
2. Arthur R. Weeks.,Fundamentals of Electronic Image Processing,Prentice Hall of India, New Delhi,1996
3. Milan Sonka, Vaclav Hlavac, Roger Boyle., Image processing, Analysis and Machine vision,Thomson Publications,2008.

Course Structure

A8751 – Optimization Techniques in Machine Learning

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The students will be able to understand and analyze how to deal with changing data. They will also be able to identify and interpret potential unintended effects in your project. They will understand and define procedures to operationalize and maintain your applied machine learning model.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8751.1. Analyze how to deal with changing data.
A8751.2. Interpret potential unintended effects in their project.
A8751.3. Comprehend and define procedures to operationalize and maintain the applied machine learning model.
A8751.4. Evaluate how to optimize the use of Machine Learning in real-life problems.
A8751.5. Evaluate the application of machine learning techniques in production and planning.

3. Course Syllabus

Model Fitting and Error Measurement: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization, Data, Models, and Learning, Empirical Risk Minimization, Parameter Estimation, Probabilistic Modelling and Inference Directed Graphical Models.

Linear Regression as an Optimization Problem: Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection.

Dimensionality Reduction and Optimization: Problem Setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective.

Unsupervised Learning and Expectation Maximization: Density Estimation with Gaussian Mixture Models, Gaussian Mixture Model, Parameter Learning via Maximum Likelihood, EM Algorithm, Latent-Variable Perspective.

Large-Margin Classification and Dual Optimization: Separating Hyperplanes, Primal Support Vector Machine, Dual Support Vector Machine, Kernels Numerical Solution.

4. Books and Materials

Text Books:

1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Mathematics for Machine Learning, 1st Edition, Cambridge University Press, Paperback, 23 April 2020, ISBN-13: 978-1108455145.

Reference Books:

1. Stephen Boyd and Lieven Vandenberghe, Convex Optimization,1st Edition, Cambridge University Press, Hardcover, March 2004, ISBN-13: 978-0521833783.
2. Suvrit Sra, Sebastian Nowozin and Stephen J. Wright, Optimization for Machine Learning, MIT Press, 2011.

Course Structure

A8652 - Cyber Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive overview of various cybercrimes, how they are planned, possible vulnerabilities and crimes that occur in mobile and wireless devices. It introduces tools and techniques that are used in cybercrime. It helps in analyzing and designing defensive security mechanisms for protecting information systems resources.

Course Pre/co-requisites

A8519- Computer Networks
A8607- Information Security

2. Course Outcomes (COs)

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

A8652.1 Identify the cybercrimes and offences in network accesses.
A8652.2 Interpret the criminal plans before going to attack.
A8652.3 Choose various security measures on mobile devices for a given scenario and make an effective report.
A8652.4 Identify the various methods and tools in Cyber Crime.
A8652.5 Examine various defense and analysis techniques to protect our information from attackers

3. Course Syllabus

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes. Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector, and Cloud Computing.

Cybercrime -Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Defense and Analysis Techniques: Memory Forensics - Why Memory Forensics Is Important, Capabilities of Memory Forensics, Memory Analysis Frameworks, Dumping Physical Memory, Installing and Using Volatility, Finding Hidden Processes, Volatility Analyst Pack, Honey pots, Intrusion Detection Systems.

4. Books and Materials

Text Books:

1. Nina Godbole and Sunil Belapure., Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Prespectives,1st Edition,Wiley INDIA, 2011.
2. James Graham, Richard Howard and Ryan Otson., Cyber Security Essentials,1st Edition,CRC Press,2011.

Reference Books:

1. Chwan-Hwa(John), Wu,J.David Irwin., Introduction to Cyber Security,1st Edition, CRC Press T and F Group, 2013.
2. Richard A. Clarke, Robert Knake., Cyberwar: The Next Threat to National Security and What to Do About It,Ecco 2010.

Course Structure

A8852 - Business Intelligence

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	40	60	100

1. Course Description

Course Overview

Business Intelligence (BI) is a set of architectures, theories, methodologies, and technologies that transform structured, semi-structured, and unstructured data into meaningful and useful information. Students will analyze enterprise data requirements to develop queries, and reports and build OLAP cubes that use business analytics to answer complex business questions.

Course Pre/co-requisites

A8814 - Database Management Systems

2. Course Outcomes (COs)

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

A8852.1 Discuss the impact of Business Intelligence (BI) theories, architectures, and methodologies on the organizational decision-making process.
A8852.2 Analyze the differences between the structured, semi-structured, and unstructured data types to leverage the best technologies.
A8852.3 Explain how different data can be integrated for querying and reporting to improve the performance of marketing and sales strategies.
A8852.4 Illustrate the ACID and BASE theories for data storage and consistency.
A8852.5 create a BI solution by conducting the enterprise-wide data requirements analysis.
A8852.6 Use OLAP tools to import data into multi-dimensional data cubes.
A8852.7 Develop Adhoc queries, reports, spreadsheets, dashboards, and mobile BI applications using business analytics.

3. Course Syllabus

Business Intelligence: Business intelligence systems: Definition, Goals, and Organisation. Understanding Attributes, Hierarchies, and Dimensions in Data Analysis for Multidimensional Analysis. Understanding the Fact Table, Dimension Tables, Surrogate Keys, and alternate Table Structure of the Dimensional Data Warehouse. What is OLAP in multi-dimensions?

Understanding OLAP: Spreadsheet formulas, meta-data-based inquiries, and mast response. Understanding the speed and meta-data of Analysis Services. Business intelligence

Platform from Microsoft. Tools for analysis services. Extraction, transformation, and loading of data. Tools and Meaning for the Same.

Making your first project for business intelligence: Making a data source and a data view. the Data view being changed. Time, creating new dimensions, and changing existing dimensions. Child-Parent Dimension. Cube creation: Cube creation wizard. Cube sneak peek. measure and measure groups being added to a cube. figured members. A Cube's Deployment and Exploration

Aggregate Functions: Advanced Measures and Calculations. To retrieve values from a cube, use MDX. Scripting for calculations. establishing KPIs. Creating reference, fact, and many-to-many dimensions is referred to as advanced dimensional design. Financial Analysis Cubes are used. manipulating a cube. creating drill-down and standard actions.

Creating Perspectives, MDX Queries, and Excel with Analysis Services: Retrieving Data from Analysis Services ,Data mining: Its significance and goal. data collection for data mining. building a data mining model. selecting an algorithm for data mining. recognising data mining software. mapping the columns of source data to the mining structure. via means of Cube Sources. defining the parameters of an algorithm. The creation of prediction queries for data mining reports. recognising DMX terminology.

4. Books and Materials

Text Books:

1. 1.Carlo Vercellis (2011). "Business Intelligence: Data Mining and Optimization for Decision Making". John Wiley & Sons.
2. 2.David Loshin (2012). "Business Intelligence: The Savvy Manager's Guide". Newnes.
3. 3.Elizabeth Vitt, Michael Luckevich, Stacia Misner (2010). "Business Intelligence". O'Reilly Media, Inc.
4. 4. Sharda, R., Delen, D., & Turban, E. (2015).Business Intelligence and Analytics: Systems for Decision Support (10th ed.). Upper Saddle River, NJ: Pearson. ISBN-13: 978-0-13- 305090-5.

Reference Books:

1. 1.Rajiv Sabhrwal, Irma Becerra-Fernandez (2010). "Business Intelligence". John Wiley & Sons.
2. 2. Swain Scheps (2013). "Business Intelligence for Dummies". Wiley.

Course Structure

A8663 - Computer Vision

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Computer Vision has become ubiquitous in our society, with applications in search, image understanding, apps, mapping, medicine, drones, and self-driving cars. Core to many of these applications are visual recognition tasks such as image classification and object detection. This course is a deep dive into details of neural-network based deep learning methods for computer vision.

Course Pre/co-requisites

A8662 - Image Processing

2. Course Outcomes (COs)

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

A8663.1 Demonstrate Image formation process, fundamentals of deep learning required for computer vision.
A8663.2 Examine existing practical computer vision techniques.
A8663.3 Analyse computer vision Classification and learning algorithms
A8663.4 Design deep learning applications for Face Detection and Recognition and Pedestrian detection.

3. Course Syllabus

Introduction to Computer Vision: What is computer vision, Applications of computer vision. The digital camera, Sampling and aliasing.Imaging Geometry: Translation and Scaling, Rotation, Perspective Transform. Image Formation: Pinhole Perspective, Weak Perspective. Model Fitting and Optimization: Scattered data interpolation.

Image Classification: Data-driven approach, K-Nearest Neighbor, Hyper parameters, Cross-validation Linear Classifiers: Algebraic / Visual / Geometric viewpoints; Soft- max / SVM classifiers. Application: Interactive colorization, Interactive segmentation

Convolutional Neural Networks: Pooling and un pooling. Application: Digit classification, Network architectures, Model zoos, Visualizing weights and activations, Adversarial examples, Self-supervised learning.

Recognition: Instance recognition, Image classification, Feature-based methods, Deep networks.

Applications: Visual similarity search, Face recognition, Object detection, Face detection, Pedestrian detection.

4. Books and Materials

Text Books:

1. Shah M., Fundamentals of Computer Vision., 1997.
2. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA)., 2nd Edition,Springer, 2011.
3. Forsyth D. and Ponce J., Computer Vision - A Modern Approach., 2nd Edition,Prentice Hall, 2002.

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing,, 2nd Edition, Prentice Hall, 2013.
2. R. Jain, R. Kasturi, and B. G. Schunk., Machine Vision, McGraw-Hill.
3. Milan Sonka,VaclavHlavac, Roger Boyle,Image Processing, Analysis, and Machine Vision, Thomson Learning.

Course Structure

A8752- Predictive Analytics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The students should be able to understand how to transform data and make it suitable for datadriven predictive tasks. Understand how to compute basic statistics using real-world datasets of consumer activities, like product reviews.

Course Pre/co-requisites

A8508 - Pyhton Programming Laboratory.

2. Course Outcomes (COs)

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

A8752.1. Apply Python to create interactive data visualizations to make meaningful predictions.

A8752.2. Apply Python to perform data processing on various files to build simple demo systems.

A8752.3. Apply simple regressions and classifications on datasets using machine learning libraries.

A8752.4. Examine the usage of various Python libraries in training & testing gradient dataset.

A8752.5. Examine and assess the classification diagnostics of data.

3. Course Syllabus

Introduction: Data Product, Data Product Examples in Enterprise, Developing a Data Product Strategy.

Reading Data in Python: Reading CSV & JSON Files, Processing Structured Data in Python, Live-Coding: JSON, Extracting Simple Statistics from Datasets Data Processing in PythonData Filtering and Cleaning, Processing Text and Strings in Python, Processing Times and Dates in Python

Python Libraries and Toolkits: Matrix Processing and Numpy, Introduction to Data Visualization, Introduction to Matplotlib, urllib and BeautifulSoup.

Gradient Descent: Classification in Python, Introduction to Training and Testing, Gradient Descent in Python, Gradient Descent in TensorFlow.

Diagnostics for Data: Meaningful Predictive modelling, Regression Diagnostic, Over- and Under-Fitting, Classification Diagnostics: Accuracy and Error, Classification Diagnostics:

Precision and Recall. Codebase for Evaluation and Validation, Model Complexity and Regularization, Evaluating Classifiers for Ranking

4. Books and Materials

Text Books:

1. Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Dean Abbott, 2014, Wiley.
2. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Tom Fawcett, O'Reilly, 1st edition, 2013.

Reference Books:

1. https://www.coursera.org/learn/design-thinking-predictive-analytics-data-products.
2. https://www.coursera.org/learn/meaningful-predictive-modeling.

Course Structure

A8653 - Web and Database Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Internet web sites are increasingly using web applications to access database systems for information retrieval, transactions and publication. These Internet web applications are commonly being used for e-commerce, e-banking, and e-government to purchase goods, make reservations, pay taxes, enroll in classes, retrieve academic transcripts, acquire account balances and pay bills, to name a few. In order to provide these Internet services many are connecting their security sensitive information stored in databases directly to the Internet. And, in many cases, the securities of these applications have been designed with the same securities as for trusted internal applications. By doing this organizations are creating security risks of possibly exposing sensitive information, critical business applications being disabled or compromised. This course looks at the problems associated with using web applications that access databases for Internet services. It also discusses some options of securing web services that utilize databases, as well as the overall security layers needed.

Course Pre/co-requisites

A8514- Database Management Systems
A8607- Information Security

2. Course Outcomes (COs)

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

A8653.1 Demonstrate the architecture and applications for web security.
A8653.2 Make use of various techniques in providing security to servers.
A8653.3 Utilize data access mechanisms for database security.
A8653.4 Identify common application vulnerabilities, prevention of misuse in database.
A8653.5 Select algorithmic techniques for privacy preserving data.

3. Course Syllabus

Web Security: The Web Security Problem, Risk Analysis and Best Practices, Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification.

Web Privacy: The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

Database Security: Recent Advances in Access Control, Access Control Models for XML, Access Control Policy Languages in XML, Database Issues in Trust Management and Trust Negotiation, Authenticated Index Structures for Outsourced Databases, Towards Secure Data Outsourcing, Managing and Querying Encrypted Data, Security in Data Warehouses and OLAP Systems.

Security Re-Engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Database Watermarking: A Systematic View, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities.

Privacy Preserving Data Mining: A survey, Privacy in Database Publishing: Bayesian Perspective, Privacy-enhanced Location-based Access Control,Privacy Preserving Publication: Anonymization Frameworks and Principles,Privacy Protection through Anonymity in Location-based Services, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

4. Books and Materials

Text Books:

1. Simson G. Arfinkel, Gene Spafford., Web Security, Privacy and Commerce, 2nd Edition, O'Reilly, 2018.
2. Michael Gertz, SushilJajodia., Handbook on Database security applications and trends, Springer, 2010.

Reference Books:

1. Jonathan LeBlanc , Tim Messerschmidt., Identity and Data Security for Web Development: Best Practices, 1st Edition, O' Reilly, 2016.
2. Bryan Sullivan and Vincent Liu., Web Application Security, A Beginner's Guide, McGrawHill, 2012.
3. Mark O'Neill., Web Services Security (Application Development) ,McGrawHill, 2003.

Course Structure

A8854 - Time Series Analysis

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This is exploring fundamental principles and advanced techniques for analyzing time-dependent data. This course equips students with the knowledge and skills to effectively model, interpret, and forecast temporal patterns in various domains, including finance, economics, climate science, and more. It includes time series decomposition, auto-regressive and moving average models, spectral analysis, and state-space models. Students will gain proficiency in data preprocessing, model selection, and diagnostic checks. Practical applications using software like R or Python will be key, allowing students to apply their learning to real-world datasets. By the end of the course, students will have a deep understanding of time series analysis and its practical implications in decision-making and prediction.

Course Pre/co-requisites

A8508 - Python Programming Laboratory

A8005- Computer Oriented Statistical Methods

2. Course Outcomes (COs)

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

A8854 .1 Analyze and forecast Time series models and state-space models.
A8854 .2 Evaluate the accuracy of time series forecasts using appropriate metrics.
A8854 .3 Identify and analyze trends, seasonality, and cyclical patterns in data through techniques.
A8854 .4 Analyze time series popular tools and programming languages.
A8854 .5 To use time series analysis to make informed business decisions with its limitations and assumptions.

3. Course Syllabus

Introduction to Time Series: Introduction, Examples of time series, Stationary models and autocorrelation function, Estimation and elimination of trend and seasonal component, simple descriptive techniques, trend, seasonality, the correlogram,Probability models for time series: stationary. Moving average (MA), Autoregressive (AR), ARMA and ARIMA models.

ARMA Models: Stationary Process and ARMA Models,Basic properties and linear processes, introduction to ARMA models, properties of sample mean and auto-correlation function, forecasting stationary time series, ARMA(p,q) processes.

Spectral Analysis: ACF and PACF, Forecasting of ARMA processes, Spectral Analysis, Spectral densities, Time-invariant linear filters, the spectral density of an ARMA process.

Modeling and Forecasting: Modeling and forecasting with ARMA Processes, preliminary estimation maximum likelihood estimation, diagnostics, forecasting, order selection.

Forecasting Techniques: Forecasting techniques, the ARAR algorithm, the Holt-Winter algorithm, the Holt-Winter seasonal algorithm estimation of time series models.

4. Books and Materials

Text Books:

1. Brockwell, Peter J. and Davis, Richard A. (2002). Introduction to Time Series and Forecasting, 2nd edition. Springer-Verlag, New York.

Reference Books:

1. Box, G.E.P., Jenkins, G.M. and Reinsel, G.C. (1994). Time Series Analysis: Forecasting and Control, 3rd Edition, Prentice Hall, New Jersey.
2. Chatfield, C. (1996). The Analysis of Time Series, 5th edition, Chapman and Hall, New York.
3. Shumway, R.H., Stoffer, D.S. (2006). Time Series Analysis and Its Applications (with R examples). Springer-Verlag, New York

Course Structure

A8664 – Pattern Recognition

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Pattern recognition is the process of recognizing patterns by using a machine learning algorithm. Pattern recognition can be defined as the classification of data based on knowledge already gained or on statistical information extracted from patterns and/or their representation. One of the important aspects of pattern recognition is its application potential. The course is designed to introduce students to theoretical concepts and practical issues associated with pattern recognition. The course also enables to Design systems and algorithms for pattern recognition (signal classification), with focus on sequences of patterns that are analyzed using hidden Markov models (HMM).

Course Pre/co-requisites

A8703 - Machine Learning

2. Course Outcomes (COs)

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

A8664.1 Examine classification problems and estimate classifier performance using probabilistic approaches.
A8664.2 Make use of various densities to make inferences in the given data.
A8664.3 Choose a mathematical model for solving the problem of density estimation.
A8664.4 Select an unsupervised learning algorithm for clustering.
A8664.5 Identify a pattern using discrete and Continuous hidden Markov models.

3. Course Syllabus

Introduction: Machine perception, pattern recognition example, pattern recognition systems, the Design cycle, learning and adaptation Bayesian Decision Theory: Introduction, continuous features – two categories classifications, minimum error-rate classification-zero–one loss function, classifiers, discriminant functions, and decision surfaces.

Normal density: Univariate and multivariate density, discriminant functions for the normal Density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context.

Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood Estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering.

Date description and clustering – similarity measures, criteria function for clustering.

Pattern recognition using discrete and Continuous hidden Markov models: Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs. Continuous observation densities, multiple mixtures per state, speech recognition applications.

4. Books and Materials

Text Books:

1. Richard O. Duda, Peter E. Hart, David G. Stork., Pattern Recognition: An Indian Adaption ,2nd Edition, Wiley student edition,2021.
2. M Narasimha Murty &. V Susheela Devi., Introduction to pattern recognition and machine learning, IISc Press,2015.

Reference Books:

1. Richard O. Duda, Peter E. Hart, David G. Stork., Pattern Classification ,2nd Edition, Wiley student edition,2000.
2. Christopher M. Bishop., Pattern Recognition and Machine Learning, Springer,2006.

Course Structure

A8753 - Generative AI

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

In this course, the students learn generative AI with stable diffusion, GANs, VAEs, etc., using Colab and Python. This course helps students to learn Deep Generative Models, understand how machines generate art, and model implementation through deep learning frameworks like PyTorch.

Course Pre/co-requisites

A8703 - Machine Learning
A8706 - Natural Language Processing
A8707 - Deep Learning

2. Course Outcomes (COs)

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

A8753.1 Apply the fundamental concepts, evolutionary developments, and major categories of generative AI models to demonstrate their use in practical scenarios.

