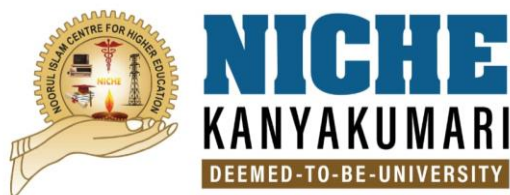


NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

(Deemed to be University Under Section 3 of the UGC Act, 1956)

Kumaracoil, Thuckalay

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



B.E. COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABI

REGULATION 2021

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION, Kumaracoil

Regulation : 2021

Curriculum and Syllabi

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E. COMPUTER SCIENCE AND ENGINEERING

Vision of the University

To be recognized by the Government and society at large as an institution able to deliver excellence with relevance in the field of higher education and research focusing on the needs of the nation in tune with the technological revolution to cope with the knowledge explosion and global competence.

Mission of the University

To develop the institution as a Centre of Excellence, keeping pace with the advances in the field, so as to provide quality higher education to the students and instill in them high standards of discipline and ethics so that they become enlightened individuals in the service of humanity and to carry out focused research in the frontier areas of science and technology.

Faculty of Information and Computer Engineering

Department of Computer Science and Engineering

Vision of the Department

To offer the most conducive environment for quality academic and research oriented undergraduate and postgraduate education in computer science and engineering and prepare the students for a globalized technological society and orient them towards serving the society.

Mission of the Department

- Impart high quality professional training at the undergraduate and postgraduate level with an emphasis on basic principles of computer science and engineering.
- Empower the students with the required skills to solve the complex technological problems of modern society and also provide them with a framework for promoting collaborative and multidisciplinary activities.
- Conduct research to advance the state of the art in computer science and integrate research results and innovations into other scientific disciplines.

Description of the programme

The field of computer science and engineering prioritizes computer design and software development, with a heavier emphasis on computing theory, emanating to a greater focus on cybersecurity, algorithms, and computer networks.

Bachelor of Engineering in Computer Science and Engineering is a 4-year program that includes all the theoretical and technical aspects of computer science, engineering, and architecture. This involves programming and also more advanced topics like Cloud computing, data science, artificial intelligence, cybersecurity, and IoT. The curriculum and syllabus are on par with the best universities in the country.

Students completing this computer science and engineering degree work as programmers or computer systems analysts, helping to build and maintain complex technological systems. The job profiles are Software Developer, System Designer, Software Engineer Research Analyst, and the highly paid job profiles like Data Scientist and Machine Learning experts are on the rise.

Programme Educational Objectives - PEO	
PEO-01	Graduates can leverage their technical skills in computer science to address real-world challenges while also demonstrates leadership in both technical and interpersonal aspects.
PEO-02	Graduates can engage in innovative research and create solutions for socially significant issues.
PEO-03	Graduates can thrive in a business setting by demonstrating teamwork, strong work ethics, adaptability, and a commitment to lifelong learning.
PEO-04	Graduates can continue their education and research, embark on successful careers in fields related to Computer Science and Engineering, or become entrepreneurs.
PEO-05	Graduates will have the capability and attitude to adapt to new technological developments.

Graduate Attributes-GA	
GA-1	Innovative Engineering Solutions Develop creative and innovative solutions to complex engineering problems, incorporating the latest technologies and approaches to address current and future challenges.
GA-2	Global Perspective in Engineering Understand and apply engineering solutions in a global context, recognizing the diversity of global issues, standards, and the impact of engineering decisions on different cultures and communities.
GA-3	Sustainable Development and Green Engineering Design and implement engineering solutions that prioritize sustainability, resource efficiency, and environmental protection, contributing to a sustainable future.
GA-4	Social Responsibility and Community Engagement Demonstrate a commitment to social responsibility by engaging with and contributing to local communities, understanding societal needs, and addressing social challenges through engineering practices.
GA-5	Adaptability and Lifelong Learning Exhibit a proactive approach to continuous learning and adaptability, keeping pace with technological advancements and industry changes, and engaging in professional development activities.
GA-6	Entrepreneurship and Innovation Foster an entrepreneurial mindset, identifying opportunities for innovation and creating value through new technologies, products, and processes that meet market needs.
GA-7	Interdisciplinary Collaboration Work effectively in interdisciplinary teams, integrating knowledge from various fields to develop comprehensive solutions to complex engineering problems.
GA-8	Ethical Leadership and Integrity Lead with integrity and ethical principles, ensuring transparency, fairness, and respect in all professional and personal interactions.
GA-9	Digital and Data Literacy Utilize advanced digital tools and data analytics techniques to solve engineering problems, optimize processes, and make informed decisions based on data-driven insights.
GA-10	Safety, Health, and Risk Management Prioritize safety, health, and risk management in engineering practices, ensuring the well-being of individuals and communities while minimizing potential risks and hazards.
GA-11	Effective Communication and Negotiation Skills Communicate ideas, solutions, and technical information effectively to a variety of audiences, and engage in negotiation to resolve conflicts and reach consensus.
GA-12	Impact Assessment and Policy Making Assess the impact of engineering projects on society and the environment, and contribute to policy-making processes that promote sustainable and responsible engineering practices.

Programme Outcome – POs

Programme Outcome – PO	
PO-A	Apply the knowledge of mathematical foundations and computer science & engineering concepts to solve complex problems related to design, development, testing and maintenance of computing systems.
PO-B	Ability to identify, formulate and analyze complex problems in computer based applications.
PO-C	Manage effectively on teams to accomplish a common goal.
PO-D	Apply professional ethics and agree to the norms or responsibilities in engineering practice of computer science.
PO-E	Communicate effectively and prepare technical documents and oral presentations.
PO-F	Ability to use current techniques, skills and state-of-art tools for computing system.
PO-G	Ability to apply design and development principles in the construction of software systems and in the allied engineering application domains.

Mapping of Graduate Attributes and Programme Educational Objectives(PEO)

GA PEOs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10	GA-11	GA-12
PEO-01	A	A	A	A	A	H	A	H	A	A	A	A
PEO-02	H	H	A	A	A	A	A	A	A	A	A	A
PEO-03	A	A	A	A	H	A	A	A	A	A	A	A
PEO-04	H	A	A	A	A	H	A	A	A	A	A	A
PEO-05	A	A	A	A	H	A	A	A	A	A	A	A

H- Highly Associated

A- Associated

Not – Not Associated

Mapping of Graduate Attributes and Programme Outcomes (PO)

GAs POs	G A- 01	GA- 02	GA- 03	GA- 04	GA- 05	GA- 06	GA- 07	GA- 08	GA- 09	GA- 10	GA- 11	GA- 12
PO-A	H	A	A	A	A	A	A	H	A	A	A	A
PO-B	A	A	A	A	A	A	A	A	H	A	A	A
PO-C	A	A	A	A	A	H	A	H	A	A	A	A
PO-D	A	A	A	H	A	A	A	H	A	A	A	A
PO-E	A	A	A	A	A	A	A	A	A	A	H	A
PO-F	A	A	A	A	A	H	A	A	H	A	A	A
PO-G	A	H	H	A	A	A	A	A	A	A	A	A

H- Highly Associated

A- Associated

Not – Not Associated

Mapping of Programme Educational Objective (PEOs) and Programme Outcomes (POs)

PEO PO	PEO-01	PEO-02	PEO-03	PEO-04	PEO-05
PO-A	H	H	A	A	A
PO-B	H	H	A	A	A
PO-C	A	A	H	A	A
PO-D	A	A	A	A	A
PO-E	A	A	A	A	A

PO-F	A	A	A	A	H
PO-G	H	A	A	A	H

H- Highly Associated

A- Associated

Not – Not Associated

Duration of the programme: 4 Years / 8 Semesters

Total credit : 162

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Total Credits	21	19	20	24	20	24	18	16	162

CURRICULUM & SYLLABI**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EG3101	Technical English	3	1	0	4
2.	MA3101	Engineering Mathematics – I	3	1	0	4
3.	BS3101	Engineering Physics	3	0	0	3
4.	BS3102	Engineering Chemistry	3	0	0	3
5.	CS3101	Fundamentals of Computing and Python Programming	3	0	0	3
PRACTICALS						
6.	CS3171	Fundamentals of Computing and Python Programming Laboratory	0	0	4	2
7.	BS3171	Physics and Chemistry Laboratory	0	0	4	2
TOTAL			15	2	8	21