A8753.2 Analyze and apply transformer-based architectures for text generation, text style transfer, and creative AI-driven writing.

A8753.3 Design GAN-based models for image and video synthesis, image-to-image translation, and artistic style generation.

A8753.4 Apply AI techniques such as Music RNNs, the Musical Organ, and MuseGAN for automated music generation using structured music representations.

A8753.5 Evaluate and build multimodal generative AI systems by understanding architectures like DALL·E 2 and Imagen.

3. Course Syllabus

Introduction to Generative AI: Definition and History of Generative AI , Types of Generative Models: Autoregressive, Variational Autoencoders, GANs Applications of Generative AI across different domains.

Generative AI for Text Generation: Transformer Architectures and Attention Mechanisms, T5, GPT-3 and GPT-4, Chat GPT.

Generative AI for Image and Video Generation: : Generative Adversarial Networks (GANs) Architectures, Cycle GANs for Image-to-Image Translation, Neural Style Transfer

and Artistic Image Generation.

Generative AI for Music Generation: Overview, Music Representation and Music RNNs, The Musical Organ, MuseGAN.

Generative AI for Multimodal Model: DALL.E 2 Architecture, The Text Encoder CLIP, The Prior, The Decoder, Examples from DALL.E 2, Imagen Architecture Draw Bench, Examples from Imagen.

4. Books and Materials

Text Books:

1. Kulkarni, Akshay, Dilip Gudivada, Anoosh Kulkarni, and Adarsha Shivananda, "Applied Generative AI for Beginners", Springer Nature, 2023.
2. David Foster, "Generative Deep Learning". 2nd Edition.

Reference Books:

1. Joseph BadCock, Raghav Bali, "Generative AI using python and Tensor flow2: Create image text and music with VAES, GANS, LSTMs, Transformer model".
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Generative Adversarial Networks".

Course Structure

A8654 - Cloud Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course will describe the Cloud security architecture and explore the guiding security design principles, design patterns, industry standards, applied technologies and addressing regulatory compliance requirements critical to design, implement, deliver and manage secure cloud based services. The course delves deep into the secure cloud architectural aspects with regards to identifying and mitigating risks, protection and isolation of physical and logical infrastructures including compute, network and storage, comprehensive data protection at all OSI layers, end-to-end identity management and access control, monitoring and auditing processes and meeting compliance with industry and regulatory mandates.

Course Pre/co-requisites

A8522 – Cloud Computing and Virtualization

2. Course Outcomes (COs)

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

A8654.1 Identify the various cloud platforms and risk issues in cloud computing.
A8654.2 Select the cloud security architecture in different cloud environments.
A8654.3 Make use of cloud security management techniques for assessment.
A8654.4 Utilize the security protocols and standards in different levels.
A8654.5 Identify the insights of data using cloud security analytics.

3. Course Syllabus

Cloud Security Introduction: Users perspective, Understanding security and privacy in Cloud Computing, Risk issues, Security challenges, Security requirements for the architecture, Securing private and public clouds, Security patterns, Cloud security architecture, and Infrastructure security.

Cloud Security Architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro architectures; Identity management, Access control, Autonomic Security. Virtualization security management, virtual threats, VM Security Recommendations, VM-Specific Security techniques.

Cloud Security Management: Security management in the cloud: SaaS, PaaS, IaaS, and availability management, Security as a service, Trust Management for Security: Vulnerability assessment tool for cloud, Privacy and Security in cloud, Identity Access Management in

Cloud.

Security Protocols and Standards: Host security, Compromise response, Security standards, Message Level Security (MLS), Transport Level Security, OAuth, OpenID, eXtensible Access Control Markup Language (XACML), and Security Assertion Markup Language (SAML).

Security Analytics: Techniques in Analytics - Challenges in Intrusion Detection System and Incident Identification DDoS attacks Analytics - Analysis of Log file - Simulation and Security Process.

4. Books and Materials

Text Books:

1. Ronald L. Krutz , Russell Dean Vines., Cloud Security: A Comprehensive Guide to Secure Cloud computing, Wiley, 2010.

Reference Books:

1. Vic (J.R) Winkler., Securing the Cloud: Cloud Computer Security Techniques and Tactics, , Elsevier 2011.
2. Ben Halpert., Auditing Cloud Computing: A Security and Privacy Guide, John Wiley Sons, 2011.
3. Ianlim, E.Coleen Coolidge, Paul Hourani., Securing Cloud and Mobility: A Practitioners Guide, Auerbach Publications, 2013.

Course Structure

A8855- Retail and Customer Analysis

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

"Retail and Customer Analytics" is a comprehensive course that delves into the dynamic intersection of data analysis and the retail industry. This course explores the strategic use of data to enhance customer experiences, optimize inventory management, and drive profitability. Students will learn how to collect and analyze customer data, identify purchasing patterns, and make data-driven decisions for merchandising, pricing, and marketing strategies. Through case studies and real-world applications, participants will gain insights into the latest tools and techniques used in retail analytics. Upon completion, you will be well-prepared to harness the power of data to revolutionize retail operations and customer engagement, contributing to the success of retail businesses in a data-centric age.

Course Pre/co-requisites

A8804 - Data Analytics

2. Course Outcomes (COs)

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

A8855.1. Demonstrate the applicability of the context of organizational behavior to understand the behavior.

A8855.2. Develop an understanding of the complexities associated with the management of individual human behavior.

A8855.3. Analyze the complexities associated with the management of the group behavior in the organization.

A8855.4. Illustrate the ways the organization's behavior can integrate the understanding of motivation.

A8855.5. Interpret how different types of leadership skills can be used by successful leaders and managers.

A8855.6. Investigate and discuss issues on Organizational Culture, manage change, and evaluate them from the perspective of Organizational Development.

3. Course Syllabus

Introduction to Retailing: Introduction to retailing: Definition and Scope, Evolution of retailing, Benefits of retailing, retailing environment – Growing importance of retailing –

Types of retail – Retail Channel and Formats – Trends in retailing industry.

Functions and Activities of Retailing: Strategic retail management process – Stores Location – Steps in choosing a retail location – Merchandise category its uses and Functionality in a retail environment – Retail Assortment basics – Retail promotions and Pricing.

Services & Quality in Retailing: Factors constituting retailing the service – classification of service and quality – Implementation of service management – Elements & Components of Retail Operation –Managing Inventory & Display.

Analytics in Retailing: Definition, importance, functions, types of analytics, Role, and applications of analytics in retailing – In-store Analytics – Inventory and product assortment analytics – Customer analytics.

Descriptive Analytics: Descriptive analytics in understanding retail consumer behavior – Predictive analytics in understanding retail consumer purchase decision making – Diagnostic and Prescriptive analytics in service quality and service recovery.

4. Books and Materials

Text Books:

1. Gibson G. Vedamani, (2012), Retail Management: Functional Principles and Practices, 4th Edition, Jaico Publishing, Bengaluru.
2. Michael Levy and Barton AWeitz, (2019), Retailing Management, 10th Revised edition, McGraw-Hill Inc., US, (ISE Editions).

Reference Books:

1. R. Sudharshan, S. Ravi Prakash and M. SubrahamanyaSarma, (2007), Retail Management: Principles & Practices, 1st Edition, New Century Publications, New Delhi.

Course Structure

A8665 - Video Processing and Analytics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course will introduce the field of video processing and analytics in particular focusing on the applications in entertainment and scientific visualization. In these applications videos have become a central component of net-centered computing, human/computer interfaces and data analysis for domains such as surveillance and remote sensing. This course offers fundamentals of video processing and algorithms for most of the work currently underway in this field. Through this course, students will get a clear impression of the breadth scope of video processing and develop conceptual understanding which will enable them to undertake further study, research and implementation work in this area.

Course Pre/co-requisites

A8005-Computer Oriented Statistical Methods
A8703- Machine Learning

2. Course Outcomes (COs)

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

A8665.1 Identify the various processing functions and formats of a given video.
A8665.2 Select a motion estimation algorithm for obtaining motion vectors.
A8665.3 Choose segmentation and tracking method for video analytics.
A8665.4 Make use mining algorithms for video segmentation and analytics.
A8665.5 Identify the different applications in which video analytics required.

3. Course Syllabus

Video Fundamentals: Basic Concepts and Terminology, Analog Video Standards, Digital Video Basics, Analog to Digital Conversion, Color Representation and Chroma Sub Sampling. Video Sampling Rate and Standards Conversion, Digital Video Formats, Video Features, Colour, Shape and Textural features.

Motion Estimation: Fundamentals of Motion Estimation, Optical Flow, 2D and 3D Motion Estimation, Block Based Point Correspondences, Gradient Based Intensity Matching, Feature Matching, Frequency Domain Motion Estimation.

Video Segmentation and Analytics: Video Segmentation, Video Shot Boundary Detection, Model Based Annotation, Video Mining, Multimodal Approach to Image and Video Data Mining, Probabilistic Semantic Mode.

Mining Data Streams: Introduction to Streams Concept, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Video Database, Categorization of Videos, Video Query Categorization.

Emerging Trends: Affective Video Content Analysis, Parsing a Video into Semantic Segments, Video Indexing and Abstraction for Retrieval, Automatic Video Trailer Generation, Video in painting, Forensic Video Analysis.

4. Books and Materials

Text Books:

1. A. Murat Tekalp., Digital Video Processing, 2nd Edition, Prentice Hall, 2015.
2. Oges Marques., Practical Image and Video Processing Using MATLAB, Wiley and Sons (IEEE Press), 2011.

Reference Books:

1. Anand Rajaraman, Jeffrey David Ullman., Mining of Massive Datasets, Cambridge University Press, 2012.
2. Alan C. Bovik., Handbook of Image and video processing, 2nd Edition,Academic Press, 2005.

Course Structure

A8754 – Federated Machine Learning

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This Course is designed to provide students with a comprehensive understanding of the principle, techniques and applications of Federated Machine Learning systems . FML is a decentralized approach that enabled training models across devices or local servers holding local data with out exchanging them. this course delves into theoretical foundations, Practical implementation and challenges, and application domain associated with FML.

Course Pre/co-requisites

A8703 - Machine Learning

2. Course Outcomes (COs)

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

A8754.1. Develop a comprehensive understanding of prevalent methodologies employed in federated learning.

A8754.2. Construct and scale a simple federated systems.

A8754.3. Develop an appreciation for the inherent limitations in current methods and an understanding of the strategies and approaches available to address these challenges effectively.

A8754.4. Develope an intuition for related technologies like differential privacy and secure aggregation, and are able to use them within typical federated settings.

A8754.5 Demonstrate the ability to analyze and reason about privacy and security concerns within federated systems.

3. Course Syllabus

Introduction: Introduction to Federated Machine Learning- Privacy Preserving- Distributed Machine Learning- Threats to Federated Machine Learning, Data Valuation.

Horizontal Federated Learning: Horizontal Federated Learning- Vertical Federated Learning and Federated Transfer Learning.

Federated optimization for Heterogenous Networks: Deep Networks from Decentralized data- Federated Multi Task Learning – Personalized Federated Learning.

Federated Learning Applications: Recommendation in Health Care and Finance - Mobile Keyboard Prediction- Learning of Out of Vocabulary words.

Adaptive Personalized Federated Learning: Privacy Preserving Deep Learning- Advances and open problems.

4. Books and Materials

Text Books:

1. Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen ,Han Yu, Federated Learning, Morgan & Claypool Publishers,2019 .

Reference Books:

1. Kim-Kwang Raymond Choo, Ali Dehghantanha, Handbook of Big data Privacy Springer Nature Switzerland,2020.

Course Structure

A8655 - IoT Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The Internet of Things (IoT) Security is a subject that focuses on addressing the security challenges and concerns associated with IoT devices and ecosystems. IoT Security is essential because IoT devices are becoming increasingly prevalent in various industries, from smart homes and healthcare to industrial automation and transportation. This course provides an in-depth exploration of security issues and solutions related to the Internet of Things (IoT). Students will learn about the unique challenges posed by IoT devices, networks, and ecosystems and gain practical knowledge of how to design, deploy, and manage secure IoT solutions.

Course Pre/co-requisites

A8519- Computer Networks
A8603 - IoT Laboratory

2. Course Outcomes (COs)

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

A8655.1 Illustrate the fundamental concepts of IoT and its impact on security.
A8655.2 Explain importance of IoT Design Standards and Protocols for true interoperability between devices and applications.
A8655.3 Identify common security threats and vulnerabilities in IoT systems.
A8655.4 Demonstrate cryptographic techniques for securing IoT communications.
A8655.5 Discover emerging trends and challenges in IoT security.

3. Course Syllabus

Introduction to IoT Security: Defining the IoT, Evolution of IoT and it's significance, Conceptualizing the Secure Internet of Things, IoT Framework and Complexities, Fundamentals of IoT Security: Security at Different Layers; System Requirements of the IoT System, Overview of Wireless Connectivity Technologies (Wi-fi, Bluetooth, Zigbee, NFC, Cellular, 5G/6G Cellular), Overview of Indusial Control System (ICS) and Industrial Internet of Things (IIoT).

IoT Design, Standards and Protocols: Layered IoT Architecture, Security and Privacy Issues with IoT Architecture, IoT Protocol Design, Protocol Stack for IoT, Design Standards, Security Standards – Regulatory and Industry, Taxonomy of Threats to IoT Networks, IoT Communication Protocols (MQTT, CoAP, HTTP), Taxonomy of IoT Authentication Protocols, Edge and Fog Computing, IoT based Cloud Platforms.

Vulnerabilities, Attacks and Countermeasures: Assets, Threats, Threat Pyramid, Vulnerabilities and Risks, IoT Security Standards, Privacy in IoT, Common IoT Attacks, Attack Tree, SCADA Systems, Cyber-Physical System, IoT Malware and Botnets, Zero-Day Attacks, Side-channel attacks, Threats to Firmware.

Cryptography for IoT Security: Importance of Secure Communication in IoT, overview of Cryptography, Basic Cryptography Concepts (encryption, and decryption), Symmetric and Asymmetric Cryptography, Introduction to Light-weight Cryptography, Use of Cryptography in IoT Authentication, Key Management in IoT, Certificates.

Recent Trends, Emerging Technologies and Future Challenges: AWS IoT, Microsoft Azure IoT Suite, CISCO Fog Computing, Software Defines Networking (SDN), Privacy-Preserving Cryptography, Machine Learning for IoT Threat Detection, Side-Channel Attacks and its Countermeasures. Challenges: Interoperability of Diverse Device Types, Firmware/Software Updates, Data Privacy.

4. Books and Materials

Text Books:

1. Brian Russell, Drew Van Duren., Practical Internet of Things Security, PACKT Publishing, 2016.
2. Sunil Cheruvu, Anil Kumar, Ned Smith, David M. Wheeler., Demystifying Internet of Things Security, Apress, 2020.
3. B.Gupta, Aakanksha Tewari., A Beginners's Guide of Internet of Things Security, CRC Press, 2020.

Reference Books:

1. Patel Chintan, Nishant Doshi., Internet of Things Security, CRC Press,2019.
2. Peter Waher., Learning Internet of Things, PACKT, 2015.
3. Mayur Ramgir., Internet of Things – Architecture, Implementation and Security, 1st Ed, Pearson India, 2020.

Course Structure

A8856 - Web and Social Media Analytics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

"Web and Social Media Analytics" is a dynamic course that immerses students in the world of digital data and social media insights. This course unravels the techniques and tools for collecting and analyzing web and social media data, providing valuable insights for businesses and organizations. Students will explore topics such as web traffic analysis, social media sentiment analysis, user engagement metrics, and the impact of social media on brand reputation. With a focus on real-world applications, this course equips participants with the skills to harness the power of online data, enabling them to make informed decisions, enhance online presence, and develop effective social media strategies in today's interconnected digital landscape.

Course Pre/co-requisites

A8804 - Data Analytics

2. Course Outcomes (COs)

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

A8856.1. Identify and select key performance indicators to accurately measure the success of social media efforts.
A8856.2. Develop social media measurement plans and analytics reports, and communicate findings and recommendations effectively.
A8856.3. Analyze social media data using Facebook analytics and social media measurement tools.
A8856.4. Compute a variety of network measures from a social media dataset.
A8856.5. Evaluate Heuristic approach and Website Traffic Analysis.

3. Course Syllabus

Web Metrics & Analytics: Common Metrics - Hits, Page Views, Visits, Unique Page Views, Bounce, Bounce Rate & its Improvement, Average Time on Site, Real-Time Report, Traffic Source Report, Custom Campaigns, Content Report, Google Analytics; Key Performance Indicator: Need, Characteristics, Perspective and Uses.

Graphs and Matrices: Basic Measures for Individuals and Networks. Random Graphs &

Network Evolution, Social Context: Affiliation & Identity Web analytics Tools: A/B testing, Online Surveys, Web Crawling, and Indexing. Natural Language Processing Techniques for Micro-Text Analysis.

Social Media & Analytics: Introduction to Social Media, Social Media Landscape, Social Media Analytics & its Need. SMA in Small and Large Organisations; Application of SMA in Different Social Media Platforms.
Introduction to Web Analytics: Definition, Process, Key Terms: Site References, Keywords and Key Phrases; Building Block Terms: Visit Characterization Terms, Content Characterization Terms, Conversion Metrics; Categories: Offsite Web, on Site Web; Web Analytics Platform, Web Analytics Evolution, Need of Web Analytics, Advantages & Limitations.

Network Fundamentals: The Social Networks Perspective - Nodes, Ties and Influencers, Social Network, Web Data and Methods. Data Collection and Web Analytics Fundamentals: Capturing Data: Web Logs, Web Beacons, Java Script Tags, Packet Sniffing; Outcome Data: E-commerce, Lead Generation, Brand/ Advocacy and Support; Competitive Data: Panel Based Measurement, ISP Based Measurement, Search Engine Data; Organisational Structure. Type and Size of Data, Identifying Unique page Definition, Cookies, Link Coding Issues.

Facebook Analytics: Introduction, Parameters, Demographics. Analyzing Page Audience: Reach and Engagement Analysis. Post-Performance on FB; Social Campaigns: Goals and Evaluating Outcomes, Measuring and Analyzing Social Campaigns, Social Network Analysis Like Instagram, Twitter, LinkedIn, YouTube etc. AdWords, Benchmarking, Categories of Traffic: Organic Traffic, Paid Traffic; Google Analytics: Brief Introduction and Working, Google Website Optimizer, Implementation Technology, Limitations, Performance Concerns, Privacy Issues.

Qualitative Analysis and Heuristic Evaluations: Conducting a Heuristic Evaluation, Benefits of Heuristic Evaluations; Site Visits: Conducting a Site Visit, Benefits of Site Visits; Surveys: Website Surveys, Post-Visit Surveys, Creating and Running a Survey, Benefits of Surveys.
Web analytics 2.0: Web Analytics 1.0 & its Limitations, Introduction to WA 2.0, Competitive Intelligence Analysis and Data Sources; Website Traffic Analysis: Traffic Trends, Site Overlap and Opportunities.