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EG3102	Communicative English	3	0	0	3
2.	MA3102	Engineering Mathematics – II	3	1	0	4
3.	BE3101	Basic Electrical and Electronics Engineering	3	0	0	3
4.	BE3102	Basic Civil and Mechanical Engineering	3	0	0	3
5.	ME3101	Engineering Graphics	3	0	2	4
PRACTICALS						
6.	BE3171	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1
7.	BE3172	Basic Civil and Mechanical Engineering Laboratory	0	0	2	1
TOTAL			15	1	6	19

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA3201	Engineering Mathematics - III	3	1	0	4
2.	CS3201	Computer Organization and Architecture	3	0	0	3
3.	CS3202	Data structures and Algorithms	3	0	0	3
4.	CS3203	Digital Design Principles	3	0	0	3
5.	CS3204	Object Oriented Programming	3	0	0	3
PRACTICALS						
6.	CS3271	Data structures and Algorithms Laboratory	0	0	4	2
7.	CS3272	Digital Design Principles Laboratory	0	0	2	1
8.	CS3273	Object Oriented Programming Laboratory	0	0	2	1
TOTAL			15	1	8	20

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA3205	Probability and Queuing Theory	2	1	0	3
2.	BS3201	Environmental Studies	2	0	0	2
3.	CS3205	Computer Networks	3	0	0	3
4.	CS3206	Database Management Systems	3	0	0	3
5.	CS3207	Operating Systems	3	0	0	3
6.	CS3208	Software Engineering	3	0	0	3
PRACTICALS						
7.	CS3274	Computer Networks Laboratory	0	0	4	2
8.	CS3275	Database Management Systems Laboratory	0	0	4	2
9.	CS3276	Operating Systems Laboratory	0	0	2	1
10.	CS32P1	Summer Internship-I	0	0	0	2
TOTAL			16	1	10	24

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	CS3209	Block Chain Technologies	3	0	0	3
2	CS3210	Artificial Intelligence and Applications	3	0	0	3
3	CS3211	Web Technologies	3	0	0	3
4	CS3212	Microprocessors and Microcontrollers	3	0	0	3
5	MS3201	Professional and Business Ethics	2	0	0	2
6	*****	Elective-I	3	0	0	3
PRACTICAL						
8	CS3277	Web Technologies Laboratory	0	0	4	2
9	CS3278	Microprocessors and Microcontrollers Laboratory	0	0	2	1
TOTAL			17	0	6	20

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	CS3213	Compiler Design	3	0	0	3
2	CS3214	Cloud Computing Techniques	3	0	0	3
3	*****	Elective-II	3	0	0	3
4	*****	Elective-III	3	0	0	3
5	AI32D1	Fundamentals of Artificial Intelligence	3	0	0	3
6	CS3215	Cyber Security	3	0	0	3
PRACTICAL						
7	CS3279	Compiler Design Laboratory	0	0	4	2
8	CS3280	Cloud Computing Laboratory	0	0	4	2
9	CS32P2	Summer Internship – II	0	0	0	2
TOTAL			18	0	8	24

SEMESTER VII

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	CS32**	Elective-IV	3	0	0	3
2	CS32**	Elective-V	3	0	0	3
3	AI3205	Internet of Things	3	0	0	3
4	*****	Open Elective-II	3	0	0	3
5	MS3202	Principles of Management	2	0	0	2
PRACTICAL						
6	CS32P3	Mini Project	0	0	6	3
7	CS3281	Data Science & Analytics Laboratory	0	0	2	1
TOTAL			14	0	8	18

SEMESTER VIII

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	CS32**	Elective-VI	3	0	0	3
2	CS3216	Big Data Analytics	3	0	0	3
PRACTICAL						
3	CS32P5	Project Work	0	0	12	10
TOTAL			6	0	12	16

PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
<u>Elective-I</u>						
1.	CS32A1	Datawarehousing and Data Mining	3	0	0	3
2.	CS32A2	Recommender System	3	0	0	3
3.	CS32A3	Foundations of Data Science	3	0	0	3
4.	CS32A4	Image and Video Analytics	3	0	0	3
<u>Elective-II</u>						
1.	CS32A5	Neural Networks and Deep Learning	3	0	0	3
2.	CS32A6	App Development	3	0	0	3
3.	CS32A7	Software Testing and Automation	3	0	0	3
4.	CS32A8	DevOps	3	0	0	3
<u>Elective-III</u>						
1.	CS32A9	Virtual Reality	3	0	0	3
2.	CS32B1	Multimedia and Animation	3	0	0	3
3.	CS32B2	Video Creation and Editing	3	0	0	3
4.	CS32B3	Computer Vision	3	0	0	3
5.	CS32B4	Optimization Techniques	3	0	0	3
<u>Elective-IV</u>						
1.	CS32B5	Cloud Services Management	3	0	0	3
2.	CS32B6	Storage Technologies	3	0	0	3
3.	CS32B7	Software Defined Networks	3	0	0	3
4.	CS32B8	Stream Processing	3	0	0	3

<u>Elective- V</u>						
1.	CS32B9	Ethical Hacking	3	0	0	3
2.	CS32C1	Cryptography and Network Security	3	0	0	3
3.	CS32C2	Modern Cryptography	3	0	0	3
4.	CS32C3	Engineering Secure Software Systems	3	0	0	3
<u>Elective-VI</u>						
1.	CS32C4	Digital Marketing	3	0	0	3
2.	CS32C5	Cost management of Engineering Projects	3	0	0	3
3.	CS32C6	Game Development	3	0	0	3
4.	CS32C7	Exploratory Data Analysis	3	0	0	3

OPEN ELECTIVE COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
<u>Open Elective-I</u>						
1.	CS32D1	Information Technology in Agricultural System	3	0	0	3
2.	CS32D2	Renewable Energy System	3	0	0	3

Sl. No.	Course Code	Course Title	L	T	P	C
<u>Open Elective-II</u>						
1.	CS32D3	Introduction to Cloud Computing	3	0	0	3
2.	CS32D4	IoT Concepts and Applications	3	0	0	3

SEMESTER - I

EG3101	Technical English	L	T	P	C
		3	1	0	4

OBJECTIVES

- To develop the linguistic, communicative and critical thinking competencies of First Year Engineering students
- To enhance the understanding of the complex grammatical structures of the English language to students
- To improve the language proficiency of students in English with emphasis on Vocabulary, Grammar, Listening, Speaking, Reading, and Writing skills
- To introduce the students to the basic phonetics of English and make them grasp the various sounds of the English language to improve their pronunciation

Course Outcomes		Cognitive Skill
CO-01	The students will be able to improve their vocabulary relating to Engineering and Technology, and use articles and prepositions effectively in sentences.	R
CO-02	The students will be able to learn grammatical items like tense, voice, compound nouns etc. and thereby enhance their linguistic competence.	U
CO-03	The students will be able to learn definitions of technical terms, relative pronouns etc. which will develop their language competence.	A
CO-04	The students will be able to acquire the essentials of writing skills relating to CV, Resume, Formal and Business Letters.	U
CO-05	The students will be able to learn English phonemes such as Vowels, Diphthongs and Consonants which will be instrumental in improving their pronunciation and speaking skills.	R

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes with Programme Outcomes

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	M	M	S	S	M	S	S
CO-02	M	S	M	M	S	S	M	S
CO-03	S	M	M	S	M	M	S	M

CO-04	M	S	M	M	S	M	S	M
CO-05	S	M	S	S	M	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I:

9

Word formation with prefixes and suffixes – Articles – Conjunctions – Prepositions – Expansion of Abbreviations and Acronyms – Writing Checklists – Writing Instructions.

Unit II:

9

Tense – Voice – Punctuation – Expansion of Compound Nouns – Writing Recommendations – Paragraph Writing – Types, Structures and Features of a Paragraph – Creating Coherence—Organizing Principles of Paragraphs in Documents.

Unit III:

9

Discourse Markers – Gerunds and Present Participles – Relative Pronouns – Conditional Clauses – Definitions of Technical Terms – Transcoding : Bar Chart - Flow Chart - Pie Chart - Tree Diagram - Tabular Column.

Unit IV:

9

Concord – Clauses – Phrases – Numerical Adjectives – CV/Resume Writing – Virtual Communication: E-Mail Writing – Essay Writing : Basic Format of an Essay - Types – Examples.

Unit V:

9

Basic Phonetics : Phonemes – Vowels, Diphthongs and Consonants – Classification : Pure Vowels/Monophthongs – Vowel Glides /Diphthongs.