4. Books and Materials

Text Books:

1. Rob Stokes, (2014), e-marketing: The Essential Guide to Digital Marketing, Quirk Education.
2. Tuten & Bikramjit Rishi, Social Media Marketing, 3rd Ed. 2020, SAGE Publishing India.
3. Dave Chaffey, Fiona Ellis-Chadwick, Richard Mayer, Kevin Johnston, (2012), Internet Marketing: Strategy, Implementation, and Practice, Prentice Hall.1."Practical Statistics for Data Scientists" by Andrew Bruce and Peter Bruce, Publisher: O'Reilly Media, First Edition (2017)

Reference Books:

1. Liana Evans, Social Media Marketing: Strategies for Engaging in Facebook, Twitter & Other Social Media, Que Publishing.
2. Vandana Ahuja, (Digital Marketing, 1stedition, Oxford University Press.

Course Structure

A8666 - Augmented Reality and Virtual Reality

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course is an introductory course in AR/VR. It introduces the Fundamentals of both Augmented Reality and Virtual Reality to the students.It adds relevance to the existing technology through demonstrations, case studies, and applications with a futuristic vision along with socio-economic impact and issues. This course helps Students to build Biomedical engineering applications and to develop PDA applications with better optimality.

Course Pre/co-requisites

This course has no Pre-requisite

2. Course Outcomes (COs)

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

A8666.1 Identify the terminology, components and design issues of the virtual reality system.
A8666.2 Choose the various input and output devices used for virtual reality as human need.
A8666.3 Identify the difference between Augmented Reality and Virtual Reality.
A8666.4 Make use of different modelling concepts for visual virtualization.
A8666.5 Illustrate applications of ARVR in Real Time.

3. Course Syllabus

Theory

Introduction of VR: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system.Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.

Input Devices and Output Devices: Input Devices and Output Devices:Trackers, Navigation, and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.Output Devices: Graphics displays, sound displays & haptic feedback.

Augmented and Mixed Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR,Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality. wireless displays in educational augmented reality applications,mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR

systems.

Modeling: Geometric modeling,kinematics modeling,physical modeling,behavior modeling,model management.

Human Factors and Applications: Methodology and terminology,user performance studies, VR health and safety issues,Applications:Medical applications, military applications, robotics applications,Engineering,Entertainment,Science,Training.

4. Books and Materials

Text Books:

1. Gregory C. Burdeaand Philippe Coiffet., Virtual Reality Technology, 2nd Edition,John Wiley & Sons,2006.
2. Jonathan Linowes, Augumented Reality with Unity AR Foundation, Packt Publishing, 2021

Reference Books:

1. Jonathan Linowes, Unity 2020 Virtual Reality, 3rd edition, Packt Publishing, 2020.
2. William R.Sherman, Alan Craig, Morgan Kaufmann., Understanding Virtual Reality interface, Application and Design, 1st Edition, Elsevier,2002.
3. Jason Jerald, The VR Book Human-Centered Design for Virtual Reality, ACM, 2016.
4. Ralf Doerner, Wolfgang Broll, Paul Grimm, Bernhard Jung, Virtual and Augmented Reality (VR/AR), Springer 2022.

Web Resources

1. https://docs.unity3d.com/

Course Structure

A8755-Cognitive Computing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Cognitive computing involves using computerized models to mimic human thought processes in complex situations where answers may be uncertain. It's closely linked with IBM's Watson system and overlaps with AI, employing similar technologies like neural networks and expert systems. These systems can analyze data from different sources, considering context and conflicting evidence to provide optimal answers. They incorporate self-learning technologies, processing data, recognizing patterns, and understanding language, akin to how the human brain functions. This course helps understand the neuroscience, computational intelligence, probabilistic programming, and learning models involved in cognitive computing.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8755.1 Identify the human mind functioning for a given complex task.
A8755.2 Choose the computational intelligence required for cognitive computing.
A8755.3 Solve a given complex task using probabilistic programming features.
A8755.4 Select an inference model for providing data to the cognitive task.
A8755.5 Identify a cognitive model for a given complex task .

3. Course Syllabus

Philosophy, Psychology and Neuroscience: Philosophy: Mental-physical Relation, From Materialism to Mental Science, Detour before the naturalistic turn, The Philosophy of Science, The Mind in Cognitive Science, Logic and the Sciences of the Mind, Psychology: Place of Psychology within Cognitive Science, Science of Information Processing, Neurosciences: Cognitive Neuroscience, Perception, Decision, Learning and Memory, Language Understanding and Processing.

Computational Intelligence: Machines and Cognition, Artificial Intelligence, Architectures of Cognition, Knowledge Based Systems, Logical Representation and Reasoning, Logical Decision Making, Decision making under Uncertainty, Learning, Language, Vision, Robotics.

Probabilistic Programming Language: Language, Syntax, Using Javascript Libraries, manipulating probability types and distributions, Finding Inference, exploring random computation, Coroutines: Functions that receive continuations, Enumeration, Other basic com-

putation.

Implementing the Inference Models of Cognition: Generative Models, Conditioning, Causal and statistical dependence, Conditional dependence, Data Analysis, Algorithms for Inference.

Implementing the Learning Models of Cognition: Learning as Conditional Inference, Learning with a Language of Thought, Hierarchical Models, Occam's Razor, Learning (Deep) Continuous Functions, Mixture Models.

4. Books and Materials

Text Books:

1. RobertA.Wilson,FrankC.Keil.,The MIT Encyclopedia of the Cognitive Sciences, 1st Edition,The MITPress,1999.
2. AndyJ. Wills, Emmanuel M. Pothos., Formal Approaches in Categorization,Cambridge University Press 2012.
3. Noah D. Goodman, Andreas Stuhlmuller.," The Design and Implementation of Probabilistic Programming Languages" dippl.org 2016.

Reference Books:

1. Bernard J. Bears and Nicole M. Gage., Cognition, Brain and Consciousness: Introduction to Cognitive Neuroscience, 2ndEdition, Academic Press, 2010.
2. Hurwitz, Kaufman and Bowles, Cognitive Computing and Big Data Analytics,Wiley,2013.

Course Structure

A8656 - Blockchain Technology

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces blockchain, a revolutionary technology that enables peer-to-peer transfer of digital assets without any intermediaries, and is predicted to be just as impactful as the Internet. A blockchain is a permanent, sequential list of transaction records distributed over a network. The course introduces consensus, proof of work, mining, in Bitcoin. The course introduces ethereum blockchain and smart contracts.

Course Pre/co-requisites

A8607 - Information Security

2. Course Outcomes (COs)

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

A8656.1 Identify the basic concepts of block chain to process data
A8656.2 Make use of Bitcoin as cryptocurrency
A8656.3 Choose Ethereum block chain for security
A8656.4 Design smart contracts as per the requirements and deploy on Testnet works.

3. Course Syllabus

Introduction to Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency. How Bitcoin Achieves Decentralization: Centralization vs. Decentralization, Distributed Consensus, Consensus without Identity: the Block Chain, Incentives and Proof of Work, Putting It All Together.

Mechanics of Bitcoin: Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations Improvements. Store Usage: How to Store and Use Bitcoins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

Bitcoin Mining: The Task of Bitcoin Miners, Mining Hardware, Energy Consumption Ecology, Mining Pools, Mining Incentives and Strategies. Bitcoin and Anonymity: Anonymity Basics, How to de-anonymizeBitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash, Tor and the Silk Road.

Ethereum: What is Ethereum, smart contracts, Solidity Ethereum Virturalmachine. Installing solidity ethereum wallet, basics of solidity by example, Layout of a solidity source file

structure of smart contracts, General value types, ether units, Time units, Globally available variables and functions.

Operators: Arithmetic, Logical Bitwise operators, Control structure (if-else, for, while, do-while), Scoping and declarations, Input parameters and output parameters, Function calls return types, Function Modifiers, Fallback functions, Abstract contract, Creating contracts via new operator, Inheriting smart contracts, Importing smart contracts compiling contracts, Events logging, exceptions, Examples of smart contract : crowd funding, voting ballot.

4. Books and Materials

Text Books:

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., Goldfeder, S.,Bitcoin and cryptocurrency technologies: a comprehensive introduction, Princeton University Press, 2016.
2. Dave Hoover, Kevin Solorio, and Randall Kanna., Hands–On Smart Contract Development with Solidity and Ethereum, O'Reilly Media, Inc., 2019.

Reference Books:

1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, 1st Edition, O'Reilly Media, Inc., 2019.

Course Structure

A8857 - Ethics and Privacy in Analytics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

"Ethics and Privacy in Analytics" is a thought-provoking course that explores the ethical implications and privacy considerations surrounding data analytics and technology. In a world increasingly driven by data, this course delves into the complex ethical challenges that arise when collecting, analyzing, and using data to make decisions. Students will examine real-world case studies and ethical frameworks to critically evaluate issues like data privacy, bias, transparency, and accountability. By the end of the course, participants will be equipped with the knowledge and tools to navigate the ethical and privacy dilemmas in the analytics field, ensuring responsible and sustainable data-driven practices in various industries.

Course Pre/co-requisites

A8033 - Universal Human Values 2: Understanding Harmony

2. Course Outcomes (COs)

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

A8857.1. Develop the capacity to have constructive conversations about ethical dilemmas of data analytics.
A8857.2. Identify types of data protection laws and legal obligations.
A8857.3. Examine a particular ethical issue in data collection and apply multiple theories to understand possible solutions.
A8857.4. Explain the challenges in ML in the language of business and business ethics.
A8857.5. Develop Ethical Guidelines and Codes of Conduct.

3. Course Syllabus

Introduction: Introduction to Data Analytics and Ethical Concerns Understanding the role of data analytics in decision-making. Introduction to ethical considerations in data collection, analysis, and application. Ethics Codes: History, Context, and Challenges. Data & Society

Legal Framework and Privacy Regulations: Overview of data protection laws (e.g., GDPR, CCPA, HIPAA). Understanding the legal obligations and responsibilities in data handling. Impact of privacy regulations on data analytics practices.

Data Collection and Informed Consent: Ethical issues in data collection, including informed consent. Ensuring transparency and fairness in data collection processes, Case studies on data collection ethics. Concepts of data privacy and de-identification., Techniques for data anonymization and pseudonymization, Evaluating the effectiveness of anonymization methods.

Data Ethics in Machine Learning: Ethical challenges in machine learning model development. Bias and fairness in machine learning algorithms. Ethical considerations in deploying machine learning models.

Ethical Guidelines and Codes of Conduct: Overview of ethical guidelines and codes of conduct in data analytics (e.g., ACM, IEEE)How to apply ethical principles in data analytics projects, Ethical responsibility of data professionals –Case Study

4. Books and Materials

Text Books:

1. Data and Goliath: The Hidden Battles to Collect Your Data and Control Your World" by Bruce Schneier, publisher: W. W. Norton & Company, First Edition(2015).

Reference Books:

1. Ethics of Big Data: Balancing Risk and Innovation" by Kord Davis and Doug Patterson, Publisher: O'Reilly Media, Latest Edition, First Edition (2012).

Course Structure

A8667-Optical Character Recognition

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides an in-depth exploration of Optical Character Recognition (OCR) technology, covering fundamental concepts, techniques, and advancements. Students will gain hands-on experience with OCR software and learn how to design and evaluate OCR systems for various applications.

Course Pre/co-requisites

A7663- Image Processing

2. Course Outcomes (COs)

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

A8667.1 Discuss OCR technology with building custom OCR applications and exercises in different sectors.
A8667.2 Identify basics of image processing techniques for image acquisition and standardization
A8667.3 Illustrate text feature extraction in image processing for different types of handwriting.
A8667.4 Analyse various neural network and deep learning architectures for better performance and efficiency.
A8667.5 Demonstrate implementation of OCR technology in various real-time applications.

3. Course Syllabus

Introduction to OCR: Overview of OCR and its applications, Historical development of OCR technology, Basics of character recognition and document analysis, Types of documents suitable for OCR, Introduction to popular OCR software -Tesseract, OCRopus, Building custom OCR applications: OCR in document management systems, OCR for data extraction and automation, OCR in healthcare, finance, and legal domains.

Image Preprocessing and Image Analysis: Image acquisition and scanning techniques, Image enhancement, noise reduction, and binarization, Layout analysis and segmentation of text regions, Document structure analysis, Table and form extraction, Document retrieval and indexing.

Feature Extraction and Character Recognition: Feature extraction methods-histogram based, contour based, Pattern recognition techniques: template matching & machine learning. Language models and dictionaries, Challenges in handwritten text recognition, Tech-

niques for cursive and disconnected handwriting, Machine learning approaches for handwritten OCR.

Advanced OCR Techniques and Error Correction: Neural networks for OCR- CNNs, RNNs. Deep learning architectures and transfer learning, Multilingual and multi-font OCR, Text alignment and layout reconstruction, Error correction techniques- spell checking, contextual analysis, Performance evaluation metrics for OCR systems.

Case Studies and Future Research: OCR in mobile applications, OCR in augmented reality and wearable technology, Ethical considerations, and bias in OCR.

4. Books and Materials

Text Books:

1. Horst Bunke and Peter J. Dickinson., Handbook of Character Recognition and Document Image Analysis, World Scientific Publishing Co Pte Ltd,1997.
2. Lawrence O'Gorman and Rangachar Kasturi., Document Image Analysis.
3. Christopher M. Bishop., Pattern Recognition and Machine Learning, Springer, 2016.

Reference Books:

1. David Doermann., Modern Multilingual Optical Character Recognition: Principles and Applications.
2. Wolfgang Ertel., Introduction to Artificial Intelligence.
3. Charu C. Aggarwal ., Neural Networks and Deep Learning: A Textbook.

Course Structure

A8657-Prompt Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Prompt engineering refers to the process of crafting effective and specific prompts or instructions when working with artificial intelligence (AI) models like GPT. This course will explain how to build systems that learn and adapt using examples from real-world applications. In this undergraduate-level course, students will be introduced to Fundamentals of Prompt Engineering ,Ethical Considerations in Prompt Engineering , Applications of Prompt Engineering,Use cases of Prompt Engineering from ChatGPT and Real-World Case Studies.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8657.1 Identify the importance of AI,Sentiment Analysis and NLP technologies in transforming industries.
A8657.2 Analyse various GPT Models and apply on Real world problems.
A8657.3 Discuss the fundamental principles, concepts and Ethical Considerations of prompt engineering.
A8657.4 Illustrate various techniques of prompt engineering and enable them to create prompts that optimize AI system performance.
A8657.5 Design Chatbots for Text Generation ,Text Summarization ,for Question Answering using ChatGPT.

3. Course Syllabus

IntroductionArtificial Intelligence and Its types, Deep Learning Neural Network,A Historical Perspective ,Natural Language Processing Applications and Advancement of NLP , Natural Language Understanding,Sentiment Analysis and Classification , Architecture of Sentiment Analysis,ML and DL , Probability in Language Modeling and NLP ,Perplexity , Burstiness.

GPT Models: How Does ChatGPT Work ,Reinforcement Learning from Human Feedback ,Features and Limitations of ChatGPT,Real-world Applications of ChatGPT , ChatGPT vs other AI Language Models.

Prompt Engineering: Fundamentals of Prompt Engineering ,Ethical Considerations in Prompt Engineering- Bias Mitigation , Fairness and Equity , Transparency and Explainability, Data Privacy and Security , User Consent and Control , Accountability and Respon-

sibility , Common Challenges and Solutions.

Prompt Engineering Implementation: Techniques of Prompt Engineering ,Advanced Techniques in Prompt Engineering ,Implementing Prompt Engineering , Evaluating Prompt Effectiveness.

Applications of Prompt Engineering: Use cases of Prompt Engineering, ChatGPT for Text Generation ,ChatGPT for Text Summarization ,ChatGPT for Question Answering, Building Chatbots Using ChatGPT ,Real-World Case Studies- Case Studies - Level 1,Case Studies -Level 2.

4. Books and Materials

Text Books:

1. Stuart Russel, Peter Norvig., Artificial Intelligence-A Modern Approach, 3rd Edition,Pearson Education, 2010.
2. Hobson Lane,Hannes Hapke,Cole Howard., Natural Language Processing in Action: Understanding, analyzing, and generating text with Python, Manning Publisher, 1st edition,2019.
3. Nathan Hunter.,The Art of Prompt Engineering with ChatGPT: A Hands-On Guide,Hunter, 1st edition,2023.

Reference Books:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville., Deep Learning, MIT Press,2017
2. Tom M.Mitchell., Machine Learning, India Edition, McGraw Hill Education, 2013.
3. Speech and Language Processing: An Introduction to Natural Language Processing,Computational Linguistics and Speech Recognition: Pearson,United States,2000.
4. Aaron Courville, Ian Goodfellow,Yoshua Bengio., Deep Learning-Adaptive Computation and Machine Learning series , MIT Press, 2016.

Web Links:

1. https://towardsai.net/p/machine-learning/learn-prompting-101-prompt-engineering-course
2. https://www.coursera.org/learn/prompt-engineering

Open Electives

Course Structure

A8181 - Smart Cities

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The purpose of this course is to provide a deep understanding about smart and sustainable cities. The course will begin with the basic concepts and theories of urbanization and elements. The course will cover the global practices in the smart cities and technologies in shaping new and existing cities. The course will include the feasibility for smart cities and financing approaches for urban development. The course will also include the role of electric vehicles and energy rating system for smart cities.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8181.1 Interpret the concepts, history and evolution of smart cities.
A8181.2 Identify the elements of smart city such as smart people, smart living, smart economy, smart infrastructure, smart governance and smart environment.
A8181.3 Analyze the concepts, discourses and practices of smart cities across globe.
A8181.4 Develop the road map for planning smart cities and benchmarking their performance for Indian context.
A8181.5 Apply relevance for smart cities of developing economies considering issues as inclusiveness, feasibility and sustainability.

3. Course Syllabus

Introduction to Smart and Sustainable Cities: Concepts and theories of Urbanization, City Planning, Emergence of Sustainability, Liveability, Green to Smart Cities; Understanding smart cities – Concepts, History and Evolution of Smart Cities.

Dimensions of Smart Cities: Elements of Smart City – Smart People, Smart Living, Smart Economy, Smart Infrastructure, Smart Governance, Smart Environment.

Global Experience of Smart Cities: Case studies from European, Middle East and Asian Contexts, specifically cases of Barcelona, Amsterdam, Majhdhar, and Singapore, Review of Global Standards.

Smart City Planning and Development: How to plan for smart cities, Concepts of Retrofitting, Redevelopment, Extension and Pan city approaches, Review of Smart financing approaches, Tools, concepts of special purpose vehicles, Land pooling-based financing approaches of urban development.

Sustainable Development in Smart Cities: Energy storage and utilization, role of electric vehicles, autonomous vehicles in urban mobility, Green Audit, Energy saving system.

4. Books and Materials

Text Books:

1. M.Barlow and C. Levy-Bencheton. Smart Cities, Smart Future: Showcasing Tomorrow
2. Gassmann, J.Böhm Smart Cities: Introducing Digital Innovation to Cities

Reference Books:

1. UN-Habitat; Inclusive and sustainable urban planning: a guide for municipalities; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4)
2. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
3. Draft Concept Note on Smart City Scheme. Government of India - Ministry of Urban Development.

Course Structure

A8182 - Disaster Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course has been framed with an intention to provide a general concept in the dimensions of disasters caused by nature beyond human control as well as the disasters and environmental hazards induced by human activities with emphasis on Natural disaster, Man-made disaster, vulnerability and risks of disasters, Disaster Management Mechanism, Capacity Building and disaster coping Strategies and Disaster management planning.

Course Pre/co-requisites

A8032 - Environmental Science and Technology

2. Course Outcomes (COs)

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

A8182.1 Identify basic concepts of hazards, vulnerabilities and risks of disaster phenomena.
A8182.2 Interpret various types of disasters and disaster coping strategies.
A8182.3 Examine Disaster Impacts and suggest suitable capacity building frame work for disaster management.
A8182.4 Select appropriate steps in Disaster management cycle for Disaster Risk Reduction.
A8182.5 Develop Strategies for disaster management planning and sustainable development.

3. Course Syllabus

Introduction: Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation, disaster phenomena, events global National & Regional.

Disasters: Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile

of India, Covid 2019 in India, mountain and coastal areas, ecological fragility, coping with disaster- strategies, safety norms & survival kits.

Disaster Impacts: Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters, capacity building – concepts, assessment –structural & non-structural measures, legislative support.

Disaster Risk Reduction: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environment friendly recovery; reconstruction and development methods.

4. Books and Materials

Text Books:

1. Manual on Disaster Management, National Disaster Management Authority, Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2017.
4. National Disaster Management Plan, Ministry of Home affairs, Government of India.

Reference Books:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.

Course Structure

A8183 - Environmental Pollution Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course has been designed to improve the understanding of the students about different pollution control strategies and the skills of application of remediation techniques to combat pollution in three environmental compartments i.e., air, water and soil. The course will also be dealing about the sources of pollution in air, soil, water, and noise and the impacts these sources on the environment and health. In addition, the students will be given the knowledge to develop the particular skills required in pollution related structured research and environmental management.

Course Pre/co-requisites

A8032 - Environmental Science and Technology

2. Course Outcomes (COs)

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

A8183.1 Identify water pollution sources, types and treatment methods.
A8183.2 Apply knowledge on Prevention and control of air pollution.
A8183.3 Inspect sources, effects and mitigation methods of noise pollution.
A8183.4 Examine soil pollution sources, effects and control measures.
A8183.5 Develop Environmental management plan to minimize environmental pollution.

3. Course Syllabus

Water pollution: Water Pollution - Introduction - Sources and types of water pollutants Physical, Chemical and Biological. Ground water - Surface water - lake water - seawater. Effects of water pollution. Water Quality standards (Drinking and Industrial) - water treatment - physical, chemical and biological. Water Pollution Prevention and Control Act, 1974.

Air pollution: Structure and composition of atmosphere – classification, sources and effects of air pollution – Acid rain – greenhouse effect – global warming – Ozone depletion, Prevention and control of air pollution particulate control – settling chamber, scrubber, bag filter, cyclones electrostatic precipitators. Gaseous emission control methods. Air pollution

prevention and control Act 1981.

Noise Pollution: Noise Pollution Basics of acoustics- propagation of indoor and outdoor sound- noise profiling effects of noise – measurement, index and mitigation methods- health effects of noise- Vibration and its Effects, Whole body vibration problems in opencast mines-ground vibration and Air blast. Green Belt Development–Principles and design considerations, Industrial Noise Pollution Control methods.

Soil Pollution: Sources - solid waste disposal and their effects - pesticides - types and effect of pollutants on Plants - animals and human beings - biomagnification - fertilizers and its Effect of pollutants on plants - animals and human beings - soil pollution Control measures - soil microbes and function - biofertilizer.

Environmental management: Environmental impact assessment and statement; Government strategies in pollution control: subsides, polluter pays principle and regulations; Government Agencies and Programs – The Tiwari committee – creation of NCEPC, Department of Environment & Forest – Function of State Pollution Control Board. Sources of environmental information and regulations; Sustainable development and environmental protection.

4. Books and Materials

Text Books:

1. C. S. Rao, Environmental Pollution Control Engineering, 3^{rd} Edition, New Age International Pvt Ltd, 2018.
2. Rao, M. N and H.V.N. Rao, Air Pollution, Tata McGraw – Hill Publishing Company Limited. New Delhi, 2017.
3. Kudesia, V.P and Ritu Kudesia, Water Pollution, Pragati Prakashan Publication, Meerut, 2017.
4. Murphy, E., King,E., Environmental Noise Pollution, 1^{st} Edition , Amsterdam : Elsevier, 2014.

Reference Books:

1. H.S Peavy, D. R. Rowe, G. Tchobanoglous, Environmental Engineering, Indian Edition, McGraw Hill Education (India) Pvt Ltd, 2014.
2. De Nevers, N., Air Pollution Control Engineering, 3^{rd} edition, Waveland Press Inc 2017.
3. Sagar Pal Singal, Noise Pollution and Control Strategy, 2^{nd} Edition, Alpha Science International Ltd, 2005.

Course Structure

A8155 - Green Building and Sustainability

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces concepts of sustainability in the context of construction building materials. It also discusses the role of low carbon cements and recycled aggregate in minimizing consumption of natural resources. The course also emphasizes the concepts of embodied, operational, life cycle energy and minimizing energy consumption. It also intends to make students aware of rating systems like LEED, GRIHA etc.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8155.1 Identify green building and green building materials.
A8155.2 Make use of different rating agencies to classify the type of building.
A8155.3 Analyze sustainability and its implications for the practice of engineering.
A8155.4 Evaluate the potential of the alternative construction materials for sustainability.
A8155.5 Examine the green building rating systems and its contribution to sustainability.

3. Course Syllabus

Green Building: Concept of Green building, Principles of green buildings, Eco-friendly materials, Certification systems – Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED).

Green Building Materials: Green Building Materials and Equipment in India, what are key requisites for Constructing a Green Building, Important Sustainable features for Green Building. **Building Services:** Fire protection – classes of fire and causes, development of fire, fire resisting materials, means of escape, Standing Fire Advisory Council norms. Water supply -Water distribution and plumbing fixtures.

Applications in the Built Environment: Concepts of green buildings, climate responsive building - Reduction of energy consumption, direct and indirect methods - Reduction of water consumption, direct and indirect methods - Carbon footprint and eco footprints of buildings - New concepts and trends in green buildings, national and international.

Sustainability: The Concept of Sustainability; Definition of Sustainability, Dimension of Sustainability. Three Pillars of Sustainability, Principles of Sustainability - 5R, Construction Materials Resource Efficiency, Operational Reuses of the Construction Materials, Sustainability Goals for construction Industry.

Sustainability in Built Environment: Environmentally sensitive design, low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings.

4. Books and Materials

Text Books:

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5^{th} edition,1994.
2. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7^{th} edition, 2013.
3. Bradley A. Striebig, Adebayo A. Ogundipe and Maria Papadakis, Engineering Applications in Sustainable Design and Development, 1^{st} edition, 2016.

Reference Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.

Course Structure

A8224 - Electric Vehicles

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces the fundamental concepts, principles, architectures and analysis of electric vehicles. Student will explore the working principle of electric vehicles, delve into key roles played by motors as propulsion systems and requirements for battery and its management systems. In addition to this, focuses on various charging systems and charging infrastructure. This course also emphasizes the EV business and the future trends in the development of electric vehicles.

Course Pre/co-requisites

A8213-Electrical Machines-II

2. Course Outcomes (COs)

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

A8224.1. Infer the electric vehicle system and its impact on environment.
A8224.2. Analyze the various hybrid vehicle configurations and its performance.
A8224.3. Interpret the electric drives used in hybrid and electric vehicles.
A8224.4. Choose proper energy storage systems for electric vehicle applications.
A8224.5. Identify the different charging systems and charging infrastructure for EVs.

3. Course Syllabus

Introduction To Electric Vehicles: EV System: EV Configuration-Fixed & variable gearing, single & multiple motor drive, In-wheel drives. Components of an EV, Components of ICEVs, EV History, the early years, recent EVs and HEVs, Types of EVs, EV Advantages, Comparison of EVs and ICEVs w.r.t to efficiency, pollution, capital & operating cost.

Hybrid Electric Vehicles: Types of Hybrids Vehicles- Series, parallel, series-parallel and complex HEVs, Advantages and Disadvantages of HEVs, Concept of Hybrid Electric Drive Trains, Architectures and power flow control of Hybrid Electric Drive Trains.

Electric Propulsion Systems: Choice of electric propulsion systems, block diagram of EV propulsion system, BLDC Machine Construction and Classification, Basic Principles of

BLDC Motor Drives, application to Electric Vehicles. Switched Reluctance Motor Drives, Basic Magnetic Structure, Torque Production, SRM Drive Converter, Modes of Operation, Generating Mode of Operation.

Introduction To Energy Storage Requirements: Electrochemistry of battery cells, Battery parameters, Types of Batteries- Lead–Acid Batteries, Ni Cd Batteries, NiMH Batteries and Lithium-Ion Batteries. EV Charging: Types of charging systems- Conductive charging On board & off-board charging, inductive charging, Wireless charging.

Charging Infrastructure: Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and charge zone. Key Battery Management Technologies, Typical Structure of Battery Management Systems. Business: E-mobility business, electrification challenges, Connected Mobility and Autonomous Mobility- case study, E-mobility Indian Roadmap, social dimensions of EVs.

4. Books and Materials

Text Books:

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003
2. Iqbal Husain, "ELECTRIC and HYBRID VEHICLES: Design Fundamentals", CRC PRESS Boca Raton London New York Washington, D.C., 2003
3. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wi- ley and Sons, 2012.

Reference Books:

1. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wi- ley and Sons, 2012.
2. Reissland, Martin.U (2010), Electrical Measurements: Fundamentals, Concepts, Applications, New Age International (P) Limited, New Delhi.
3. Shen, Weixiang Xiong, Rui, "Advanced battery management technologies for electric vehicles" 2019, John Wiley & Sons

Course Structure

A8281 - Solar Energy and Applications

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces students about the solar energy technologies and potentials. The course aims to introduce the concepts of Photo Voltaic cells, their properties, and its societal needs. The applications of solar cells will be explained in detail also the environmental issues of solar systems will be explained. It also covers the economic analysis of a solar energy system and its environmental benefits.

Course Pre/co-requisites

"The course has no specific prerequisite and co-requisites"

2. Course Outcomes (COs)

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

A8281.1. Compare the present and future available electrical power from solar energy based on the knowledge of global solar horizontal irradiation.

A8281.2. Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems.

A8281.3. Identify the problems involved in solar thermal energy conversion technique used in the solar heating and cooling systems for buildings/societal needs.

A8281.4. Examine the components of a solar photo voltaic system and their function by utilizing the previous literature knowledge on different photovoltaic solar cells.

A8281.5. Analyze the techno-economics performance and issues in the solar energy system.

3. Course Syllabus

Theory

Principles of Solar Radiation: Role and potential of solar energy, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and Sun shine, solar radiation data.

Solar Energy Collectors: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Different methods of solar energy storage, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating /cooling technique, solar distillation and drying.

Photo Voltaics (PV): Fundamentals of solar cells, types of solar cells, absorption of photons, excitations and photo emission of electrons.
PV Cell Properties: Solar cell properties and design, p-n junction photodiodes, depletion region, electrostatic field across the depletion layer, electron and holes transports, device physics, charge carrier generation, recombination and other losses, I-V characteristics, output power.

Solar Cell Applications:PV cell interconnection, module structure and module fabrication, Equivalent circuits, load matching, efficiency, fill factor and optimization for maximum power, Design of stand-alone PV systems, system sizing, device structures, device construction, DC to AC conversion, inverters.

Cost Analysis and Environmental Issues: Cost analysis and pay back calculations for different types of solar panels and collectors, installation and operating costs, Environmental and safety issues, protection systems, performance monitoring.

4. Books and Materials

Text Books:

1. G. D. Rai (2009), Non-Conventional Energy Sources, 4^{th} Edition, Khanna Publishers, New Delhi.
2. Martin A. Green (2008), Solar Cells: Operating Principles, Technology and system Applications, 1^{st} Edition, Prentice Hall, New Delhi.

Reference Books:

1. B. H. Khan (2016)- Non Conventional Energy Resources-3^{rd} Edition, McGraw Hill Education (India) Private Limited.
2. Sukatme (2008), Solar Energy, 3^{rd} Edition, McGraw Hill Companies, New Delhi.
3. D. Yogi gosuami, Frank Kreith, Jan F. Kreider (2000), Principles of Solar Engineering, 3^{rd} Edition, Taylor & Francis, USA.

Course Structure

A8282 - Energy Storage Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces students to impart fundamental knowledge on energy storage systems considering the operation and design of various energy storage devices. This course provides a foundation for understanding the general principles and fundamentals of lithium-ion rechargeable battery engineering, fuel cells and super capacitors.

Course Pre/co-requisites

"The course has no specific prerequisite and co-requisites"

2. Course Outcomes (COs)

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

A8282.1. Apply the knowledge of concepts of science to understand the concepts of electro chemical cell.
A8282.2. Apply the knowledge of electro chemistry to describe the components and process in batteries.
A8282.3. Describe the electrical, thermal, and mechanical behavior of Li-Ion batteries under various operating conditions.
A8282.4. Apply the knowledge of basic science concepts to distinguish various types of fuel cells and their functionalities
A8282.5. Apply the knowledge of science to interpret the operation and characteristics of super capacitors.

3. Course Syllabus

Theory

Battery Technology Overview: Battery definitions, terms and terminology, Primary cells, Secondary cells. Electro chemistry - Electro chemical energy sources, Voltage and potential energy, Reduction and oxidation, Reduction potentials and electro chemical couples.

Battery Construction : Electro chemical cell, Cell mechanical structure, Resistance and polarization, Electrode design, Discharging and charging. Major Battery Chemistries and performance comparison.

Lithium-Ion Batteries: Lithium-ion cell reaction, construction - pouch cells, cylindrical, flexible foil. Principle of operation, Charge and discharge characteristics, State of charge (SOC), State of health (SOH), State of function (SOF), Charging procedures, Safety of

lithium-ion batteries, Lifetime. Types of Lithium-ion Batteries .

Fuel Cells: Introduction – working, performance characteristics and efficiency, types of fuel cell – Alkaline Fuel Cell, Polymer Electrolyte Membrane Fuel Cell, Molten Carbonate Fuel Cell, Solid-Oxide Fuel Cell, hydrogen fuel cells.

Super Capacitors: Introduction, Electro chemical Double-Layer Super capacitors, Charge-Discharge characteristics, Energy and power density, Design Considerations, Stacking and Voltage cell balancing.

4. Books and Materials

Text Books:

1. John Warner, The Handbook of Lithium-Ion Battery Pack Design: Chemistry, Components, Types and Terminology, 1^{st} Edition, Elsevier Science, 2015.
2. 2. Reiner Korthauer, Lithium-Ion Batteries: Basics and Applications, 1^{st} Edition, Springer, 2018.

Reference Books:

1. R. O'hayre, S.W. Cha, W.G. Colella, F.B. Prinz, Fuel Cell Fundamentals, 3^{rd} Edition, Wiley, 2016.
2. Masaki Yoshio, Ralph J. Brodd, Akiya Kozawa, Lithium-Ion Batteries: Science and Technologies, 1^{st} Edition, Springer, 2009.
3. Aiping Yu, Victor Chabot, Jiujun Zhang, Electrochemical Supercapacitors for Energy Storage and Delivery: Fundamentals and Applications, CRC Press, 2013.

Course Structure

A8283 - Power Generation Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Electrical Energy plays a significant role in day-to-day life of entire mankind. This course deals with the generation of power along with its economic aspects. It deals with the basic theory of various conventional power stations and the different components present in them. The course also helps the students to familiarize with different types of substations and its advantages and disadvantages. It also deals with the economic aspects of power system, power factor correction techniques and suitable pricing methods.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8283.1 List the different components of an electric power system.
A8283.2 Categorize the conventional methods of generating electrical power to meet the required load demand.
A8283.3 Categorize the Non-conventional methods of generating electrical power to meet the required load demand.
A8283.4 Model a power system to reduce economic losses.

3. Course Syllabus

Introduction: Conventional Energy Sources and their availability, Non-Conventional Energy Sources and their availability, Environmental impact of conventional and Non-Conventional energy sources.Hydro Electric Power Plants: Site selection, Plant layout, various components, Types of turbines, Governor and speed regulation, Pumped storage, Small scale hydroelectric plants (mini and micro).

Thermal Power Plant: Site selection, Plant layout, Coal its storage, Preparation, Handling, Feeding and burning, Cooling towers, Ash handling, Water treatment plant, High pressure boilers and steam turbines.

Nuclear Power Plant: Main components of nuclear power plant, Nuclear reactors types and applications, Radiation shielding, Radioactive and waste disposal safety aspect.

Non-Conventional Energy: Types of Non conventional Energy generation: solar, wind, tidal, biomass and wave energy.

Economic Aspects of Power Generation and Tariff Methods: Base load and peak load on power station. Interconnected grid system, Load curve, load duration and integrated load duration curves, demand, diversity, capacity, utilization and plant use factors. Costs of electrical energy - Fixed, Semi-fixed and Running Costs, Selection of type of generation and generation equipment, Performance and operating characteristics of power plants, Economic scheduling principle. Tariff, Characteristics, Types - Flat Rate, Block-Rate, two-part, three-part, and power factor tariff methods.

4. Text Books:

1. M. L. Soni, P. V. Gupta, U. S. Bhatnagar, A. Chakrabarti (2010), "A Text Book on Power System Engineering", 2nd Edition, Dhanpat Rai & Co. Pvt. Ltd, New Delhi.
2. C. L. Wadhwa (2010), "Generation, Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International (P) Limited, New Delhi.

Reference Books:

1. Leonard L. Grigsby (2012), "Electric Power Generation Transmission and Distribution, 3rd Edition, CRC press.
2. J. B. Gupta (2010), "A Course in Power Systems", 10th Edition, S. K. Kataria & Sons, New Delhi.

Course Structure

A8381 - Hybrid Vehicles

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The Basics of Hybrid Vehicles course introduces fundamental concepts in hybrid technology, combining internal combustion engines with electric propulsion. Students learn about hybrid vehicle architectures, regenerative braking, and battery systems. The curriculum covers energy management strategies, efficiency considerations, and the environmental impact of hybrid vehicles. Practical insights and case studies provide a foundation for understanding the design and operation of hybrid transportation systems.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8381.1 Identify different types of hybrid vehicles and their power train configurations
A8381.2 Analyze the energy management strategy for hybrid vehicles
A8381.3 Develop and optimize the hybrid vehicles subsystems
A8381.4 Apply advanced technologies and materials in hybrid vehicles design
A8381.5 Evaluate the performance and environmental impact of hybrid vehicle.

3. Course Syllabus

Introduction to Hybrid Vehicles:

Overview of hybrid vehicles and their advantages, types of hybrid vehicles (series, parallel, series-parallel), comparison with conventional vehicles and electric vehicles, historical background and evolution of hybrid vehicles, current market trends and future prospects.

Powertrain and Energy Storage Systems: Overview of powertrain configurations for hybrid vehicles, electric motors and their control systems, internal combustion engines and their optimization for hybrid use, energy storage systems (batteries, capacitors, flywheels) and their selection criteria, power electronics and electrical systems for energy conversion and distribution.

Energy Management and Control Systems: Overview of energy management strategies for hybrid vehicles, energy flow diagrams and efficiency maps, control systems for hybrid powertrains (electronic controls, sensors, actuators), algorithm development for optimal energy management, real-time operating systems and software architectures for vehicle control.

Aerodynamics and Thermal Management: Overview of aerodynamic principles relevant to hybrid vehicles, drag reduction techniques and wind tunnel testing, cooling system design and optimization for hybrid vehicles, climate control systems and cabin comfort considerations, NVH (noise, vibration, harshness) management in hybrid vehicles.