L: 45 + T:15 = TOTAL: 60 Periods

EXTENSIVE READING:

Shiv Khara, *You Can Win*, Milan, Delhi, 2004

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

TEXT BOOK

1. Khaleel Rahuman A., Deepa P., Sheila J., Mathi Vathani J. , *Technical English*, R. K. Publishers, 2023.

REFERENCES:

1. Nagarajan S., Senthil C. S., *Engineering English I & II*, Sri Krishna Publications, 2004.
2. Jewelcy Jawahar , Rathna P., *English Work Book for First Year B.E./ B.Tech.*, VRB Publishers, Chennai, 2008.

MA3101	ENGINEERING MATHEMATICS – I	L	T	P	C
		3	1	0	4

OBJECTIVE:

The course objective is to develop the required skill of the students in the area of Engineering Mathematics with special emphasis on the characteristic equation of matrices, differential calculus, Beta and Gamma functions and to develop basic knowledge to the students in double and triple integration.

Subject Code: MA3101		Subject Name: ENGINEERING MATHEMATICS I	
Course Outcome – Cos Students able to			Cognitive Skill
CO-01	Understand the characteristic equation and find eigen values and Eigen vector of a real matrix. Compute the eigen value and eigen vector using properties. Verify Cayley Hamilton theorem and its applications. Apply orthogonal transformation of a symmetric matrix.		U, A, E, R
CO-02	Define the definitions and formula for curvature, radius of curvature, circle of curvature. Apply the formula and solve problems using the required formulas also find the evolute of the curves.		U, A, E, An
CO-03	Know about the differentiation formulae and apply on partial derivatives, total derivatives and Jacobians. Verify the functions be maximum or minimum and Lagrange's multiplier method. Express the Taylor's expansion for two variables.		U, A, E, R
CO-04	Know the Fundamental concepts of improper integrals, Beta and gamma function and their properties. Develop the skill in the relation between Beta and Gamma Functions. Calculate definite integral values using Beta and Gamma Functions.		U, A, An, E
CO-05	Evaluate the double and multiple integrals and can apply these concepts to find areas of regions on a plane or in space. Graph Cartesian and polar equations. Convert Cartesian coordinates into polar coordinates.		U, A, An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-k	PO-L
CO-01	S	M	S	M	S	S	S	S	M	S	S	M
CO-02	S	M	M	M	S	S	M	S	M	M	M	M
CO-03	S	M	M	M	S	S	M	M	M	S	S	M
CO-04	S	M	S	M	S	M	S	S	M	S	S	M
CO-05	S	M	S	M	S	M	S	S	M	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I MATRICES

9

Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of eigen values and eigen vectors(without proof)- Cayley Hamilton theorem (statement only),

verification and its applications - Orthogonal and Symmetric matrices and their properties(excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form.

UNIT-II DIFFERENTIAL CALCULUS

9

Curvature - Cartesian co-ordinates and parametric form -Centre and radius of curvature, Circle of curvature - Evolutes.

UNIT-III FUNCTIONS OF SEVERAL VARIABLES

9

Partial derivatives - Total derivatives - Jacobians - Properties - Maxima and minima for functions of two variables - Lagrange Multiplier method- Taylor's expansion.

UNIT-IV IMPROPER INTEGRALS

9

Evaluation of improper integrals- Beta and Gamma functions - Properties - Relation between Beta and Gamma functions - Evaluation of integrals using Beta and Gamma functions.

UNIT-V MULTIPLE INTEGRALS

9

Evaluation of double and triple integrals - Area enclosed by plane curves as double integral in cartesian and polar co-ordinates - Change of order of integration- Transformation of Cartesian coordinates into polar coordinates.

L: 45 + T: 15, TOTAL: 60 Periods

OUTCOMES:

At the end of the course, the students will be familiar with various concepts of calculus which are essential for engineering. They also become acquainted with the basic ideas of multiple integrals and their usage.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics"- 40th Edition , Khanna Publishers, Delhi 2007

REFERENCES:

1. M.Immaculate Mary , K.Uma Samundesvari," Engineering Mathematics - I" Revised Edition, R.K Publishers, 2016.
2. Veerarajan T, " Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw- Hill Publishing Company Ltd.,New Delhi , 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Seventh Edition, Wiley India, 2007.
4. P.Kandasamy , K.Thilagavathy , K.Gunavathy" Engineering Mathematics" Vol,1 ,S.Chand & Company Ltd.2002.
5. B.V. Ramana,"Higher Engineering Mathematics" Second Edition Tata McGraw- Hill, Publishing Company Ltd.,New Delhi, 2006 .

BS3101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES

The course objective is to provide basic ideas about the principles of physics related to properties of matter, wave optics, heat, quantum concepts and materials. engineering problems.

SubjectCode: BS3101		SubjectName: Engineering Physics	
Course Outcome–Cos		Cognitive Skill	
CO-01	Students will be able to understand and apply knowledge about the properties of materials.	R,U,A	
CO-02	Students will be able to understand the types of oscillations and the wave nature of light in interference, diffraction and polarization phenomenon.	R,U,A,E	
CO-03	Students will be able to state and explain the various laws of thermodynamics, understand entropy and its application.	R,U,A,An, ,E	
CO-04	Students gain basic knowledge about quantum mechanics and will be able to solve time dependent and time independent Schrodinger equation for simple potentials.	R,U,A,E,S	
CO-05	Students will be able to know the different types of crystal structures and also gain basic knowledge about nanomaterials and biomaterials.	R,U,A,E	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate,S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D
CO-01	S	S	S	S
CO-02	S	S	S	M
CO-03	S	S	S	S
CO-04	S	M	S	S
CO-05	S	S	M	M

S-Strong,M-Medium,L-Low,N-NotRelevant

Unit I: Properties of Matter**9**

Elasticity – Poisson's ratio – Stress-strain diagram – factors affecting elasticity – bending of beams – cantilever depression – Young's Modulus- theory and experiment of Young's modulus determination (uniform and non-uniform bending) –Shear Modulus – twisting couple – hollow cylinder – torsion pendulum – determination of rigidity modulus - Bulk Modulus - applications of elastic behaviours of materials.

Unit II: Oscillations and Wave optics**9**

Oscillations - Rectilinear motion - Oscillations or Vibrations - Simple Harmonic Motion - Damped Harmonic motion - Real oscillatory system - Forced or Driven oscillation. Wave optics -Interference of light – Photons - Young's Double Slit Experiment - Huygens's Principle - Diffraction - Diffraction Grating - Polarization.

Unit III: Thermal Physics**9**

Transfer of heat energy (conduction, convection and radiation) - thermal expansion of solids and liquids – expansion joints – bimetallic strips-Thermal conductivity- Forbe's and Lee's disc methods (theory and experiment)- thermal insulation in buildings -Laws of thermodynamics- heat exchanger -solar power- applications of solar power (solar water heater, photo voltaic cell).

Unit IV: Quantum Physics**9**

Matter waves- de-Broglie wavelength - Schrodinger's wave equation-time independent and time dependent equations- physical significance of wave function- uncertainty principle and its application- energy and momentum operators-particle in a one dimensional box-scanning electron microscope- transmission electron microscope-scanning tunnelling microscope.

Unit V:Material Physics**9**

Single crystalline, polycrystalline and amorphous materials- Single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, miller indices – inter planar distances. Introduction and applications of Metallic glasses, Shape Memory Alloys (SMA), Nanomaterials, Biomaterials.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Engineering Physics I by Bindhu B, Sagi Rani C, Meenadevi V N, Ganapathi Raman R, RK Publishers 2015.
2. Engineering Physics II by Bindhu B, GeethaKumari R, SugirthaSunil N Y, RK Publishers 2016.
3. Engineering Physics by R K Gaur And S L Gupta, [Dhanpat Rai Publications](#) 2011.
4. A Text Book Oscillations, Waves & Acoustics by Dr. M. Gosh, Dr. D. Battacharya, S. Chand, Revised Edition.

REFERENCES:

1. Engineering Physics by Rajendran V, McGraw-Hill, New Delhi, 2013
2. Engineering Physics by Arumugam M, Anuradha Publications, 2014.
3. Principles of Physics by Halliday D, Resnick R and Walker J, Wiley 2015.
4. Physics for scientist and Engineers by Serway R A and Jewett J W, Cengage Learning 2010.
5. Engineering Physics by Bhattacharya D K and Poonam T, Oxford University Press 2015.

BS2102	Engineering Chemistry	L	T	P	C
		3	0	0	3

OBJECTIVES

To make the students conversant with the principles of the following topics: (i) Use of free energy in chemical equilibria (ii) Water chemistry (iii) Periodic properties (iv) Spectroscopic techniques and applications and (v) Organic reactions and synthesis of a drug molecule.