Challenges and Opportunities in Hybrid Vehicle Design: Discussion of challenges unique to hybrid vehicle design (e.g., packaging, weight, cost), opportunities for innovation and advancement in hybrid technology, case studies of successful hybrid vehicle designs and their lessons learned, future outlook for hybrid vehicles and their role in sustainable transportation, emerging trends in alternative propulsion technologies (fuel cells, hydrogen fuel cell vehicles, autonomous vehicles)

4. Books and Materials

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management

Reference Books:

1. . M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge.

Course Structure

A8382 - Fundamentals of Robotics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces students to the basics, types and elements of robots. The course exposes students to the theoretical concepts of robot kinematics. Path planning and trajectory planning concepts gives the perception on control of robotics. The concepts on actuators and sensors gives clear understanding and design ability for mobility systems. It gives an overview on application of robotics in manufacturing industry.

Course Pre/co-requisites

A8002 - Ordinary Differential Equations and Vector Calculus

2. Course Outcomes (COs)

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

A8382.1 Illustrate the basic concepts and components of a robotic system
A8382.2 Select appropriate actuators and sensors for designing robot mobility system
A8382.3 Solve transformation problems to describe the robot position and orientation of robot
A8382.4 Apply the concepts of robot work cell design and control
A8382.5 Choose appropriate robots for various applications suitable to modern manufacturing systems.

3. Course Syllabus

Introduction to Robotics: Classification of Robots, Advantages and Disadvantages of Robots, Degree of freedom, joints, Robot coordinates, Robot workspace, Robot characteristics, Robot Components, types of robot arms, end effectors, grippers.

Actuators: Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic and Pneumatic Devices, Electric Motors in Robotics.Sensors: Sensor Characteristics, Position Sensors, Velocity Sensors, Acceleration Sensors, Touch and Tactile Sensors, Proximity Sensors, Range Finder.

Manipulator Kinematics: Specifications of matrices, Homogeneous Transformation, D-H notation, joint coordinates and world coordinates, Forward and inverse kinematics, Simple problems.Path Planning:Trajectory planning and avoidance of obstacles, Path planning, introduction to robot programming.

Robot Work Cell Design and Control: Robot Cell Layouts, Multiple Robots and Machine Interface, Some Consideration in Work Cell Design, Interlocks, Error Detection and Recovery, Robot Cycle Time Analysis.

Robotic Applications: Robots in manufacturing and non- manufacturing applications, Health Service, Intelligent Home Applications, Military Applications, Space Application, Entertainment robots, Service robots, Domestic or household robots.

4. Books and Materials

Text Books:

1. Richard D. Klafter, Robotic Engineering, 2nd Edition, Prentice Hall of India, New Delhi.
2. M.P. Groover, Industrial Robotics, 3rd Edition, Pearson Education, New Delhi.

Reference Books:

1. R.K. Mittal, I.J. Nagrath, Robotics and Control, 1st Edition, Tata Mc Graw Hill, New Delhi.
2. P. Coiffet, M. Chaironze, An Introduction to Robot Technology, 3rd Edition, Kogam Page Ltd,London.
3. Ganesh S. Hegde, A Textbook of Industrial Robotics, 2nd Edition, University Science Press.

Course Structure

A8383 - 3D Printing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

3D printing is an additive manufacturing process whereby objects are built up from plastic filament, liquid resin, layers of powder, or even bio-compatible and edible materials.Desktop 3D printing is today's printing press, putting rapid prototyping, customizable products, and individualized medical appliances in reach of the general public. Literacy in basic 3D modeling and manufacturing is an essential skill for future STEM success in this country. In this course students will learn how to be "makers" by using various types of 3D modeling software and imaging equipment, printing actual physical objects that they have designed and modeled themselves, and participating in educational outreach in the institute and the community.

Course Pre/co-requisites

A8302 - Computer Aided Drawing

2. Course Outcomes (COs)

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

A8383.1 llustrate the fundamental concepts of Additive Manufacturing and 3-D printing, its advantages and limitations
A8383.2 Apply engineering knowledge, techniques, skills and modern tools to analyze problems in 3D Printing
A8383.3 Appraise additive manufacturing through 3d printing
A8383.4 Solve Complex manufacturing problems for significant technological and societal development
A8383.5 Evaluate engineering products using the knowledge of mathematics, science, engineering and IT tools.

3. Course Syllabus

Introduction to 3D Printing: Fundamental of 3D printing, Need for 3D printing Generic 3d printing process, Distinction between 3D printing and CNC, Classification of 3D printing Processes, Steps in 3D printing process, Advantages of 3D printing, standards for 3D printing, Major Applications. VAT Photo Polymerization 3d Printing Processes: Stereo

lithography (SL), Materials, SL resin curing process, Process Benefits and Drawbacks, Applications of Photo polymerization Processes.

Material and Binder Jetting 3D Printing Processes: Evolution of Printing as a 3D printing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes. Binder Jetting 3d Printing Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.

Extrusion-Based 3D Printing Processes: Fused Deposition Modeling (FDM), Principles, Materials, Plotting and path control, Bio-Extrusion, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes. Powder Bed Fusion 3d Printing Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.

Directed Energy Deposition 3D Printing Processes: Process Description, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Benefits and drawbacks, Applications of Directed Energy Deposition Processes. Wire arc based additive manufacturing methods, Advantages and disadvantages, comparison with conventional 3D printing and WAAM. Post Processing of 3d Printing Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques. Inspection of 3D printing parts: Different destructive and non-Destructive testing of 3D printing parts, acceptance standards for 3D printing parts.

3D Printing Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries.

4. Books and Materials

Text Books:

1. Ian Gibson, David W Rosen, Brent Stucker,Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2nd Edition, Springer.
2. Ali K. Kamrani, EmandAbouel Nasr,Rapid Prototyping: Theory & Practice,2nd Edition, Springer.

Reference Books:

1. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling,1st Edition, Springer.
2. Rafiq Noorani,Rapid Prototyping: Principles and Applications in Manufacturing,1st Edition, John Wiley & Sons.

Course Structure

A8402 - Digital Electronics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course aims to teach students the fundamentals of digital electronics. Starting from learning the basic postulates of Boolean algebra, to cover map method for simplifying Boolean expressions, to outline the formal procedures for the analysis and design of combinational and sequential circuits, to design combinational and sequential programmable devices. These digital components are the basic building blocks from which more complex digital systems are constructed.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8402.1. Apply fundamental theorems and properties of Boolean algebra to simplify a Boolean function.
A8402.2. Apply the map method to obtain simplified and optimized logical expressions.
A8402.3. Build combinational circuits using logic gates for real time digital systems.
A8402.4. Analyze the behaviour of latches and flipflops for designing sequential logic. .
A8402.5. Make use of programmable logic devices in the design of digital systems.

3. Course Syllabus

Boolean Algebra and Logic Gates: Introduction, basic definitions, axiomatic definition of Boolean algebra, basic theorem and properties, Boolean functions, canonical and standard forms, digital logic gates.

Gate-Level Minimization: The map method, two-variable, three-variable and four-variable K-maps, sum-of-products, product-of-sums simplification, don't-care conditions, NAND and NOR implementation.

Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, magnitude comparator, decoders, encoders, multiplexers, demulti-

plexers.

Synchronous Sequential Logic: Sequential circuits, storage elements – latches and flip-flops, analysis of clocked sequential circuits. **Registers and Counters:** Registers, shift registers, ripple counters, synchronous counters.

Memory and Programmable Logic: Random-Access Memory, read-only memory, programmable logic array, programmable array logic.

4. Books and Materials

Text Books:

1. M. Morris Mano, Michael D. Ciletti (2017), Digital Design With an introduction to the Verilog HDL, 6thEdition, Pearson Education/ PHI, India

Reference Books:

1. Ronald J Tocci, Ronald J Tocci, Neal S Widmer , Gregory L Moss , Digital Systems - Principles an Applications , 10th Edition, Pearson Education International
2. Charles H RothJr, Larry L Kinney, Fundamentals of Logic Design,6th Edition, Cengage Learning

Course Structure

A8481 - Basic Electronics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course covers fundamental topics that are common to a wide variety of analog and digital electronics. This course starts with basics of semiconductors, review the operation and characteristics of semiconductor devices (namely, semiconductor diodes and BJTs), and buildup to more advanced topics in analog circuit designs.

Course Pre/co-requisites

A8006 - Applied Physics.
A8204 - Basic Electrical Engineering.

2. Course Outcomes (COs)

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

A8481.1 Analyze the operation and characteristics of electronic devices.
A8481.2 Construct electronic circuits making use of diodes and transistors.
A8481.3 Analyze single stage amplifiers using small signal low frequency transistor model.
A8481.4 Analyze the effect of negative and positive feedback on amplifiers.
A8481.5 Design single stage amplifier for given specifications.

3. Course Syllabus

Diode and its Characteristics: P-N junction diode, operation in forward and reverse bias conditions, V-I characteristics, Zener diode and its characteristics, rectifiers - half wave, full wave and bridge rectifiers (simple problems), Filters (qualitative treatment), voltage regulation using Zener diode.

Transistors: Bipolar Junction Transistor (BJT) - construction, operation, CE, CB and CC transistor configurations and characteristics. **BJT Biasing:** Need for biasing, operating point, load line analysis, biasing and stabilization techniques: fixed bias, collector to base bias, self-bias.

BJT Amplifiers: Transistor as an amplifier, BJT h-parameter model, analysis of transistor amplifier using h- parameter model, CE, CB and CC amplifiers, comparison of CB, CE and CC configurations, Simplified h parameter model.

Feedback Amplifiers Concept of feedback, classification of feedback amplifiers, general Characteristics of negative feedback amplifiers, effect of negative feedback on input and output resistances.

Oscillators: Condition for oscillations, RC Phase shift oscillator with transistor, Wein bridge oscillator, Hartley and Colpitts oscillator.

4. Books and Materials

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, PHI, 2013.
2. Jacob Milliman, Christos C .Halkias, Satyabrata Jit (2011), Electronic Devices and Circuits, 3rd edition, Tata McGraw Hill, New Delhi

Reference Books:

1. G.K.Mittal (1999), Electronic Devices and Circuits, 22nd edition, Khanna Publications, New Delhi
2. S. Shalivahanan, N. Suresh Kumar, A. Vallavaraj (2007), Electronic Devices and Circuits, 3rd edition, McGraw Hill, New Delhi, India.

Course Structure

A8482 - Principles of Communication Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a foundation in the theoretical aspects of Electronic Communication Systems. This course focuses on Analog and Digital Communications, Pulse and Data Communications. This course forms the basis for the study of advanced communication systems like Telephone Switching networks, Computer Communications, Radar Communications, Cellular and Mobile Communications, Optical Communications and Satellite Communications.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8482.1 Summarize the fundamental concepts and acquire competencies for each topic of analog and digital modulation techniques.

A8482.2 Illustrate elements of analog, digital and data communications systems and identify their real-time applications.

A8482.3 Compare analog and digital communication systems with respect to performance parameters and applications.

A8482.4 Analyze the error control and coding techniques including Source Coding Technique, Huffman Source Coding, Error Control, and Coding.

A8482.5 Distinguish the features of advanced communication systems.

3. Course Syllabus

Introduction to Electronic Communications: Historical Perspective, Electromagnetic Frequency Spectrum, Signal and its Representation, Elements of Electronic Communications System, Primary Communication Resources, Signal Transmission Concepts, Analog and Digital Transmission, Modulation, Concept of Frequency Translation, Signal Radiation and Propagation, Classification and Sources of Noise, Signal-to-Noise Ratio (SNR), Noise Figure.

Principles of Analog Communication: Types of Analog Modulation, Principles of Amplitude Modulation, AM Power Distribution, Limitations of AM, DSBSC Modulation, SSB Modulation, Vestigial-Sideband Modulation, Comparison of Analog Modulations, Applications, Principles of Angle Modulation, Theory of FM—Basic Concepts, Spectrum Analysis, Narrowband and Wideband FM, Theory of Phase Modulation, Relationship between FM and PM, Comparisons and Applications of FM and PM.

Sampling Theorem and Pulse Modulation Techniques: Digital Versus Analog Transmissions, Sampling Theorem, Classification of Pulse-Modulation Techniques: Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Pulse-Code Modulation (PCM), Quantization of Signals, Delta Modulation, Comparison of PCM Techniques, Vocoders.

Digital Modulation Techniques and Information Theory: Types of Digital Modulation, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Quadrature Phase Shift Keying, M-Ary PSK, Quadrature Amplitude Modulation, Minimum Shift Keying, Information, Entropy and Its Properties, Channel Capacity Theorem, Objectives of Source Coding, Source Coding Technique, Huffman Source Coding, Error Control and Coding.

Advanced Communication Systems: Spread Spectrum Communication: General Model, Features, Multiple Access techniques, Telephone Switching, Computer Communications, Optical Communications, Mobile Communications-the Cellular Concept, Satellite Communications, RADAR systems.

4. Books and Materials

Text Books:

1. T L Singal, "Analog and Digital Communications", 1st edition, Tata McGraw-Hill, 2012
2. H. Taub, D L Schilling and G Saha, "Principles of Communication Systems", 3rd Edition, Tata McGraw-Hill, 2008.

Reference Books:

1. George Kennedy, Electronic Communication Systems, Tata McGraw-Hill.
2. B. P.Lathi, "Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press, 2007.

Course Structure

A8483 - Fundamentals of IoT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces you to Advance concepts and design techniques for creating Internet of Things systems and applications, as well as programming languages and tools optimized for the IoT industry. Participants are also exposed to new IoT-specific applications, physical layer protocols, communication technologies, and legacy protocols. This course will primarily present the fundamental IOT architecture building blocks and its theoretical components, such as Raspberry Pi programming using the Python Language Interface and other IOT peripherals.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8483.1 Identify the basic building blocks and its characteristics.
A8483.2 Determine the most appropriate IoT Devices and Sensors based on Application.
A8483.3 Make use of Python standard libraries for implementing various IoT Applications.
A8483.4 Analyze the appropriate protocol for establishing communication between various IoT Devices.
A8483.5 Interpret cloud infrastructure, services, APIs and architectures of commercial and industrial cloud platforms.

3. Course Syllabus

Introduction to Internet of Things: Introduction, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies, IoT Levels and Templates, IoT Platforms Design Methodology.

Introduction to Python: Language features of Python, Data types & data structures, Control of flow, Functions, Modules, Packages, File Handling, Data/Time operations, Classes, Python packages of interest for IoT(JSON,XML).

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, IoT System Management with NETCONF- YANG-Need for IoT Systems Management, SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG.

IoT Physical Devices and Endpoints: Introduction to IoT Device, Exemplary Device: Raspberry Pi, Components of Raspberry Pi Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming – Raspberry Pi with Python.

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs,WAMP – AutoBahn for IoT, Xively Cloud for IoT, ThingSpeak IoT Python web application framework-Django, Designing a RESTful web API.

4. Books and Materials

Text Books:

1. ArshdeepBahga and Vijay Madisetti: Internet of Things,A Hands-on Approach; University Press, 2016
2. Mark Lutz, "Learning Python", 4th edition, OREILLY, 2009.

Reference Books:

1. Getting Started with Raspberry Pi:Matt Richardson & Shawn Wallace,O'Reilly (SPD), 2014.

Course Structure

A8484 - Introduction to Embedded Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Introduction to Embedded systems course introduces the basic concepts like purpose and quality attributes of embedded systems. It covers the differences between the general purpose computers and specific purpose computers and selection of memory according to the requirement for a system. This course presents ASICs, PLDs, COTS, Memory Interface, and communication interface. This course provides a comprehensive introduction to microcontroller (8051) and their architecture with an emphasis on its interfacing with external devices. Focus is on 8051 microcontroller family which includes internal architecture, pin diagram, instruction set, register organization, addressing modes, operating modes, interrupt structure, assembly language programming and etc. Various aspects of hardware design, such as interfacing of memory and different types of I/O devices will be covered in detailed.

Course Pre/co-requisites

A8401 - Digital Logic Design.
A8416 - Computer Organization and Microprocessors.

2. Course Outcomes (COs)

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

A8484.1 Classify the embedded systems based on the performance, complexity and the era in which they evolved.
A8484.2 Understand different factors to be considered for the selection of memory, sensors, actuators and their interfacing.
A8484.3 Apply the fundamentals of microcontroller to investigate existing designs.
A8484.4 Demonstrate assembly language programming to assemble and driver circuitry to microcontroller I/O ports to interface external devices.
A8484.5 Develop a product with functional requirements using optimal hardware and software components.

3. Course Syllabus

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing,

Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

The 8051 Architecture: Introduction, 8051 micro controller hardware, external memory interfacing, Data transfer and logical instructions, arithmetic operations, decimal arithmetic, jump and call instructions and simple programs. The Assembly Language Programming: Programming tools and techniques, counter and timers programming, interrupts, interrupt programming.

I/O Interfaces: 8051 interfacing with seven segment LED displays, stepper motor, D/A converter interfacing, Interfacing DC motor, Interfacing 4*4 Matrix Keypad, Interfacing to Alphanumeric Displays (LCD) interfacing.

Basic Design Using a Real-Time Operating System: Tasks and Task states, Tasks and Data, Semaphores and Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment, Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System.

4. Books and Materials

Text Books:

1. Introduction to embedded systems Shibu K V Tata Mcgraw-Hill First Edition 2012
2. Kenneth J. Ayala (2008), The 8051 Microcontroller, 3rd edition, Cengage Learning, India.
3. David E. Simon (1999), An Embedded Software Primer, Pearson Education, India

Reference Books:

1. M. A. Mazidi J. G. Mazidi, Rolin D. McKinlay (2000), The 8051 Microcontroller and Embedded System, Prentice Hall of India, New Delhi.
2. Ajay V. Deshmukh (2004), Microcontrollers Theory and applications, Tata McGraw Hill Edition, New Delhi
3. Embedded Systems Rajkamal Tata Mcgraw-Hill Second Edition 2012

Course Structure

A8510 - Operating Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Operating Systems is a graduate-level introductory course that teaches the concepts in operating systems like abstractions, mechanisms, and various services provided. This course deals with Process Management & Synchronization, Inter process communication, Memory Management, Virtual Memory, File & Disk Management and Deadlock handling methods. Using these concepts, the student will be able to understand the internal working of various operating systems. The course provides the concepts and terminology required for advanced courses.

Course Pre/co-requisites

A8506 - Computer Organization

2. Course Outcomes (COs)

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

A8510.1. Identify the services provided by the operating system for user and system.
A8510.2. Examine the concepts of IPC and Synchronization for process cooperation
A8510.3. Make use of Memory Management techniques for efficient use of main memory.
A8510.4. Select File and Disk Management methods for effective storage and access.
A8510.5. Identify a Deadlock Handling Method in allocating resources among processes.

3. Course Syllabus

Operating Systems Overview and Process Management: Definition, Operating System Types, Operating System operations, Operating system services, System calls and System Programs. Process concepts- Process, Process State Diagram, PCB and Operations on processes, Process Scheduling- Scheduling Criteria, Scheduler Types and Scheduling Algorithms.

Process Synchronization: Inter Procee Communication- Pipes, Message Passing and Shared Memory. Concept of Synchronization, Critical section problem, Peterson's solution,

Semaphores, Classic problems of Synchronization-The Bounded Buffer Problem, The Readers –Writers Problem, Dining - Philosophers Problem.

Memory Management: Introduction to Memory Management, Swapping, Contiguous Memory Allocation, paging, segmentation, virtual memory, demand paging, Page-replacement algorithms, allocation of frames, thrashing.