Course Outcome		Cognitive Skill
CO-01	Students will be able to understand the estimation of free energy and entropy	U,A,An
CO-02	Students will be able to apply the different techniques in water technology	R,A
CO-03	Students will be able to analyze the properties of periodic tables.	E,A,E
CO-04	Students will be able to describe the different types of spectroscopic techniques.	An,U
CO-05	Students will be able to predict the structure of organic molecules.	S,U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	S	L	S
CO-02	M	S	L	S	S
CO-03	S	S	S	M	S
CO-04	S	M	S	S	S
CO-05	S	L	M	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA 9

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Unit II: WATER CHEMISTRY 9

Water as a universal solvent – hard and soft water – reasons for hardness – disadvantages of hard water in washing and industrial purposes - estimation of hardness by EDTA method, problems; boiler feed water – characteristics- softening methods - external conditioning – demineralization (ion exchange) process, desalination by reverse osmosis method- internal conditioning (phosphate, calgon and carbonate conditioning methods); stages in domestic water treatment – disinfection by chlorination, ozone and UV treatments.

Unit III: PERIODIC PROPERTIES 9

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Unit IV: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS 9

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

.Unit V: ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE 9

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

TOTAL: 45 PERIODS

TEXT BOOKS

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

CS3101	FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

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

Subject Code: CS3101 Subject Name: Fundamentals of Computing and Python Programming		
Course Outcome – Cos		Cognitive Skill
CO-01	Understand the basics of algorithmic problem solving.	R,U
CO-02	Ability to analyze various techniques for read and write simple Python programs.	A
CO-03	Introduce Python programs with conditionals and loops.	An
CO-04	Evaluate and Define Python functions, call them and use Python data structures – lists, tuples, dictionaries.	E
CO-05	Apply input/output with files in Python.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	N	M	S	L	M	M	L
CO-02	N	S	L	L	M	S	S
CO-03	M	L	S	M	L	L	M
CO-04	M	L	L	S	M	M	L
CO-05	M	L	L	L	M	S	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I ALGORITHMIC PROBLEM SOLVING 9

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

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROLFLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS,TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES,MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist``, 2nd edition, Updated for Python 3, Shroff /O'Reilly Publishers, 2016
(<http://greenteapress.com/wp/thinkpython/>)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.,2011.

REFERENCES:

1. John V Guttag, —Introduction to Computation and Programming Using Python``, Revisedand Revised and expanded Edition, MIT Press ,2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
3. Timothy A. Budd, —Exploring Python®, Mc-Graw Hill Education (India) Private Ltd.,,2015.
4. KennethA.Lambert,—Fundamentals of Python:First Programs®,CENGAGE Learning,

2012. Charles Dierbach, —Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition,2013.
5. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC,2013.

CS3171	FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

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

Subject Code: CS3171 Subject Name: FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING LABORATORY		
Course Outcome – Cos		Cognitive Skill
CO-01	Understand the basic syntax of python	U
CO-02	Understand the problem solving techniques	An,U
CO-03	Analyze data structure concept in python	U
CO-04	Understand all tools of python	An
CO-05	Understand pygame with simulation	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	L	S	M	L	L	S
CO-02	L	L	M	M	S	M	L
CO-03	M	M	L	L	M	S	L
CO-04	S	L	L	M	M	M	L
CO-05	L	L	L	S	L	L	S

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.

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

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

TOTAL: 45 PERIODS

BS3171	PHYSICS & CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

Objective : The course objective is to teach students, the importance of physics through involvement in experiments and to have knowledge of the world due to constant interplay between observations and hypothesis.

Subject Code: BS3171 Subject Name: PHYSICS & CHEMISTRY LABORATORY		
Course Outcome – Cos		Cognitive Skill
CO-01	The students will be able to analyse the physical principle involved in various instruments and also relate the principle to new applications.	R,U,A,An, E
CO-02	Various experiments in the areas of optics, properties of matter and ultrasonics will nurture the students in all branches of engineering.	R ,U,A, An,E
CO-03	The students will be able to think innovatively and also improve the creative skills that are essential for engineering.	R,U,A,An, E
CO-04	The students will be able to gain knowledge of new concept in the solution of practical oriented problems and theoretical problems.	R,U,A,An, E
CO-05	The students will be able to understand measurement technology ,usage of new instruments and real time applications in engineering studies.	R,U,A,An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D
CO-01	S	S	S	S
CO-02	S	S	S	M
CO-03	S	S	S	S
CO-04	S	M	S	S
CO-05	S	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

List of experiments: Physics Laboratory (Any Five Experiments)

1. Determination of velocity of ultrasonic waves and compressibility of the given liquid by Ultrasonic interferometer.(Real and Virtual Lab)
2. Determination of rigidity modulus by Torsional pendulum. (Real and Virtual Lab)
3. Determination of coefficient of viscosity by Poiseulli's method.
4. Determination of Youngs modulus by non-uniform bending method.(Real and Virtual Lab)
5. Determination of LASER parameters using LASER diode. (Real and Virtual Lab)
6. Determination of band gap of the semi-conductor.(Real and Virtual Lab)
7. Determination of wavelength of mercury spectrum by diffraction grating.(Real and virtual lab)
8. Determination of wavelength of light by Newton's rings.(Real and Virtual Lab)
9. Determination of angle of the prism using spectrometer. (Real and Virtual Lab)

CHEMISTRY LAB (Any FIVE experiments)

OBJECTIVE

The objective of the course is to develop the interest among the students regarding chemistry and their applications in engineering.

Course Outcomes

The student at the end of the course will

Subject Code: BS3171		Subject Name: CHEMISTRY LABORATORY	
Course Outcome – Cos			Cognitive Skill
CO-01	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.		R,U,A,An, E
CO-02	Be able estimate the ions/metal ions present in domestic/industry waste water.		R ,U,A, An,
CO-03	Utilize the fundamental laboratory techniques for analyses such as titrations, separation/purification and spectroscopy.		R,U,An,E
CO-04	Able to analyze and gain experimental skill.		R,U,A,An

CO-05	The students will be able to understand measurement technology ,usage of new instruments and real time applications in engineering studies.	R,U,A,An, E
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R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D
CO-01	S	S	S	S
CO-02	S	S	S	M
CO-03	S	S	S	S
CO-04	S	M	S	S
CO-05	S	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

List of Experiments

1. Determination of conductance of solutions
2. Potentiometry - determination of redox potentials and emfs
3. Synthesis of drug
4. Determination of Chloride content
5. Determination of hardness of water sample
6. Determination of Alkalinity of water sample
7. Virtual lab experiments

TOTAL: 45 PERIODS

SEMESTER – II

EG3102	Communicative English	L	T	P	C
		3	0	0	3

OBJECTIVES

1. To widen and expand students' knowledge of English vocabulary
2. To develop skills of students in the areas of vocabulary, grammar, listening, speaking, reading, and writing
3. To develop the knowledge, skills and strategies the student must possess to become proficient readers
4. To make the students learn the importance and purpose of communication skills and overcome the communication barriers by gaining confidence
5. To make the students understand how to apply technical information and knowledge in practical documents

Course Outcomes		Cognitive Skill
CO-01	The students will be able to understand the basic vocabulary items, sentence structures and error detection and correction which, in turn, will expand their knowledge of the English language.	R
CO-02	The students will be able to grasp the LSRW Skills and gain exposure to absorb Comprehension and Note-making.	U
CO-03	The students will get real time practice in speaking through Oral Presentation, Small Talk, Role Play, Debate , Group Discussion etc.	A
CO-04	The students will be able to improve their writing skills through exposure to Report Writing and Letter Writing.	U
CO-05	The students will be able to learn the Theory of Communication , the Importance of Communication, and be introduced to the various facets of Verbal and Non verbal Communication.	R

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes with Programme Outcomes

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	M	M	S	S	M	S	S
CO-02	M	S	M	M	S	S	M	S
CO-03	S	M	M	S	M	M	S	M
CO-04	M	S	M	M	S	M	S	M
CO-05	S	M	S	S	M	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT – I – VOCABULARY AND GRAMMAR

9

Parts of Speech – Sentence Structures – Technical Vocabulary – Synonyms – Antonyms – Homonyms – Homophones – Misspelled Words – One word Substitutes – Odd Words Out – Changing words from one form to another – Common Errors in English – Correction of Errors in Sentences.

UNIT – II – LISTENING AND READING

9

Reading Comprehension – Skimming – Scanning – Predicting the Content – Comprehension Questions – Inductive Reading – Close Reading – Note Making – Précis Writing.

UNIT – III – SPEAKING**9**

Introducing Oneself – Exchanging Personal Information – Small Talk : Family, Friends, Studies, Profession – Speaking : Greeting , Taking Leave – Product Description – Completing information – Gap Exercises – Presentation / Public Speaking Skills – Group Discussion – Debate – Role Play.

UNIT – IV- TECHNICAL WRITING**9**

Report Writing – Characteristics of a Report – Categories of Reports – Letter Writing (Formal Letters) : Job Application Letter with Resume – Letter Seeking Permission – Letter of Invitation – Letter Declining an Invitation – Letter of Complaint – Letter of Requisition.

UNIT – V- TECHNICAL COMMUNICATION**9**

The Theory of Communication – Definition and Scope – Nature, Importance and Types – Different Communication Models – Barriers to Communication – Effective Communication (Verbal / Non-verbal).

L: 45 + T:15 = TOTAL: 60 PERIODS**EXTENSIVE READING :**

CanField Jack, *Chicken Soup for the Soul*, Westland, Chennai, 1999.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

REFERENCE BOOKS:

1. Communication Skills. Oxford University Press.
2. Wood, F. T. (2007). Remedial English Grammar. Macmillan.
3. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
4. The Four Skills for Communication – Josh Sreedharan – Foundation Books
- Communicative English – E. Sureshkumar and P. Sreehari – Orient Blackswan

MA3102	ENGINEERING MATHEMATICS – II	L	T	P	C
		3	1	0	4

Objective: To develop basic knowledge to the students in differential equations and vector calculus. This subject is further broadened to the functions of complex variables and complex integration. A thorough knowledge about Laplace transforms is also covered to aid the students solve the differential equations.

Subject Code: MA3102 Subject Name: ENGINEERING MATHEMATICS –II		
Course Outcome - COs		Cognitive Skill
CO-01	The Students will be able to solve ordinary differential equations	An , E , S
CO-02	The Students will be able to solve complex variables	E

CO-03	The Students will be able to synthesize complex integration	S
CO-04	The Students will be able to solve Vector Calculus	E , S
CO-05	The Students will be able to Synthesize Laplace transforms	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	P O - B	PO -C	PO -D	PO -E	PO -F	PO -G	PO -H	P O - I	PO- J	PO -k	PO -L	PO- M
CO-01	M	S	M	S	S	N	M	M	S	S	M	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M	S
CO-03	S	L	S	S	L	L	S	S	M	M	S	S	M
CO-04	S	L	M	S	N	L	S	S	M	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M	M	S	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I ORDINARY DIFFERENTIAL EQUATIONS

9

Linear differential equations of second order with constant and variable coefficients- Cauchy's and Legendre's linear equations – Method of variation of parameters.

UNIT II: COMPLEX VARIABLES

9

Functions of a complex variable – Analytic function – Necessary conditions- Cauchy-Riemann equations in cartesian and polar co-ordinates - Sufficient conditions(excluding proof) –Properties of analytic function – Harmonic and its conjugate – Construction of analytic function by Milne Thomson method – Conformal mappings $w = z + c$, cz , $1/z$ and Bilinear transformation.

UNIT III: COMPLEX INTEGRATION

9

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Laurent's expansion – Singular points – Residues – Cauchy's Residue theorem – Evaluation of real definite integral using contour integration(excluding poles on the real

axis) - $\int_0^{2\pi} f(\cos\theta, \sin\theta) d\theta$ and $\int_{-\infty}^{\infty} \frac{f(x)}{g(x)} dx$

UNIT IV: VECTOR CALCULUS

9

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT V: LAPLACE TRANSFORMS

Laplace transform –Existence condition– Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Transform of Periodic functions. Inverse Laplace transform – Convolution, Initial and Final value theorems (statement only) – Solutions of linear ordinary differential equation of second order with constant coefficients using Laplace transform techniques.

L: 45 + T: 15 = TOTAL 60 PERIODS

Outcomes :

At the end of the course, the students will be familiar to solve differential equations using Laplace Transform method, which is easier to handle the problems that is being investigated. They'll also become acquainted with the basic ideas of complex variable theory so as to enable the students to apply them with confidence in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics"- 40th Edition , Khanna Publishers, Delhi 2007.

REFERENCES:

1. M.Immaculate Mary , K.Uma Samundesvari, Engineering Mathematics – II" First Edition, Anuradha Publications, ,2013.
2. Erwin Kreyszig, " Advanced engineering Mathematics", Seventh Edition, Wiley India, 2007.
3. Veerarajan T, " Engineering Mathematics (for first year)", Tata McGraw- Hill Publishing Company Ltd.,New Delhi,2007.
4. P.Kandasamy , K.Thilagavathy , K.Gunavathy" Engineering Mathematics" S.Chand & Company Ltd.2002.
5. B.V. Ramana,"Higher Engineering Mathematics" Second Edition Tata McGraw-Hill, Publishing Company Ltd.,New Delhi, 2006.

BE3101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic solutions of AC and DC circuits.
- To study the basic principle and operation of AC and DC machines.
- To study the fundamental operations of measuring instruments.
- To study the layout of power system
- To understand the fundamental operation and characteristics of Electron devices
- To understand the implementation of Boolean expression using logic gates.
- To become familiar with basic concepts of Communication system.

Course Outcome		Cognitive Skill
CO-01	Understand the basic principle and operation of electrical circuits.	R, U
CO-02	Study the fundamental operations of measuring instruments and the layout of power system.	R, U

CO-03	Understand the fundamental operation and characteristics of semiconductor devices.	R, U
CO-04	Understand the implementation of Boolean expression using logic gates.	R, U
CO-05	Become familiar with basic concepts of Communication system.	R, U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	M	S	M	S	S	N	M	M	S	S	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M
CO-03	S	L	S	S	L	L	S	S	M	M	S	S
CO-04	S	L	M	S	N	L	S	S	M	S	S	M
CO-05	S	L	M	M	M	L	N	S	M	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT: 1 – ELECTRICAL CIRCUITS

9

Ohms Law, Kirchhoff's laws, Mesh and Nodal Analysis for DC Circuits.

Introduction to AC Circuits, Faraday's Law of Electromagnetic Induction, Lenz law, Inductor, Capacitor, Power factor, Waveforms and RMS value, Average Value, Peak factor and Form factor, Single phase circuits- Series and Parallel, Three phase balanced circuits. Fundamentals of wiring and earthing.

UNIT: II – ELECTRICAL MEASUREMENTS, MACHINES AND POWER SYSTEM

9

Operating principles of Moving coil and Moving iron instruments (Ammeter and voltmeter), Dynamometer type watt meter and Energy meter, Errors in Measurements.

Construction, Principle of operation and Applications of DC Generators, DC Motors, Single phase transformers. Structure of power system.

UNIT- III SEMICONDUCTOR DEVICES

9

Introduction to Semiconductors, PN Junction diode-Zener diode and its characteristics-Half wave and Full wave Rectifiers-Bipolar Junction transistor-CB,CE,CC Configuration and characteristics-JFET and MOSFET construction, operation ,characteristics (CS only) and uses.

UNIT-IV DIGITAL ELECTRONICS**9**

Number systems-binary arithmetic--Boolean algebra-laws and theorems-Simplification of Boolean expression- logic gates –Implementation of Boolean expression using logic gates-standard forms of Boolean expression.

UNIT – V COMMUNICATION SYSTEMS**9**

Block diagram of basic communication system-need for modulation-Types of modulation-Principles of Amplitude and Frequency modulation – pulse analog and digital modulation-AM and FM transmitter and receiver(Block diagram description only) –Satellite Communication Radar Systems-Data transmission and MODEM.

TOTAL: 45 PERIODS**REFERENCES:**

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
3. V.K.Mehta “Principles of Power System”, S.Chand & Company Ltd, New Delhi, 2001.
4. R.S.Sedha,”Applied electronics”S.Chand&Co.,2006.

BE3102	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enable the students to understand the Basic Civil and Mechanical Engineering concepts.

OUTCOMES:

- To gain the basic knowledge in Surveying and civil Engineering materials.
- Students can attain the basic knowledge in basic civil structures and building components.
- Can obtain the basic fundamental knowledge of Engineering Mechanics.
- Students can expand their knowledge in knowing about IC engines and power plants.
- Can increase the skill in basic manufacturing processes.