File and Disk Management: Concept of a file – File Attributes, File Types, Access Methods, Directory Structures, File System Implementation, Directory Implementation, File Allocation methods, and Free-Space management. Introduction to Magnetic Disks, Disk Structures, Disk Scheduling, Swap Space Management.

Deadlocks: System Model, Deadlock Characterization-Necessary Conditions, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance - RAG Algorithm, Banker's Algorithm, Detection- Single Instance ofa Resource type, Multiple Instances of a resource type, recovery from deadlock.

4. Books and Materials

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne., Operating System Concepts, 8th Edition, Wiley India Private Limited, New Delhi,2009.

Reference Books:

1. William Stallings., Operating Systems, Internals and Design Principles, 5th Edition, Pearson Education, India, 2006.
2. Sumitabha Das., Your Unix the Ultimate Guide, Tata Mc Graw Hill, New Delhi, India, 2007.
3. T.Chan., Unix System Programming using C++, PHI, India,1996.

Course Structure

A8514 - Database Management Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, query languages like relational algebra, relational calculus and SQL. It also covers essential DBMS concepts such as: Normalization, Transaction Processing, Concurrency Control, Recovery and tree based indexing techniques like ISAM, B+ trees etc which are required for designing an effective database. Students can undertake a semester project to design, build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Pre/co-requisites

A8608 - Java Programming

A8601 - Object Oriented Programming

2. Course Outcomes (COs)

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

A8514.1. Design a database for a given problem using E-R diagrams and Relational Model.
A8514.2. Construct Queries in Relational algebra and SQL for a case study.
A8514.3. Use Normalization techniques to reduce data redundancy in data base.
A8514.4. Select transaction control and recovery methods to keep data base consistent.
A8514.5. Compare various indexing techniques and NoSQL databases for efficient access.

3. Course Syllabus

Introduction and Data Base Design: Introduction to DBMS, applications of DBMS, database systems versus file systems, view of data, Database users and administrators, database system structure. Introduction to Relational database model, database schema, relations, columns and tuples. SQL data types, Database languages, DDL commands, DML commands, DCL commands, TCL commands. Database Design: Introduction to ER model, entities, attributes and entity sets, relationships and relationship sets, additional features of

the E-R model. logical database design: E-R to relational.

SQL Programming: SQL basic operators, SQL set operators-union, intersect and except operators, Integrity constraints in SQL. aggregate operators, GROUP BY, ORDER BY and HAVING Clause, null values, views in SQL, nested queries, SQL joins-inner join, outer join, left outer join, right outer join, storing and retrieving images, storing and retrieving files, Relational algebra operations and basic queries.

Schema Refinement and Normal Forms: Introduction to schema refinement & Normalization, Decomposition and properties of decompositions, functional dependencies, Closure of Attributes set. Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF,5NF. Problems on normalization, Schema refinement in database design. PL/SQL basics for writing triggers, cursors.

Transaction Management: Transaction concept, transaction states, ACID properties, schedules, Serializability-Conflict serializability, View serializability, recoverability. Concurrency control: lock based protocols, timestamp based protocols, deadlocks handling. SQL stored procedures.

Indexing and NoSQL: :Recovery-ARIES recovery algorithm, Log based recovery. File organization techniques, Tree index structures: ISAM and B+ trees. SQL Vs NoSQL, basic CRUD operations using MongoDB.

4. Books and Materials

Text Books:

1. Raghurama Krishnan, Johannes Gehrke., Database Management Systems, 3rd Edition, Tata McGraw-Hill, New Delhi, India, 2014.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan., Database System Concepts, 7th Edition, McGraw- Hill, New Delhi, India, 2019.

Reference Books:

1. Elmasri Navate., Fundamentals of Database Systems, Database System Concepts, 7th Edition, Pearson Education, India,2016.
2. C. J. Date, A. Kannan and S. Swamynathan., An Introduction to Database Systems, 8th Edition, Pearson Education, India, 2015.

Course Structure

A8520 - Software Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course acts as a foundation in the field of software engineering and is aimed at helping students develop an understanding of how software systems are developed from basic, by guiding them through the development process, adopting the fundamental principles of system development. The course will orient the students to the different software process models, software requirements engineering process, systems analysis and design as a problem-solving activity, with focus on quality.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8520.1. Identify the design issues and process models to develop a software.
A8520.2. Determine the functional and non functional requirements with appropriate validation for a software product.
A8520.3. Develop software design documents for the given requirements.
A8520.4. Prepare test documents at various stages to validate project.
A8520.5. Illustrate the need of quality management and metrics for product standardization

3. Course Syllabus

Introduction to Software Engineering: The Evolving nature of software engineering, Changing nature of software engineering, Software engineering Layers, The Software Processes,Software Myths. Process Models: A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model, the Unified Process.

Requirements Engineering: Functional and Non-Functional Requirements, The Software requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management.

Design and Implementation: System Modeling: Interaction Models, Structural Models, Behavioral Model, Model Driven Engineering. The Object Oriented Design with UML, Implementation Issues. User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Software Testing Strategies: A Strategic approach to Software Testing, Strategic Issues and Test Strategies for Conventional Software, Validation Testing, Unit Testing , Integration Testing, Regression Testing , The Art of Debugging, White Box Testing - Basic Path Testing, Control Structure Testing. Black Box Testing - Equivalence partitioning, Boundary value analysis, Graph Based testing and state transition testing.

Quality Management: Quality Concepts, Software Quality, Software Quality Dilemma, Achieving Software Quality, Review Techniques, Reviews: A Formal spectrum, Informal Reviews, Formal Technical Reviews. Software Quality Assurance: Background Issues,Elements of Software Quality Assurance, Tasks, Goals and Metrics, Software Reliability,the ISO 9000 Quality Standards.

4. Books and Materials

Text Books:

1. Roger S. Pressman.,Software Engineering, A Practitioner's approach , 7th Edition, McGraw Hill International Edition, New Delhi,2011.
2. Sommerville., Software Engineering, 9th Edition,Pearson education, India.

Reference Books:

1. K. K. Agarval, Yogesh Singh., Software Engineering, 3rd Edition, New Age International Publishers, India,2007.
2. Lames F. Peters, Witold Pedrycz, Software Engineering an Engineering approach,John Wiely & Sons, New Delhi, India,2000.
3. Shely Cashman Rosenblatt., Systems Analysis and Design, 6th Edition, Thomson Publications, India.

Course Structure

A8607– Information Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Information security is the practice of protecting information by mitigating risks across computer systems. The course introduces the technical and policy foundations of information network security. This course explains the inner workings of cryptographic systems and how to correctly use them in real-world applications.

Course Pre/co-requisites

A8519 - Computer Networks.

2. Course Outcomes (COs)

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

A8607.1 Recognize various security threats, services, mechanisms, and classical encryption techniques.

A8607.2 Apply classical encryption algorithms (Substitution and Transposition ciphers) and DES, AES algorithms to encrypt plain text.

A8607.3 Explain various key management techniques, exemplifying RSA and Diffie-Hellman.

A8607.4 Examine the problems of authentication techniques (SHA, Digital signature).

A8607.5 Analyze different symmetric key distribution and understanding of various authentication applications

3. Course Syllabus

Introduction to Information Security: Computer security concepts, OSI security architecture,security attacks, security services, security mechanisms, a model for network security.Classical Encryption Techniques: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques.

Block Cipher and Data Encryption Standards: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles, tools used for DES.Advanced Encryption Standards: Advanced Encryption Standard, Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Key Expansion, tools used for AES.Blowfish Algorithm,International Data Encryption Algorithm(IDEA).

Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, extended Euclid's algorithm. Public-Key Cryptography

and RSA: Principles of Public key crypto Systems, RSA algorithm, Diffie-Hellman Key Exchange.

Hash Functions: Cryptographic Hash Functions, Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA). Digital Signature: Digital Signature Requirements, Attacks and Forgeries, Properties.

Key Management and Distribution : Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security Email Security:Pretty Good Privacy (PGP).

4. Books and Materials

Text Books:

1. William Stallings, Cryptography and network security: principles and Practice Upper Saddle River: Pearson, 6th edition.

Reference Books:

1. Forouzan, Behrouz A., and Debdeep Mukhopadhyay. Cryptography and network security (Sie).McGraw-Hill Education, 2011.
2. AtulKahate., Cryptography and Network Security, 2nd edition, Tata Mc-Grawhill, India,2008.

Course Structure

A8608 - Java Programming

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides Object Oriented Programming concepts using Java. The course focuses on different aspect of core Java Environment suitable to write efficient, maintainable, and portable code. It also ignites Object Oriented thinking and explores with the evolution of Java and its basics. It provides strong foundation on Inheritance, Packages and Interfaces and also illustrates Exception Handling and Multithreaded mechanisms. It also provides Collection framework for manipulating data. This course also focuses on file handling using Java API.

Course Pre/co-requisites

A8505 - Data Structures

A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

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

A8608.1 Make use of various constructs to write a console application.
A8608.2 Use principles of OOP to develop real time applications.
A8608.3 Identify the need of exception handling to deal with runtime errors.
A8608.4 Build applications for parallel processing using Multithreading.
A8608.5 Choose Collection framework and I/O to manipulate and store data.

3. Course Syllabus

Introduction to OOP : Evolution of Java, OOP principles, Java Buzzwords, Implementing Java program, JVM, Data Types, Variables, Type conversions and Casting, Operators, Control statements, Arrays. Classes, Objects, Methods, Constructors, this keyword, Overloading Methods and Constructors, Argument passing, Exploring String class.

Inheritance, Interfaces and Packages: Inheritance- Inheritance Basics, Using super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract classes, final keyword. Packages and Interfaces: Defining a Package, Finding Packages and CLASSPATH,

Access Protection, Importing Packages, Defining and Implementing interfaces, Extending interfaces.

Exception Handling: Exception Handling Fundamentals, Exception Types, using try catch, throw throws and finally keywords, Built-in Exceptions, Creating own exception subclasses.

Multithreading: Multithreading: Multithreading- Life cycle of a thread, Thread class methods, creating threads, thread priorities, Synchronizing threads, Interthread Communication.

Collections and I/O : Collections - Introduction to Collection Framework, Collections Hierarchy, ArrayList, LinkedList, HashSet, TreeSet. The Date and StringTokenizer. I/O – Basics, reading and writing console input and output, PrintWriter class, operations of files – reading, writing and copying files.

4. Books and Materials

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, Tata McGraw-Hill Education, 2019.

Reference Books:

1. Y.Daniel Liang, Introduction to Java Programming-Comprehensive Version, 10th Edition,Pearson Education,2018.
2. Kathy Sierra, Bert Bates, OCA Java SE 8 Programmer, 1st Edition, McGraw-Hill Education, 2017.

Course Structure

A8651 - Ethical Hacking

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Ethical hacking strikes all of us as a subject that requires a great deal of prerequisite knowledge about things like heavy duty software, languages that includes hordes of syntaxes, algorithms that could be generated by maestros only. Well that's not the case, to some extent. This course introduces the steps required to complete a penetration test, or ethical hack. Requiring no prior hacking experience, the book explains how to utilize and interpret the results of modern day hacking tools that are required to complete a penetration test. Coverage includes GoogleHacking, Nmap, Nessus, Metasploit, and Hacker Defender rootkit. Simple explanations of how to use these tools and a fourstep methodology for conducting a penetration test provide readers with a better understanding of offensive security.

Course Pre/co-requisites

A8519-Computer Networks

2. Course Outcomes (COs)

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

A8651.1 Use the various security tools to assess the computing system.
A8651.2 Identify the vulnerabilities across any computing system using penetration testing.
A8651.3 Choose a prediction mechanism to prevent any kind of attacks.
A8651.4 Make use of metasploit tool to probe systematic vulnerabilities on networks and servers.
A8651.5 Identify the wireless network flaws and fill security patches in web access.

3. Course Syllabus

Introduction to Hacking: Important Terminologies, Penetration Test, Vulnerability Assessments versus Penetration Test, Pre-Engagement, Rules of Engagement, Penetration Testing Methodologies, OSSTMM, NIST, OWASP, Categories of Penetration Test, Types of Penetration Tests, Vulnerability Assessment Summary Reports.

Information Gathering Techniques: Information Gathering Techniques, Active Information Gathering, Passive Information Gathering, Sources of Information Gathering, Information Gathering with Whois, Tracing the Location, Traceroute, ICMP Traceroute, TCP Traceroute, Usage, UDP Traceroute, Enumerating and Fingerprinting the Webservers, Google Hacking.

Network Attacks: Vulnerability Data Resources, Exploit Databases, Network Sniffing, Types of Sniffing, Promiscuous versus Nonpromiscuous Mode, MITM Attacks, ARP Attacks, Denial of Service Attacks, Hijacking Session with MITM Attack, SSL Strip: Stripping HTTPS Traffic, DNS Spoofing, ARP Spoofing Attack Manipulating the DNS Records, DHCP Spoofing, Remote Exploitation, Attacking Network Remote Services, Overview of Brute Force Attacks, Traditional Brute Force, Attacking SMTP.

Exploitation: Introduction to Metasploit, Reconnaissance with Metasploit, Port Scanning with Metasploit, Compromising a Windows Host with Metasploit, Client Side Exploitation Methods, e- Mails with Malicious Attachments. .

Wireless and Web Hacking: Wireless Hacking, Introducing Aircrack, Cracking the WEP, cracking a WPA/WPA2 Wireless Network Using Aircrack-ng, Brute Force and Dictionary Attacks, Types of Authentication.

4. Books and Materials

Text Books:

1. Rafay Baloch., Ethical Hacking and Penetration Testing Guide, CRC Press, 2014.

Reference Books:

1. Kevin Beaver, Ethical Hacking for Dummies,6th Edition,Wiley, 2018.
2. Jon Erickson., Hacking: The Art of Exploitation, 2nd Edition, Rogunix, 2007.

Course Structure

A8652 - Cyber Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive overview of various cybercrimes, how they are planned, possible vulnerabilities and crimes that occur in mobile and wireless devices. It introduces tools and techniques that are used in cybercrime. It helps in analyzing and designing defensive security mechanisms for protecting information systems resources.

Course Pre/co-requisites

A8519- Computer Networks
A8607- Information Security

2. Course Outcomes (COs)

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

A8652.1 Identify the cybercrimes and offences in network accesses.
A8652.2 Interpret the criminal plans before going to attack.
A8652.3 Choose various security measures on mobile devices for a given scenario and make an effective report.
A8652.4 Identify the various methods and tools in Cyber Crime.
A8652.5 Examine various defense and analysis techniques to protect our information from attackers

3. Course Syllabus

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes. Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector, and Cloud Computing.

Cybercrime -Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Defense and Analysis Techniques: Memory Forensics - Why Memory Forensics Is Important, Capabilities of Memory Forensics, Memory Analysis Frameworks, Dumping Physical Memory, Installing and Using Volatility, Finding Hidden Processes, Volatility Analyst Pack, Honey pots, Intrusion Detection Systems.

4. Books and Materials

Text Books:

1. Nina Godbole and Sunil Belapure., Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Prespectives,1st Edition,Wiley INDIA, 2011.
2. James Graham, Richard Howard and Ryan Otson., Cyber Security Essentials,1st Edition,CRC Press,2011.

Reference Books:

1. Chwan-Hwa(John), Wu,J.David Irwin., Introduction to Cyber Security,1st Edition, CRC Press T and F Group, 2013.
2. Richard A. Clarke, Robert Knake., Cyberwar: The Next Threat to National Security and What to Do About It,Ecco 2010.

Course Structure

A8656 - Blockchain Technology

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces blockchain, a revolutionary technology that enables peer-to-peer transfer of digital assets without any intermediaries, and is predicted to be just as impactful as the Internet. A blockchain is a permanent, sequential list of transaction records distributed over a network. The course introduces consensus, proof of work, mining, in Bitcoin. The course introduces ethereum blockchain and smart contracts.

Course Pre/co-requisites

A8607 - Information Security

2. Course Outcomes (COs)

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

A8656.1 Identify the basic concepts of block chain to process data
A8656.2 Make use of Bitcoin as cryptocurrency
A8656.3 Choose Ethereum block chain for security
A8656.4 Design smart contracts as per the requirements and deploy on Testnet works.

3. Course Syllabus

Introduction to Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency. How Bitcoin Achieves Decentralization: Centralization vs. Decentralization, Distributed Consensus, Consensus without Identity: the Block Chain, Incentives and Proof of Work, Putting It All Together.

Mechanics of Bitcoin: Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations Improvements. Store Usage: How to Store and Use Bitcoins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

Bitcoin Mining: The Task of Bitcoin Miners, Mining Hardware, Energy Consumption Ecology, Mining Pools, Mining Incentives and Strategies. Bitcoin and Anonymity: Anonymity Basics, How to de-anonymizeBitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash, Tor and the Silk Road.

Ethereum: What is Ethereum, smart contracts, Solidity Ethereum Virturalmachine. Installing solidity ethereum wallet, basics of solidity by example, Layout of a solidity source file

structure of smart contracts, General value types, ether units, Time units, Globally available variables and functions.

Operators: Arithmetic, Logical Bitwise operators, Control structure (if-else, for, while, do-while), Scoping and declarations, Input parameters and output parameters, Function calls return types, Function Modifiers, Fallback functions, Abstract contract, Creating contracts via new operator, Inheriting smart contracts, Importing smart contracts compiling contracts, Events logging, exceptions, Examples of smart contract : crowd funding, voting ballot.

4. Books and Materials

Text Books:

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., Goldfeder, S.,Bitcoin and cryptocurrency technologies: a comprehensive introduction, Princeton University Press, 2016.
2. Dave Hoover, Kevin Solorio, and Randall Kanna., Hands–On Smart Contract Development with Solidity and Ethereum, O'Reilly Media, Inc., 2019.

Reference Books:

1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, 1st Edition, O'Reilly Media, Inc., 2019.

Course Structure

A8658 - Robotic Process Automation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

RPA is an advanced form of business process automation that can provide a path for businesses to automate human actions. RPA is ultimately about automating some of the most mundane and repetitive computer-based tasks and processes in the workplace like text, image automation with sequence of actions, keyboard-based automation, and E-mail automation etc. Process automation is able to record tasks performed by a human on their computer, then perform those same tasks without human intervention.This course will help Students to learn how to Automate the Tasks in real time.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8658.1. Discuss use of RPA platform and its components.
A8658.2. Apply sequence and control flows as per the requirements.
A8658.3. Analyse data manipulation concepts to solve real time problems.
A8658.4. Illustrate user interface explorer and handle events.
A8658.5. Demonstrate scenario of handling the errors and exceptions and benefits of RPA.

3. Course Syllabus

Introduction to Robotic Process Automation: Scope and techniques of automation, Benefits of RPA, Components of RPA, RPA platforms, About UiPath. Record and Play: UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio,Task recorder, Step-by-step examples using the recorder.

Sequence & Control Flow: Sequence, Flowchart, and Control Flow, Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-Step example using Sequence and Flowchart, Step-by step example using Sequence and Control flow.

Data Manipulation: Variables and scope, Collections, Arguments-purpose and use,Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example).

Handling events: Element triggering events, image triggering events, system triggering events, PDF Extraction, Revisit Recorder: Basic recording, Desktop recording, web recording, Screen Scraping, Automation Techniques: Incoming Email automation, Sending Email automation, Workbook and Excel automation (read/write).

Error and Exception Handling: Exception handling, Common exceptions and ways to handle them,debugging techniques, Collecting crash dumps, Error reporting. Future of RPA,RPA Compared to BPO, BPM and BPA

4. Books and Materials

Text Books:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940.
2. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA System, Publisher: A press,2020.