Course Outcome		Cognitive Skill
CO-01	To understand surveying: Objects – types – classification – principles – measurements of distances – angles –levelling–determination	R,U,A
CO-02	To understand the types, bearing capacity– Requirement of good foundation	R,U,A
CO-03	To understand the statics –Basics concepts, Fundamental principles & concepts: Newton’s laws, gravitation, force, couple	R,U,A
CO-04	To understand the introduction to IC Engines, working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles	R,U,A,

CO-05	To understand the foundry- Investment casting, Die casting, Centrifugal casting, Continuous casting, Stir casting, Squeeze casting.	R,U,A
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R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	S	M	L	L	M	L	L	L	M	M	L	M
CO-02	M	N	M	L	N	M	L	L	S	M	L	M
CO-03	S	M	L	L	N	M	L	L	L	N	M	L
CO-04	S	L	M	M	N	M	M	L	N	M	M	M
CO-05	S	L	N	M	N	M	L	L	M	M	M	M

A– CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects – types – classification – principles – measurements of distances – angles –leveling–determination of areas–illustrative examples.

Civil Engineering Materials: Bricks–stones–sand–cement–concrete–steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 9

Foundations: Types, Bearing capacity– Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring –plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams–Basics of Interior Design and Landscaping.

B– MECHANICAL ENGINEERING

UNIT III FUNDAMENTALS OF ENGINEERING MECHANICS 9

Statics –Basics Concepts, Fundamental principles & concepts: Newton’s laws, gravitation, force, couple, moment (about point and about axis), Varignon’s theorem, resultant of concurrent and non-concurrent coplanar forces, Problem formulation concept; 2-D statics, two and three force members, alternate equilibrium equations, 3-D statics.

UNIT IV BASIC CONCEPTS OF THERMAL ENGINEERING 9

Introduction to IC Engines, Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles, Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants, Principle of vapour compression and absorption system.

UNIT V BASIC MANUFACTURING PROCESSES

9

Foundry-Investment casting, Die casting, Centrifugal casting, Continuous casting, Stir casting, Squeeze casting. Metal fusion welding processes- Oxyfuel gas welding – Arc welding processes. Additive Manufacturing-3D Printing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Shanmugam G and Palanichamy MS, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi,(1996).
2. Ramamrutham S., “Basic Civil Engineering”, DhanpatRai Publishing Co.(P)Ltd. (1999).

REFERENCES:

1. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies,(2005).
2. Venugopal K. and Prahu Raja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam,(2000).
3. Shantha KumarSRJ., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai,(2000).

ME3101	ENGINEERING GRAPHICS	L	T	P	C
		3	0	2	4

OBJECTIVE

- To develop skills for communication of concepts, ideas and design of Engineering Products.
- To expose them to existing national standards related to technical drawings

Course Outcome: After learning the course the students should be able to

- To know and understand the conventions and the methods of engineering drawing.
- Interpret Engineering drawings using fundamental technical mathematics.
- Construct basic and intermediate geometry.
- To improve their visualization skills so that they can apply these skills in developing new products.
- To improve their technical communication skill in the form of communicative drawings and comprehend the theory of projection.

Course Outcome		Cognitive Skill
CO-01	Students should able to understand the Use of drafting instruments, BIS conventions and specifications – Size, layout and folding of drawing sheets	U
CO-02	Students should able to learn Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations.	A
CO-03	Students should able to understand the Prisms, pyramids, cylinder and cone, axis perpendicular to any one reference plane. Axis parallel to both	U

	the planes	
CO-04	Students should able to learn about Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, Isometric view,	E
CO-05	Students should able to understand the Fundamental of projection along with classification, Projections from the pictorial view of the object	R

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L	PO-M
CO-01	S	M	M	M	M	M	M	M	M	M	L	M	S
CO-02	S	S	M	M	M	M	M	M	M	M	L	M	S
CO-03	S	S	M	M	M	M	M	M	M	M	L	M	S
CO-04	S	S	M	M	M	M	M	M	M	M	L	M	S
CO-05	S	M	M	M	M	M	M	M	M	M	L	M	S

Unit I – Introduction

9

Concepts and conventions: Use of drafting instruments, BIS conventions and specifications – Size, layout and folding of drawing sheets, Lettering and dimensioning. General principles of orthographic projection, First angle projection – Layout of views. (Not for examination)

General Plane Curves

Conic sections including the Rectangular Hyperbola (General method); Cycloid, Epicycloid, Hypocycloid and Involute.

Unit II - Projection of Points, Lines & Planes

9

Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations. Projection of planes- parallel to any one reference plane, perpendicular to any one reference plane, Inclined to any one reference plane and inclined to both reference planes

Unit III - Projection of Solids & Section of Solids

9

Prisms, pyramids, cylinder and cone, axis perpendicular to any one reference plane. Axis parallel to both the planes. Axis inclined to any one reference plane.

Sectioning of solids- Prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane. Obtaining the true shape of section.

Unit IV –Development of Surfaces & Isometric Projection

9

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, Isometric view, Isometric scale to draw Isometric projection, Non-Isometric lines, construction of Isometric view from given orthographic views and to construct Isometric view of a Pyramid, Cone, Sphere.

Unit V – Orthographic Projection & Perspective Projection

9

Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view. Perspective Projection of Solids (Any one Method).

L: 45+P: 15 = TOTAL: 60 PERIODS

TEXT BOOKS:

1. Venugopal K and Prabhu Raja V, “*Engineering Graphics*”, New Age International Publishers, 2007.
2. Luzadder W J, “*Fundamentals of Engineering Drawing*”, Prentice Hall Book Co., New York, 1998
3. Bhat, N.D.& M. Panchal , *Engineering Drawing*, Charotar Publishing House, 2008

REFERENCES:

1. Kumar M S, “*Engineering Graphics*”, Ninth Edition, DD Publications, Chennai, 2007.
2. Bureau of Indian Standards, “*Engineering Drawing Practices for Schools and Colleges SP 46-2003*”, BIS, New Delhi, 2003.
3. Shah, M.B. & B.C. Rana , *Engineering Drawing and Computer Graphics*, Pearson Education, 2008

BE3171	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To make basic electrical connection
- To measure the electrical parameters
- To obtain the characteristics of Electron devices
- To verify the operation of logic gates.

Course Outcome		Cognitive Skill
CO-01	Study of Symbols, Cables and Earthing.	U,An
CO-02	Residential house wiring using switches, fuse, indicator, lamp and energy meter.	U,An
CO-03	Fluorescent lamp wiring.	U,An
CO-04	Stair case wiring / Lamp control from three different places/ Doctor Room control/ Go down control	A,An

CO-05	Measurement of electrical quantities	A,An
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R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	S	S	S	L	L	M	M	M	L	S	S	L
CO-02	S	S	M	L	L	M	S	S	L	S	S	L
CO-03	S	S	S	L	L	M	M	M	L	S	S	L
CO-04	S	S	S	L	L	M	M	S	L	S	S	L
CO-05	S	S	M	L	L	M	S	S	L	S	S	L

I. Electrical Engineering Lab

- 1 Study of Symbols, Cables and Earthing.
- 2 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 3 Fluorescent lamp wiring.
- 4 Stair case wiring / Lamp control from three different places/ Doctor Room control/ Go down control
- 5 Measurement of electrical quantities – voltage, current, power & computation of power factor in RLC circuit.
- 6 Measurement of energy using single phase energy meter.
- 7 Fan Wiring.

II. Electronics Engineering Lab

1. Study of Electronic components and equipments – Resistor, colour coding, Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Characteristics of PN Junction diode
3. Characteristics of Zener diode
4. Voltage Regulator using Zener diode
5. Measurement of ripple factor of HWR and FWR.
6. Study of logic gates AND, OR, EX-OR and NOT, NAND and NOR.
7. Generation of Clock Signal.
8. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.

TOTAL: 30 PERIODS

BE3172	BASIC CIVIL AND MECHANICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To gain fundamental knowledge about Buildings and pipe line works.
- To handle Carpentry and power tools.
- To gain knowledge in basic welding and machining process.
- To attain the practice of using gyroscope in dynamics.
- To understand the fundamental knowledge in foundry, fitting, sheet metal and IC engines.

Course Outcome		Cognitive Skill
CO-01	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in house hold fittings.	U,An
CO-02	Study of pipe connections requirements for pumps and turbines.	U,An
CO-03	Preparation of plumbing line sketches for water supply and sewage works.	U,An
CO-04	Preparation of arc welding of butt joints, lap joints and tee joints.	A,An
CO-05	Demonstration on foundry, fitting and sheet metal exercises.	A,An

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	S	L	M	M	L	M	M	M	L	S	S	L
CO-02	S	S	S	L	L	M	S	S	L	S	S	L
CO-03	S	S	S	M	L	S	M	M	L	S	S	L
CO-04	S	S	M	L	S	M	M	S	L	S	S	L
CO-05	S	S	S	L	S	M	S	S	L	S	S	L

I CIVIL ENGINEERING PRACTICE

Buildings:

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

Plumbing Works:

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in house hold fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE**Welding:**

Preparation of arc welding of butt joints, lap joints and tee joints.