Reference Books:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant.
3. SrikanthMerianda,Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.

Web Resources:

1. https://www.uipath.com/rpa/robotic-process-automation

Course Structure

A8681 - E-Commerce

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The tremendous growth of the Internet and World Wide Web is making a great impact on businesses, governments and individuals throughout the world. In this course, students will understand the phenomena, technological, economic and social, behind these rapid changes, and how organizations successfully conduct Internet-based activities. This course discusses some of the technology of the Internet. This course provides an overview of e-commerce from both technological and managerial perspectives. It introduces e-commerce frameworks and technological foundations; and examines basic concepts such as strategic formulation for e-commerce enterprises, management of their capital structures and public policy. It is particularly important that the students emphasis on understanding the different E-Commerce system design principles.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8681.1. Elaborate the components and roles of the E-Commerce environment.
A8681.2. Estimate how to sell products and services on the web as well as to meet the needs of website visitors.
A8681.3. Analyze the impact of E-commerce on business models and strategy.
A8681.4. Create a portfolio of the steps required to start-up an on-line business.
A8681.5. Interpret legal and ethical issues related to E-Commerce and web marketing approaches.

3. Course Syllabus

Introduction to E-Business and E-Commerce: What is the difference between e-commerce and e-business, Anatomy of E-Commerce applications, E-Business risks and barriers to business adoption, Management responses to E-Commerce and E-Business, Electronic Commerce-Frame work.

E-Commerce Fundamentals: Location of trading in the marketplace, Business models for ecommerce, Focus on auction business models, Focus on Internet start-up companies. E-Business Infrastructure - Introduction, Internet technology, Web technology, Internet-access software applications, Managing e-business infrastructure, Focus on web services, SaaS and service oriented Architecture (SOA), Focus on mobile commerce.

E-Environment: Social and legal factors, Environmental and green issues related to Internet Usage, Focus on e-commerce and globalization, Political factors.
E-Business Strategy - What is e-business strategy, Strategic analysis, Strategic objectives, Strategy definition, Strategy implementation, Focus on information systems strategy and e-business strategy.

E-Security: Securing the Business on Internet- Security Policy, Procedures and Practices, Transaction Security, Cryptology, Digital Signatures, Security Protocols for Web Commerce. Supply Chain Management- What is supply chain management?,Focus on the value chain, Using e- business to restructure the supply chain, Supply chain management implementation

E-Procurement: What is e-procurement, Drivers of e-procurement, Focus on estimating eprocurement cost, implementing e-procurement.

4. Books and Materials

Text Books:

1. Dave Chaffey., E-Business and E-Commerce Management , strategy, Implementation and practice, 5th Edition, Prentice Hall,2011.

Reference Books:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth - 215 - Chang, JohnWiley.
2. Whinston,Pearson., Frontiers of electronic commerce –Pearson Education, Kalakata,2015.
3. Bharat Bhaskar: Electronic Commerce,TataMc-Graw-Hill, New Delhi, 2003
4. E-Commerce — Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico-Traver.

Course Structure

A8682 - Full Stack Development

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The popularity of JavaScript has brought many advancements and changed the face of web development. Real-world applications are looking at the web design with push capabilities. The purpose of this course is to study the concepts of JAVASCRIPT, React JS and Node JS to build user interface web-based applications to meet real-world needs.

Course Pre/co-requisites

A8604 - Web Technologies

2. Course Outcomes (COs)

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

A8682.1 Demonstrate the fundamentals of scripting languages & non - scripting languages and its differences.
A8682.2 Use react concepts to design forms.
A8682.3 Use different node.js modules to connect with database.
A8682.4 Build web application using Node.js.

3. Course Syllabus

Introduction: Introduction to scripting language, motivation , applications; scripting languages vs non-scripting languages; overview of popular scripting languages-JavaScript, Perl, Python; environments - Node.js and react.js, java scripting language constructs.

React JS: JSX and its use case, DOM, Virtual DOM and its working, ES6, Difference between ES5 and ES6, NPM Modules, React Elements, Render Function, Redux ,ReactJS with Redux.

React JS: Components, Class Component, Props, Events, Forms, CSS, Hooks & Context API, Material UI.

Node.JS: Concepts-modules, packages, working with HTTP, streams and file systems,

events, REST API, ExpressJS.

Node.JS: Database connectivity-Mysql, create connection, create database, working with Database operations-create table, insert, select, update, delete, etc.s

4. Books and Materials

Text Books:

1. Learning Node.js A Hands on Guide to Building Web Applications in JavaScript, Marc Wandschneider, Second Edition, Addinson-Wesley.
2. React.js Book: Learning React JavaScript Library From Scratch, Greg Sidelnikov, Learning Curve, 2017.

Reference Books:

1. Beginning Node.js, Basarat Ali Syed, Apress, 2004.
2. The Node Beginner Book: A Comprehensive Node.js Tutorial, Manuel Kiessling, Leanpub, 2011.
3. FullStack React: The Complete Guide to ReactJS and Friends, Anthony Accomazzo, Anthony Accomazzo, Nate Murray, Ari Lerner, Clay Allsopp, David Guttman, and Tyler McGinnis.
4. Learning React: Functional Web Development with React and Redux, Alex Banks & Eve Porcello, O'Reily.

Course Structure

A8702 – Artificial Intelligence

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This is an undergraduate course to acquire the ability to design intelligent solutions to problems in a variety of domains and business applications such as natural language Processing, text mining, and robotics, reasoning and problem-solving. AI will focus on problem solving, reasoning, planning and gaming. Through learning problem solving skills can be acquired. The course enables to choose data science domain to implement machine learning and deep learning applications.

Course Pre/co-requisites

A8508-Python Programming Laboratory
A8509-Discrete Mathematical Structures

2. Course Outcomes (COs)

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

A8702.1. Apply AI techniques to solve game playing theorem proving and machine learning.
A8702.2. Apply the propositional logic to AI designs .
A8702.3. Learn different playing and reinforcement learning techniques .
A8702.4. Examine the role of searching strategies in AI environment.
A8702.5. Analyse the constraint satisfaction problems for problem solving.

3. Course Syllabus

Introduction: Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

Adversarial Search : Games, Optimal decisions in games, The minimax algorithm, Alpha–Beta pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking search for CSPs, Knowledge-Based Agents, The wumpus world.

Propositional Logic: Inference and proofs, Proof by resolution, Horn clauses and definite clauses. First-Order Logic : Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning ,Graphs, Analysis of Planning approaches, Hierarchical Planning.

Reinforcement learning: Introduction, passive Reinforcement learning, active Reinforcement learning, Generalization in reinforcement learning. Robotics: Introduction, Robot Hardware, Robot Perception, planning to move, moving Robotic Software Architectures.

4. Books and Materials

Text Books:

1. Stuart J.Russel, Peter Norvig, Artificial Intelligence – A Modern Approach, 3rd Edition, Pearson Education, 2009.

Reference Books:

1. E.Rich and K.Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2008.
2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Pearson Education Private Limited, India, 2001.
3. George F. Luger , Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th Edition, Pearson, 2008.
4. Shivani Goel, Artificial Intelligence, 4th Edition, Pearson Education Private Limited, India, 2009.

Course Structure

A8781- Computer Organization and Architecture

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	3	40	60	100

1. Course Description

Course Overview

This course is designed to understand the concepts and functionalities of computer system among the various components such as registers, control unit and memory units. The course provides in-depth knowledge of internal working, structuring, and implementation of a computer system, the way the system is structured so that all those catalogued tools can be used properly. In addition, this course helps to construct the circuits to the corresponding operations and also discusses the multiprocessing. It is a fundamental course and provides the concepts and terminology required for advanced courses.

Course Pre/co-requisites

A8402 - Digital Electronics

2. Course Outcomes (COs)

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

A8781.1. Identify various functional aspects of computer hardware.
A8781.2. Choose various instructions and addressing modes to execute an instruction.
A8781.3. Make use of integer and floating point algorithms to perform arithmetic operations on data.
A8781.4. Design control unit and memory for a computer system.
A8781.5. Examine the performance of a system using pipelining and multiprocessors.

3. Course Syllabus

Introduction and Micro operations: Computer functional units, Von – Neumann Architecture, Harvard architecture. Register transfer, Bus and memory transfer, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic and shift unit. Data Representation – Fixed point and Floating point.

Instructions and Addressing Modes: Computer Instructions, Instruction Cycle, Register reference instructions, Memory reference instructions, Input-output and Interrupt. Stack organization, instruction formats, addressing modes, data transfer and manipulation, Inter-

rupt Handling and types.

Computer Arithmetic: Introduction, Addition, Subtraction and Multiplication algorithms on signed magnitude and two's complement data, Division Algorithms, Floating point arithmetic operations.

Control Unit and Memory Organization: Control memory, address sequencing, micro program example and design of control unit. Memory Hierarchy, Main Memory – RAM and ROM chips, Cache Memory – Introduction, Cache Mapping Techniques.

Pipelining and Multiprocessors: Parallel processing, Arithmetic Pipeline, Instruction pipeline and RISC pipeline. Multiprocessors- characteristics of multiprocessors, Interconnection structures, Interprocessor arbitration.

4. Books and Materials

Text Books:

1. M. Moris Mano., Computer System Architecture,3rd Edition, Pearson Publication, India, 2006.
2. Stallings William., Computer Organization and Architecture,9th Edition, Pearson Education India, 2012.

Reference Books:

1. Carl Hamacher, ZvonksVranesic, SafeaZaky., Computer Organization,5th Edition, McGraw-Hill, New Delhi, India, 2002.

Course Structure

A8851 - Data Science for Engineers

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Data Science for Engineers course aims to equip engineering students with the essential knowledge and practical skills required to excel in the dynamic field of data science, emphasizing their ability to proficiently query and analyze diverse datasets. Through this course, students will gain a comprehensive understanding of the intricacies involved in handling heterogeneous data, learning how to effectively preprocess and visualize it. By exploring the methodologies and tools employed in data science, students will not only grasp the theoretical foundations but also engage in hands-on applications. Ultimately, upon completing this course, students will emerge with a well-rounded skill set that encompasses data querying and analytics, data preprocessing and visualization, and a solid foundation in data science methodologies and tools. This comprehensive preparation equips them to navigate the complex landscape of data science effectively and contribute meaningfully to data-driven decision-making processes.

Course Pre/co-requisites

A8005- Computer Oriented Statistical Methods
A8514- Database Management Systems
A8804- Data Analytics

2. Course Outcomes (COs)

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

A8851.1 Identify the various requirements for data science process.
A8851.2 Choose an appropriate database required for processing data.
A8851.3 Demonstrate the data science methodology and text mining approaches.
A8851.4 Make use of data science tools to visualize the insights of data.
A8851.5 Apply various data visualization techniques using Tableau over Google Sheets.

3. Course Syllabus

Importance of Data Science: Need for Data Science, what is Data Science? Data Science Process, Business Intelligence and Data Science, Prerequisites for a Data Scientist, Components of Data Science, Tools and Skills needed. Statistics and Probability- Data Types, Variable Types, Statistics, Sampling Techniques and Probability, Information Gain and Entropy, Probability Theory, Probability Types, Probability Distribution Functions, Bayes' Theorem, Inferential Statistics.

Databases for Data Science: SQL – Tool for Data Science, Basic Statistics with SQL, Data Munging with SQL, Filtering, Joins, and Aggregation, Window Functions and Ordered Data, Preparing Data for Analytics Tool, Advanced NoSQL for Data Science- Why NoSQL, Document Databases for Data Science, Wide-Column Databases for Data Science, Graph Databases for Data Science.

Data Science Methodology: Analytics for Data Science, Examples of Data Analytics, Data Analytics Life Cycle- Data Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalization. Data Analytics and Text Mining- Text Mining, Major Text Mining Areas, Text Analytics, Major Components of NLP, Stages of NLP, Statistical Processing of Natural Language, Applications of NLP.

Data Science Tools-I: Python Libraries: DataFrame Manipulation with pandas and NumPy, Data Wrangling: Clean, Transform, Merge, Reshape, Exploration Data Analysis with Python, Time Series Data, clustering with Python, Plotting and Visualization, ARCH and GARCH, Dimensionality Reduction.

Data Science Tools-II: Tableau- Introduction to Data Visualization and Tableau, Dimensions and Measures, Cleaning and Structuring Messy Data Descriptive Statistics, Basic Charts, Joins and blends, Filtering data, Row-level calculations, Aggregate-level calculations, Level of detail calculations, Custom Table Calculations, Dashboard Design & Principles, Special Chart Types, Integrate Tableau with Google Sheets.

4. Books and Materials

Text Books:

1. Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, Fundamentals of Data Science, 1st Edition,CRC Press, India,2022.
2. Wes McKinney., Python for Data Analysis, 1st Edition,„O'Reilly Publications, 2015.
3. Joshua N. Milligan, Learning Tableau 2019, Packt Publications,2019.

Reference Books:

1. Avrim Blum, John Hopcroft, Ravindran Kannan., Foundations of Data Science, 1st Edition, Cambridge University Press, 2020.
2. Ani Adhikari and John DeNero,Computational and Inferential Thinking: The Foundations of Data Science,GitBook, 2019.

Course Structure

A8081 - Mathematical Programming

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the Linear programming problem, Formulation and Graphical solution of Linear programming problem, Simplex method, Big -M method, Two-phase simplex method, Dual simplex method, Degeneracy in simplex and unbounded solutions, Transportation problem, Assignment model, Replacement models and Sequencing models. In addition, this course can be applied in many areas of engineering such as computer graphics, cryptography.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8081.1. Identify LPP and express in mathematical form to solve by graphical or simplex method.
A8081.2. Apply artificial variable techniques to obtain the optimal solution of an LPP.
A8081.3. Interpret various methods under transportation model to get optimal results.
A8081.4. Solve travelling salesmen problem using Hungarian method.
A8081.5. Develop various replacement and sequencing models to arrive at an optimal decision.

3. Course Syllabus

Introduction to Operations Research: Basic definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem, Formulation and Graphical solution of Linear Programming Problem, Simplex method.

Artificial Variables Techniques: Big -M method, Two-phase simplex method, Duality in simplex method, Dual simplex method, degeneracy in simplex and unbound solutions.

Transportation problem: Formulation, solution, unbalanced Transportation problem. Finding initial basic feasible solutions, North-West corner rule, lowest cost entry method and Vogel's approximation method. Optimality test- MODI method, degeneracy in transportation, restricted transportation problem, conditional transportation problem.

Assignment Model: Formulation, Hungarian method for optimal solution, solving unbalanced problem, restricted assignment, conditional assignment problems, crew assignment problems, Travelling salesman problem, Transportation problem as assignment problem.

Replacement Models and Sequencing Models: Replacement Models: Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value, Replacement of items that fail suddenly, individual replacement policy, group replacement policy. Sequencing Models: Solution of Sequencing Problem, Processing n Jobs through two machines, Processing n Jobs through three machines, Processing two Jobs through m machines, Processing n Jobs through m Machines.

4. Books and Materials

Text Books:

1. Sharma S. D. Operation Research, Tata McGraw Hill, New Delhi, 2009.
2. Panneerselvam R. Operations Research, 2nd Edition, Prentice Hall of India, India, 2008.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
2. Sharma J. K. Operations Research – Theory and Applications, 5th Edition, Macmillan India Ltd, India, 2007.

Course Structure

A8082 - Transform Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the Series Solutions of Second Order Ordinary Differential Equations, Fourier Series, Fourier Transforms, Z-Transforms and Applications of Transforms to Integral equations. In addition, this course can be applied in many areas of engineering such as computer graphics, cryptography, wireless communication, signal processing, robotics and animation.

Course Pre/co-requisites

A8002 - Ordinary Differential Equations and Vector Calculus.

2. Course Outcomes (COs)

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

A8082.1. Formulate series solutions of ordinary differential equations.
A8082.2. Develop Fourier series for different types of functions.
A8082.3. Apply Fourier Transform to connect the time and frequency domain.
A8082.4. Analyze Z-transform and discrete signals to solve equations.
A8082.5. Apply Laplace transforms to solve integral equations.

3. Course Syllabus

Series Solutions of Second Order Ordinary Differential Equations: Classification of Singularities, Series Solutions to Differential Equations around zero, Frobenius Method around zero.

Fourier Series: Euler's formulae, Dirichlet's conditions, Fourier series for functions having period , Fourier series for even and odd functions, Half range Fourier sine and cosine series.

Fourier Transforms: Fourier integrals, Fourier sine and cosine integrals, Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms, Finite Fourier transforms.

Z-Transforms: Definition, Some standard Z-transforms, Damping rule, Shifting rule, Multiplication by n , Initial and final value theorems. Inverse Z-transforms using partial fractions, Convolution theorem, Solution of difference equations by Z - transforms.

Applications of Transforms to Integral equations: Integral equations, Abel's Integral equations, Integral equation of convolution type, Integro differential equations, Applications

of Transforms to Integral equations.

4. Books and Materials

Text Books:

1. Grewal,B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.
2. Jain, R.K. and Iyengar, S.R.K. Advanced Engineering Mathematics, Narosa Publishing House, 2015.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
2. Ramana, B.V. Higher Engineering Mathematics, 23rd Reprint,Tata Mc-GrawHill Education Private Limited, New Delhi, 2015.

Course Structure

A8083 - Numerical Techniques

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course offers more advanced topics of mathematics required to analyze the problems in engineering. Topics to be covered in this course include: Solution of algebraic and transcendental equations, system of linear equations, Interpolation, Numerical differentiation and integration, curve fitting, Numerical solutions of ordinary and partial differential equations. The mathematical skills derived from this course provides necessary base to analytical and theoretical concepts occurring in the program.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8083.1	Apply numerical methods to obtain approximate solutions of algebraic and transcendental equations
A8083.2	Make use of interpolation techniques to find approximate values and derivatives of the function at intermediate points
A8083.3	Compute an approximate value of a definite integral using numerical integration
A8083.4.	Construct curve of best fit for the experimental data using method of least squares
A8083.5.	Select an appropriate numerical method to solve ordinary and partial differential equations.

3. Course Syllabus

Solution of Algebraic, Transcendental Equations and System of Linear Equations: Bisection method, Regula-falsi method, Iteration method, Newton - Raphson method. Iterative methods of solution of system of equations: Jacobi's iteration method, Gauss-Seidel iteration method.

Interpolation: Finite differences: Forward, Backward and Central differences, Other difference operators and relations between them, Differences of a polynomial, Missing terms, Newton's interpolation formulae, Interpolation with unequal intervals: Lagrange's interpolation formula.

Numerical Differentiation, Integration and Curve fitting: Numerical differentiation: Derivatives using Newton's interpolation formulae. Numerical integration: Newton-Cote quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth

rule. Curve Fitting: Method of least squares, Fitting a straight line, Second degree parabola and Non-linear curves of the form $y = ae^{bx}, y = ab^x, y = ax^b$ by the method of least squares

Numerical Solution of Ordinary Differential Equations of First Order: Taylor's series method, Picard's method, Euler's and modified Euler's Method, Runge-Kutta method of fourth order, Predictor and Corrector methods: Milne's method, Adams-Bashforth-Moulton method.

Numerical Solution of Partial Differential Equations: Finite difference approximations to partial derivatives, Elliptic equations: Solution of Laplace equation by Liebmann's iteration process, Parabolic equations: Solution of one dimensional Heat equation by Schmidt explicit method and Crank-Nicolson implicit method.