Basic Machining:

Simple Turning and Taperturning

Dynamics:

Experiment using Gyroscope/Four bar link mechanism.

Demonstration on:

- (a) Demonstration on foundry, fitting and sheet metal exercises.
- (b) Demonstration on the working principle of two stroke and four stroke I.C. engines.

TOTAL: 30 PERIODS

SEMESTER - III

MA3201	ENGINEERING MATHEMATICS III	L	T	P	C
		3	1	0	4

Objective:

To develop the skill of the students in the areas of boundary value problems and Transform techniques. This will be necessary for their effective studies in a large number of Engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. This course will also serve as a prerequisite for post graduate and specialized studies and research.

Course Outcomes		Cognitive Skills
At the end of the course students should be able to		
CO-01	Recognize a Partial Differential Equation and formulate a Partial Differential Equation from a given equation. Solve linear Partial	R,U,A,An, E, S

	Differential Equation of both first and second order using various methods.	
CO-02	Derive a Fourier series expansion for a given periodic function by evaluating Fourier coefficient and expand Fourier cosine and Sine series for given function. Also find the Fourier series expansion for a given set of numerical values by applying harmonic analysis.	R,U,A,An, E, S
CO-03	Classify the second order Partial Differential Equation and solve second order Partial Differential Equations such as wave equation, heat equation and Laplace equation with boundary and initial conditions applying Fourier series expansion.	R,U,A,An, E, S
CO-04	Know fundamental and mathematical properties of Fourier transform. Calculate the Fourier transform of a given function and inverse Fourier transform of function. Know the applications of Parseval's and convolution theorem.	R,U,A,An, E, S
CO-05	Understand the characteristics and properties of Z-transform. Compute Z-transform of simple functions and inverse z transform of given functions and apply Z-transform for solving difference equations.	R,U,A,An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

PO CO	PO- A	P O - B	PO -C	PO -D	PO -E	PO -F	PO -G	PO -H	P O - I	PO- J	PO -k	PO -L	PO- M
CO-01	M	S	M	S	S	N	M	M	S	S	M	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M	S
CO-03	S	L	S	S	L	L	S	S	M	M	S	S	M
CO-04	S	L	M	S	N	L	S	S	M	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M	M	S	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I : Partial Differential Equations

12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of Clairaut's equations – Lagrange's linear equation – Homogeneous linear partial differential equations of second order with constant coefficients.

UNIT II : Fourier Series

12

Dirichlet's conditions – Fourier series – Change of interval - Odd and Even functions – Half range sine and cosine series – Parseval's identity – Harmonic Analysis.

UNIT III : Boundary Value Problems**12**

Classification of second order linear partial differential equations – One dimensional wave and heat equations – Assumptions – Fourier series solution – Steady state solution of two dimensional heat equation (insulated edges excluded) – Fourier series solution in Cartesian co-ordinates.

UNIT IV : Fourier Transforms**12**

Statement and meaning of Fourier integral theorem – Fourier transform — Properties - Inverse Fourier transform – Fourier Sine and Cosine transforms – Inverse sine and cosine transforms – Properties -Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V: Z-Transforms**12**

Z- transform – Elementary properties – convolution theorem-Inverse Z-transform –Partial fraction Method, Inversion integral method and Convolution – Initial and Final value theorems –Formation of difference equations – Solution of difference equations using Z-transform

L: 45 + T: 15 = TOTAL: 60 PERIODS**TEXT BOOK**

1. Grewal B.S., "Higher Engineering Mathematics" – 40th Edition , Khanna Publishers, Delhi 2011.

REFERENCE BOOK

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, Inc., USA, 2011
2. Kandasamy P, Thilagavathy K, and Gunavathy K., "Engineering Mathematics Volume III", First Edition, S.Chand & Company Ltd., New Delhi.
3. Veerarajan T., "Engineering Mathematics(for Semester III), Third Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi 2007.
4. 4.Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Seventh Edition, Lakshmi Publications Pvt. Ltd., New Delhi, 2009

CS3201	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart basic concepts of computer architecture and organization.
- To explain key skills of constructing cost-effective computer systems.
- To familiarize the basic CPU organization.
- To help students in understanding various memory devices.
- To facilitate students in learning IO communication.

Course Outcomes		Cognitive Skill
CO-01	Identify various components of computer and their interconnection.	U
CO-02	Identify basic components and design of the CPU: the ALU and control unit.	U
CO-03	Compare and select various Memory devices as per requirement.	An
CO-04	Compare various types of IO mapping techniques	An
CO-05	Critique the performance issues of cache memory and virtual memory	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis
Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	L	S	L	L	L	M
CO-02	M	L	S	M	M	L	M
CO-03	S	M	S	L	S	M	S
CO-04	M	L	S	L	S	L	M
CO-05	S	L	S	M	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Structure of Computers

9

Computer types - Functional units - Basic operational concepts – Von Neumann Architecture - Bus Structures - Software - Performance - Multiprocessors and Multicomputer - Data representation - Fixed and Floating point - Error detection and correction codes. Computer Arithmetic: Addition and Subtraction - Multiplication and Division algorithms - Floating point Arithmetic Operations - Decimal arithmetic operations.

Unit II: Basic Computer Organization and Design

9

Instruction codes - Computer Registers - Computer Instructions and Instruction cycle - Timing and Control - Memory Reference Instructions - Input Output and interrupt. Central processing unit: Stack organization - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Complex Instruction Set Computer (CISC) - Reduced Instruction Set Computer (RISC) - CISC Vs RISC.

Unit III: Register Transfer and Micro-Operations

9

Register Transfer Language - Register Transfer - Bus and Memory Transfers - Arithmetic Micro-Operations - Logic Micro Operations - Shift Micro Operations - Arithmetic logic shift unit. Micro-Programmed Control: Control Memory - Address Sequencing – Micro Program example - Design of Control Unit.

Unit IV: Memory System**9**

Memory Hierarchy - Semiconductor Memories - RAM(Random Access Memory) - Read Only Memory (ROM) - Types of ROM - Cache Memory - Performance considerations - Virtual memory – Paging - Secondary Storage - RAID.

Unit V: Input/ Output**9**

I/O interface - Programmed IO - Memory Mapped IO - Interrupt Driven IO - DMA. Multiprocessors: Characteristics of multiprocessors - Interconnection structures - Inter Processor Arbitration - Inter processor Communication and Synchronization - Cache Coherence.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. M. Morris Mano, Computer System Architecture, 3rd edition, Pearson/PHI, India, 2017 (Electronic Edition).

REFERENCES

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky, Computer Organization, 5th edition, McGraw Hill, New Delhi, India, 2019.
2. William Stallings, Computer Organization and Architecture- designing for performance, 11th edition, Prentice Hall, New Jersey, 2019 (Electronic Edition).
3. Andrew S. Tanenbaum, Structured Computer Organization, 6th edition, Pearson Education Inc, 2016.
4. John P. Hayes, Computer Architecture and Organization, 3rd edition, Tata McGrawHill, 2002.

CS3202	DATA STRUCTURES & ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the basics of C programming language.
- To understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

Course Outcome		Cognitive Skill
CO-01	Understand C Programming fundamentals	U
CO-02	Analyze the various algorithms in design and analysis techniques	R,U
CO-03	Apply linear data structures – lists, stacks, and queues	A
CO-04	Analyze and implement various searching and sorting algorithms.	An
CO-05	Evaluate trees and apply graphs to solve problems.	E,A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	L	N	N	L	M	S	M
CO-02	N	M	L	L	M	L	S
CO-03	S	S	L	L	M	M	S
CO-04	M	S	L	L	M	M	M
CO-05	S	S	L	M	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: C Programming Fundamentals

9

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays- Structures – Union – Pointers.

Unit II: Algorithm Analysis, List ADT

9

Algorithms: Notation - analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array-based implementation – linked list implementation – singly linked lists- applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

Unit III: Stacks and Queues

9

Stack ADT - Applications - Evaluating arithmetic expressions- Conversion of Infix to Postfix- Recursion. Queue ADT – Priority Queue - applications of queues. Implementation of Stack ADT and palindrome checking using C. Implementation of Queue operations using arrays.