4. Books and Materials

Text Books:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Pvt. Ltd, New Delhi, 2012.
2. M.K. Jain, S.R.K Iyengar and R.K.Jain, Numerical Methods for Scientific and Engineering Computation, 5rd Edition, New Age International Publishers, New Delhi, 2007.

Reference Books:

1. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Ramana, B.V. Higher Engineering Mathematics, 23nd Reprint, Tata McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.
3. T.K.V. Iyengar, B. Krishna Gandhi & Others, Numerical Methods, 2nd Revised Edition, S Chand & Company Ltd, New Delhi, 2013.

Course Structure

A8084 - Entrepreneurship Development

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course aims to provide students with an understanding of the nature of enterprise and entrepreneurship and introduces the role of the entrepreneur, will inculcate the knowledge of government supporting programs like financial assistance by public sector banks. Apart from this, students learn about the women entrepreneurs and success stories of women entrepreneurs, gain the knowledge of project management and profitability appraisal, focus on importance of training the new entrepreneurs as well as existing entrepreneurs.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8084.1 Identify the role, characteristics, qualities and functions of entrepreneur.
A8084.2 Interpret various Institutional supports for setting up a business enterprise.
A8084.3 Illustrate role, importance and functions of women entrepreneur.
A8084.4 Infer the concept of Project Management and steps in Project development.
A8084.5 Indicate training programs and different training institutions to impart training.

3. Course Syllabus

Entrepreneurship: Importance and role of entrepreneurship, Qualities of an entrepreneur, Functions of entrepreneur, Theories of entrepreneurship, Stimulants of entrepreneurship and Barriers to entrepreneurship, Ethics and Social Responsibility, Role of entrepreneur in economic development.

Institutional Support: Role of Government: Role of IDBI, SIDBI, SIDO, NIESBUD, DIC, Entrepreneurship Development Institute, T-Hub (Telangana Hub).

Women Entrepreneurship: Role & Importance, Functions of women entrepreneur, Profile of Indian Women Entrepreneur, Problems of Women Entrepreneurs, Women Entrepreneurship Development in India and in Foreign Countries.

Project Management: Concept of project and classification of project, Project life cycle identification, Project formulation, Project report, Project evaluation- profitability appraisal, social cost benefit analysis, feasibility analysis, financial analysis and project financ-

ing, Project implementation, Project completion.

Entrepreneur Training: Designing appropriate training programmes to inculcate Entrepreneurial Spirit, significance of entrepreneurial training, Feedback and Performance of Trainees, NSIC, Pradhan Mantri Kaushal Vikas Yojana (PMKVY), Telangana Academy for Skill and Knowledge (TASK).

4. Books and Materials

Text Books:

1. Robert Hisrich, Michael P. Peter, Dean A. Shepherd (2010), Entrepreneurship, Tata Mc Graw Hill, New Delhi

Reference Books:

1. Bholanath Datta (2009), Entrepreneurship, Excel publications, India.
2. David H Holt (2010), Entrepreneurship, Prentice hall of India, New Delhi, India

Course Structure

A8085 - Logistics and Supply Chain Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The LSCM deals with effective management, organizing and monitoring of storage and distribution of goods. It imparts knowledge on the various functions of logistics management. It educate on designing of the supply chain network. it gives clarify the significance of establishing global supply chain. Also it will highlight the role of information technology in supply chain. The aim is to manage the entire order cycle in the most efficient way so that it enhances business development and ensures sustainability and customer satisfaction.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8085.1. Understand the cyclical perspective of logistics and supply chain process.
A8085.2. Learn about the distribution, transportation, warehousing related issues and challenges in supply chain.
A8085.3. Appreciate the significance of network design in the supply chain.
A8085.4. Gain knowledge of various models/tools of measuring the Supply Chain Performance.
A8085.5. Appreciate the role of coordination and technology in supply chain management.

3. Course Syllabus

Understanding Supply Chain: Objectives of a Supply Chain, Importance, Stages of Supply Chain, Value Chain Process, Cycle View of Supply Chain Process, Key Issues in SCM, Logistics & SCM, Supply Chain Drivers and Obstacles, Supply Chain Strategies, Strategic Fit, Best Practices in SCM, Obstacles of Streamlined SCM, Green Supply Chain Management, Supply Chain Sustainability – case study.

Logistics: Evolution, Objectives, Components and Functions of Logistics Management, Difference between Logistics and Supply Chain, Distribution related Issues and Challenges. Gaining Competitive Advantage through Logistics Management. TRANSPORTATION: Functions, Costs, and Mode of Transportation Network and Decision, Models, Containerization, Cross Docking, Reverse Logistics. Outsourcing: Nature and Concept, Strategic Decision to Outsourcing, Third-party Logistics (3PL), Fourth-party Logistics (4PL) - case study.

Designing the Supply Chain Network: Designing the Distribution Network ,Role of Distribution, Factors Influencing Distribution, Design Options, e-Business and its Impact, Distribution Networks in Practice, Network Design in the Supply Chain, Role of Network, Factors Affecting the Network Design Decisions ,Modeling for Supply Chain - case study.

Supply Chain Performance: Bullwhip Effect and Reduction, Performance Measurement: Dimension, Tools of Performance Measurement, SCOR Model. Demand Chain Management, Global Supply Chain, Challenges in Establishing Global Supply Chain, Factors that influence Designing Global Supply Chain Network-case study.

Coordination in a Supply Chain: Importance of Coordination, Lack of Supply Chain Coordination and the Bull whip Effect, Obstacles to Coordination, Managerial Levels, Building Partnerships and Trust, Continuous Replenishment and Vendor Managed Inventories, Collaborative Planning, Forecasting and Replenishment. Role of Information Technology in Supply Chain, Supply Chain 4.0.-Case study.

4. Books and Materials

Text Books:

1. David B. Grant, Chee Yew Wong, Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management, Kindle Edition
2. Fundamentals ofLogistics Management (The Irwin/Mcgraw-Hill Series in Marketing), Douglas Lambert, James R Stock, LisaM. Ellram, McGrawhill/Irwin, First Edition, 1998.
3. Vinod V. Sople (2009) Logistic Management (2nd Edn.), Pearson Limited.

Reference Books:

1. IMT Ghaziabad, Advanced Supply Chain Management Sage Publications, 2021.
2. Rajat K. Basiya, Integrated Supply Chain Management, Sage Publications, 2020.
3. K Sridhara Bhat, Logistics & Supply Chain Management, HPH,1e,2017.
4. Chopra, Sunil, Meindl, Peter and Kalra, D.V., Supply Chain Management: Strategy, Planning and Operation, Pearson Education,6e,2016.
5. Altekar, Rahul V, Supply Chain Management: Concepts and Cases, PHILearning,1e,2005.
6. Ballou, R.H. Business Logistics Management.Pearson Education,5e, 2014.
7. Coyle, Bardi, Langley, The Management of Business Logistics–A Supply Chain Perspective, Thomson Press,7e,2003.

Course Structure

A8086 - Management Science

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

In this course, students will learn the fundamental concepts and contributions of Management. It also explains Inventory control techniques, Human Resource Practices, Quality control techniques and Project Management which plays a vital role in the organization.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8086.1 Explain and infer the concepts and aspects of management.
A8086.2 Analyze the contributions of management, organizational structures, plant layouts, work study tools for enhancement of productivity in an organization
A8086.3 Apply the project management techniques to decide the optimum time and cost for completion of a project.
A8086.4 Apply statistical quality control & Inventory control techniques to manage and control products and materials.
A8086.5 Use Human resource management techniques for better people management.

3. Course Syllabus

Introduction: Management - Definition, Nature, Importance of management, Functions of Management- Taylor's scientific management theory, Fayol's principles of management, Contribution of Elton mayo, Maslow, Herzberg, Douglas MC Gregor. Basic concepts of Organisation Authority, Responsibility, Delegation of Authority, Span of control, Departmentation and Decentralization - Organisation structures (Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization).

Operations Management: Plant location, Factors influencing location, Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement.

Quality Control and Materials Management: : Statistical quality control - Meaning-Variables and attributes - X chart, R Chart, C Chart, P Chart, (simple Problems) Acceptance sampling, Sampling plans, Deming's contribution to quality. Materials management - objectives, Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels.

Human Resource Management (HRM): Concepts of HRM, Basic functions of HR manager: Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers, Separation, performance appraisal, Job evaluation and Merit rating.

Project Management: Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems)..

4. Books and Materials

Text Books:

1. Koontz & weihrich - Essentials of management, TMH, 8th edition, 2010
2. O.P. Khana, Industrial engineering and Management, Dhanpat rai publication

Reference Books:

1. Dr.A.R.Aryasri, Management Science, TMH, 4th edition, 2009.
2. Stoner,Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. L.S.Srinath, PERT & CPM, 3rd edition East-West press pvt. ltd.-New Delhi.

Course Structure

A8087 - Human Resource Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course is intended to disseminate the concepts of Human resource management, functions of Human resource management from human resource planning to employee relations aspects that helps in effective functioning of an organization.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8087.1. Identify the functions of Human Resource Management.
A8087.2. Illustrate the process of Recruitment and selection.
A8087.3. Analyse the needs and methods of training.
A8087.4. Appraise the functional relationship with performance compensation and employee welfare.
A8087.5. Examine the significance of employee relations.

3. Course Syllabus

Introduction to HRM: Objectives and Functions of HRM, Challenges of HRM, Line Managers. HR Roles and responsibilities, Workforce and demographic trends, New Approaches to organizing HR, HR Scorecard - Human Resource Information System (HRIS).

Recruitment and Selection: Job Design, Job Analysis, Process and methods of data collection, Job descriptions and Job specification, Job enlargement, Job enrichment and Job rotation. Human Resource Planning, Recruitment, Sources of Recruitment, Recruitment on Diverse Work Force, e-Recruitment and Selection Process, Employee Testing and Selection, Basic Types of Interviews, Errors in Interviews.

Training and Development: Definition, Training vs. Development, Importance of Training and Development, Process of Training, Methods of Training and Management development programmes. PERFORMANCE APPRAISAL: Concepts of Performance Management, Process of Performance Management, Performance Appraisal, Techniques of Performance Appraisal, Errors in Performance Appraisal, Career Management.

Compensation: Objectives of compensation, Factors influencing on compensation, concept of job evaluation and techniques of job evaluation. EMPLOYEE WELFARE: Concept of employee welfare, performance-based pay benefits, provisions of employee's compensation

act and implications of employee welfare on productivity.

Employee Relations: Employee Associations, Grievances: Grievances Handling Procedure, Employee Separation, Downsizing, Work-Life Integration - Hybrid work culture, contemporary developments in HR practices. Stress Management, talent mobility, Prevention of sexual harassment (POSH) at workplace.

4. Books and Materials

Text Books:

1. Gary Dessler, BijuVarkkey, Human Resource Management, 4th edition, Pearson Publication, 2017.
2. P. Subba Rao, Essentials of Human Resource Management, Himalaya Publishing, 6e, 2021.

Reference Books:

1. Biswajeet Pattanayak, Human Resource Management, 6e, PHI Learning Pvt. Ltd, 2020.
2. Mamoria and Mamoria, Personnel Management, Himalaya Publications, 2006

Course Structure

A8088 – Organizational Behavior

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	45	0	3	40	60	100

1. Course Description

Course Overview

The course focuses upon translation of organizational behaviour theory to practices that result in organizational effectiveness, efficiency, and human resource development. The primary goal of this course is to prepare students for advanced leadership roles in modern organization.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8088.1. Analyse the Concepts and models of Orgnizational Behaviour and Contemporary challenges.

A8088.2. Analyse the relevance of planning and decision making process for the development of the organisation.

A8088.3. Identify various organisation design and control technique for better performance of the company.

A8088.4. Examine the relevance of Individual and group behaviour in an organization and the role of Culture and dynamics

A8088.5. Apply the theories of leadership and motivation to lead people to attain the organisation goals.

3. Course Syllabus

Behavioural Concepts: Nature and Concepts of Orgnizational Behaviour, Models of Organizational Behaviour, Relationship with Other Fields, Contemporary challenges. Learning: Nature and Significance of Learning, Process of Learning, Theories of Learning.

Planning and Decision Making: Planning and Goal Setting, Organizational Planning, Vision, Mission and Goals, Types of Plans, Steps in Planning Process, Approaches to Planning, Planning in Dynamic Environment. Decision-making Process, Types of Decisions, Decision Making Styles, Vroom's Participative Decision-making Model.

Organizing and Controlling: Organizational Structure, Principles of Organizing, Authority, Power and Influence, Designing Organizational Structure. Mechanistic and Organic Structures, Contemporary Organizational Design and its Challenges. Controlling: The Control Process, Controlling for Organizational Performance, Types of Control, Financial Controls, Balanced Scorecard, Bench Marking, Contemporary issues in Controlling.

Organizational Behavior: Individual and Group Behavior: Importance of Organizational Behavior, Culture and Dynamics of Diversity, Personality Theories, Perception, Formation of Group Behavior, Classification of Groups, Group Properties, Group Cohesiveness, Building Teams.

Leadership and Motivation: Leadership Traits, Leadership Styles, Leadership Theories, Power and Politics. Motivation: Approaches to Motivation, Maslow's Needs Hierarchy Theory, Two-factor Theory of Motivation, McGregor's Theory, ERG theory, McClelland's Needs Theory, Valance Theory.

4. Books and Materials

Text Books:

1. K. Aswathappa, Organisational Behaviour, Himalaya Publications, 8e, 2021
2. Harold Koontz, Heinz Weihrich, Mark V Cannice, Essentials of Management, Tata McGraw Hill Education, 11e, 2020.
3. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behaviour, Pearson Education, 18e, 2018.

Reference Books:

1. Luthans Fred, "Organizational Behaviour", Tata McGraw Hill.
2. Rao V S P., "Organizational Behaviour", Excel Books.
3. Chandrani Singh, Aditi Ktri, Principles and Practices of Management and Organizational Behaviour, Sage Publications, 1e,2016.
4. Afsaneh Nahavandi, Robert B. Denhardt, Janet V. Denhardt, Maris P. Aristigueta, Organizational Behaviour, Sage Publications, 1e, 2015.

Course Structure

A8089 – Intellectual Property Rights

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	45	0	3	40	60	100

1. Course Description

Course Overview

This Course deals with the types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights. It analyzes and evaluates the procedures involved in submission of application for the grant of intellectual property rights. It also deals with the significance of intellectual property of a business enterprise.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

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

A8089.1. Identify the different types of intellectual property, agencies and treaties that protect intellectual property rights
A8089.2. Classify the protectable matter of intellectual property rights.
A8089.3. Analyze and evaluate the procedures involved in submission of application for the grant of intellectual property rights
A8089.4. Interprete Trade secret law, liability for misappropriations of trade secrets, protection for submission, and trade secret litigation

3. Course Syllabus

Introduction to Intellectual Property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Trade Marks: Purpose and function of trademarks, Trade mark rights, protectable matter, selecting and evaluating trademarks, trade mark registration process.

Law of Copy Rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of Patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Trade Secrets: Trade secret law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, and trade secret litigation.Unfair Competition: Misappropriation right of publicity, false advertising.

4. Books and Materials

Text Books:

1. R.S.Nagarajan, a Textbook on Professional Ethics and Human Values, New Age Publishers – 2006. Deborah.
2. Neeraj Pandey, Khushdeep Dharni- 2014, Intellectual property rights, PHI, India.

Reference Books:

1. Prabudda ganguli (2003), Intellectual property right, Tata McGraw Hill Publishing company ltd., India.
2. P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew, Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA, 1985
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010

Course Structure

A8090 - Professional Practice, Law and Ethics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course makes students to understand the types of roles they are expected to play in the society as practitioners of an engineering profession. It develops ideas of the legal and practical aspects of their profession. Students will learn importance of professional practice, Law and Ethics in their personal lives and professional careers and the rights and responsibilities as an employee and team leader.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8090.1. Apply the concepts of professional practice, Law and Ethics in their personal lives and professional careers.
A8090.2. Analyze Arbitration, Conciliation and Alternative Dispute Resolution system
A8090.3. Interpret Law relating to Intellectual property
A8090.4. Apply the rights and responsibilities as an employee, team member in any organization as a global citizen.

3. Course Syllabus

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders.

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996;UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention;

International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970.

4. Books and Materials

Text Books:

1. R. Subramanian - Professional Ethics, Oxford University Press, 2015.
2. Ravinder Kaur - Legal Aspects of Business, 4th edition, Cengage Learning, 2016.

Reference Books:

1. RERA Act, 2017.
2. Wadhera - Intellectual Property Rights, Universal Law Publishing Co.,2004.
3. 3. T. Ramappa - Intellectual Property Rights Law in India, Asia Law House,2010.
4. 4. O.P. Malhotra - Law of Industrial Disputes, N.M. Tripathi Publishers.

Course Structure

A8091 - National Cadet Corps(NCC)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

National Cadet Corps, is a unique course designed for youth in India that aims to develop character, discipline, leadership, secular outlook, spirit of adventure, and ideals of selfless service among young citizens. Through this course students learn about rhe national integration and its importance. They understand the concept of self-awareness and emotional intelligence, critical & creative thinking, decision making & problem solving and importance of Social service.This course also explores the security challenges & role of cadets in border areas. Students acquire the knowledge about various wars and their heroes.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

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

A8091.1. Acquire knowledge of the history of NCC, its organization, and incentives of NCC for their career prospects and duties & conduct of ncc cadets.

A8091.2. Imbibe good leadership traits and apply them in practical life and appreciate the visible outcome of leadership and motivation.

A8091.3. Develop a sense of responsibility, smartness in appearance and improve self-confidence, inculcate importance of empathizing with others, improve their deep-thinking ability and apply ideas and be able to face problems in a constructive manner with solutions.

A8091.4. Learn about the various natural resources, their utilization and practice method of conservation of these resources in daily life.

A8091.5. Appreciate value of physical and mental health in daily life and spread awareness about treatment and care of wounds in their society.

A8091.6. Understand individaul responsibilities & role in meetings the security challenges on Border/Coastal areas.

3. Course Syllabus

Introduction to NCC and National Integration: Introduction of NCC, History, Aims, Objective of NCC & NCC as Organization, Duties of NCC Cadet. National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building.

Personality Development & Leadership: Intra & Interpersonal skills - Self-Awareness- & Analysis, Empathy, Critical & creative thinking, Decision making and problem solv-

ing. levels of Creativity, Characteristics of creative person. Leadership capsule., Important Leadership traits, Indicators of leadership and evaluation., Motivation- Meaning & concept, Types of motivation. Factors affecting motivation., Ethics and Honor codes.

Social Service & Community Development: Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare. Protection of Children & Women Safety., Road/Rail Safety., New Government Initiatives., Cyber and mobile Security Awareness.

Environmental Awareness and Conservation: Natural Resources, Conservation and Management, Water Conservation, Waste Management, Energy Conservation. Adventure Environmental Awareness and Conservation. Health & Hygiene: Hygiene & Sanitation (Hygiene- Personal & Social Hygiene)., First Aid in common medical emergencies. Treatment & Care of Wounds.

Border & Coastal Areas: History, Geography & Topography of Border/ Coastal Areas. Security Setup and Border/Coastal management in the area., Security Challenges & Role of cadets in Border management.

4. Books and Materials

Text Books:

1. R. K. Gupta, "Hand book of NCC Cadets for A, B & C Certificate Examinations", R-1992, 23rd Edition. Ramesh Publishing House, New Delhi (2023).