Unit IV: Searching and Sorting Algorithms

9

Divide and conquer methodology - Searching: Linear Search - Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort. Analysis of searching and sorting techniques. Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

Unit V:Trees & Graphs

9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT – applications of trees. Heap – applications of heap-Representation of Graph – Traversal - Floyd’s algorithm – Greedy method - Dijkstra’s algorithm – applications of graphs.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2011.
2. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, Pearson Education, 2018 (Electronic Edition).

3. Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.
4. Narsimha Karumanchi, “Data Structures and Algorithms Made Easy”, Fifth edition 2017
5. Prateek Narang, “Data Structures and Algorithms Essential Using C++”, 2022.

REFERENCES

1. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education, 2021.
2. S.Sridhar, “Design and Analysis of Algorithms”, First Edition, Oxford University Press. 2014
3. Byron Gottfried, Jitender Chhabra, “Programming with C” (Schaum’s Outlines Series), Mcgraw Hill Higher Ed., III Edition, 2010
4. Yashvant Kanetkar, “Data Structures through C”, BPB publications, II Edition, 2003.

CS3203	DIGITAL DESIGN PRINCIPLES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn how to design digital circuits by simplifying the Boolean functions.
- To give an idea about designs using PLDs
- To write HDL codes for designing larger digital systems.

Course Outcome		Cognitive Skill
CO-01	Remember the concept of Number system, Boolean algebra and Logic gates.	R
CO-02	Understand the concept and implement the ideas in combinational circuits and PLD’s.	U
CO-03	Apply the concept and design with MSI devices.	A
CO-04	Writing HDL codes for designing larger digital systems. Analyze the concept and apply it in the synchronous sequential logic circuit.	An
CO-05	Understand the concept and apply the ideas in asynchronous sequential logic circuit.	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	M	L	N	S	L
CO-02	L	S	L	S	M	S	M
CO-03	S	M	L	L	N	S	N
CO-04	L	S	L	M	L	S	S
CO-05	M	L	S	L	S	S	M

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Boolean algebra And Logic Gates

9

Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map – Logic Gates.

Unit II: Combinational Logic

9

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Introduction to HDL.

Unit III: Design with MSI Devices

9

Decoders and Encoders – Multiplexers and Demultiplexers-Memory and Programmable Logic-HDL for combinational circuits.

Unit IV: Synchronous Sequential Logic

9

Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits.

Unit V: Asynchronous Sequential Logic

9

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, “Digital Design | With an Introduction to the Verilog HDL, VHDL, and SystemVerilog”, Sixth Edition, Pearson Education, 2018.

REFERENCES:

1. John F. Wakerly, “Digital Design Principles and Practices”, Fourth Edition, Pearson Education, 2016 (Electronic Edition).
2. Charles H. Roth Jr, “Fundamentals of Logic Design”, Seventh Edition – Jaico Publishing House, Mumbai, 2013.
3. Donald D. Givone, “Digital Principles and Design”, Tata McGraw Hill, 2017.

4. G. K. Kharate, “Digital Electronics”, Oxford University Press, 2010.

CS3204	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the object oriented programming concepts
- To explore the basics of Java language.

Course Outcome		Cognitive Skill
CO-01	Understand the basics of java programming.	R,U
CO-02	Ability to analyze various techniques for constructing inheritance and interfaces.	A
CO-03	Introduction to exception handling and I/O.	An
CO-04	Evaluate and Define Multi-threading and generic programming	E
CO-05	Apply graphics programming in Java.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	S	S	M	N	M	M	S
CO-02	M	N	S	S	S	M	N	L
CO-03	S	L	M	S	S	M	S	S
CO-04	N	M	L	S	L	S	S	S
CO-05	S	S	L	L	N	M	S	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Introduction to OOP and Java Fundamentals

9

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

Unit II: Inheritance and Interfaces

9

Inheritance — Super classes- sub classes –Protected members — constructors in sub classes- the Object class — abstract classes and methods- final methods and classes — Interfaces — defining an interface, implementing interface, differences between classes and interfaces and extending interfaces — Object cloning -inner classes, Array Lists — Strings

Unit III: Exception Handling and I/O

9

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

Unit IV: Multithreading and Generic Programming

9

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

Unit V: Event Driven Programming

9

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

TOTAL: 45 HOURS

TEXT BOOKS

1. Y.Daniel Liang, “Introduction to Java Programming”, 10th Edition, Pearson, December 2013.
2. Rajkumar Buyya, S Thamarai Selvi, Xingchen Chu, “Object oriented programming with Java “, Tata McGraw Hill Education Private Limited, 2009.
3. M.T. Somashekara , D.S. Guru , K.S. Manjunatha,”Object Oriented Programming with Java”, PHI Publications, 2017

REFERENCES

1. Sachin Malhotra, Saurabh Choudhary, “Programming in Java” , Oxford University Press, 2010
2. E Balagurusamy, “Programming with JAVA”, McGrawHill, Sixth Edition, March 2019
3. Cay Horstmann, “CORE JAVA volume –I”, Pearson, January 2013

CS3271	DATA STRUCTURES & ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

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

Course Outcome		Cognitive Skill
CO-01	Understand and implement linear and non-linear data structures	U
CO-02	Understand and apply the concepts of Tress and heaps	U,A
CO-03	Understand and apply the different operations of search trees and graph traversal algorithms	U,A
CO-04	Apply and get familiarized to sorting and searching algorithms	An
CO-05	Evaluate hashing algorithms	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	N	N	L	M	S	M
CO-02	N	M	L	L	M	L	S
CO-03	S	S	L	L	M	M	S
CO-04	M	S	L	L	M	M	M
CO-05	S	S	L	M	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF PROGRAMS

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms

10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

TOTAL: 45 PERIODS

PLATFORM NEEDED

- C++ for Windows/Linux

CS3272	DIGITAL DESIGN PRINCIPLES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To understand and implement the design of digital circuits
- To understand the use of Hardware Description Language(HDL) in digital Electronics

Course Outcome		Cognitive Skill
CO-01	Remember the concept of Boolean algebra and Logic gates and study the characteristics of basic logic gates.	R
CO-02	Understand the concept and implement the ideas in combinational circuits and Analyze the characteristics.	U,An
CO-03	Analyze the characteristics of combinational circuits.	An
CO-04	Evaluate the characteristics of a Synchronous sequential circuit.	E
CO-05	Apply the combinational/sequential circuits using HDL.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	S	M	N	S	S	L
CO-02	N	S	S	L	L	M	M
CO-03	M	N	L	S	S	L	L
CO-04	S	L	M	S	L	S	S
CO-05	S	L	S	M	S	M	L

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates
2. Half adder and full adder
3. Half subtractor and full subtractor
4. Multiplexer and Demultiplexer using gates

5. Encoder and Decoder
6. Code converter
7. Synchronous Counters
8. Asynchronous Counters
9. Design and implementation of parity generator / checker using basic gates and MSI devices
10. Design and implementation of Shift registers
11. Coding combinational/sequential circuits using Hardware Description Language (HDL).

TOTAL: 30 PERIODS

CS3273	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

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

Course Outcome		Cognitive Skill
CO-01	Understand the basic Object Oriented concepts	U
CO-02	Remember and apply the concepts of classes, packages, and interfaces,	R,A
CO-03	Apply the concept of inheritance.	A
CO-04	Develop and implement Java programs with array list, exception handling and multi-threading.	An
CO-05	Design applications using file processing, generic programming and event handling.	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	S	S	M	N	M	M	S
CO-02	M	S	S	S	S	M	S	L
CO-03	S	L	M	S	S	M	S	N
CO-04	N	M	L	S	L	S	S	S
CO-05	S	S	L	L	S	M	S	M

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF PROGRAMS

1. Electricity Bill Generation using Classes
2. Currency converter, Distance converter and Time converter Implementation using Packages
3. Pay slip Generation using Inheritance
4. Stack ADT Implementation using Multiple Inheritance (Interface)
5. String Operations using Array List
6. Abstract Class Implementation
7. User Defined Exception Handling Implementation
8. File Handling
9. Multithreading Implementation
10. Generic Function Implementation

TOTAL: 30 PERIODS

PLATFORM NEEDED

- Java for Windows/Linux

SEMESTER IV

MA3205	PROBABILITY AND QUEUEING THEORY	L	T	P	C
		2	1	0	3

Objective:

To have the fundamental knowledge of basic probability concepts, the standard distributions and random variables which can describe real life phenomena. To acquire skills in the basic characteristic features of queuing system and in analyzing queuing models.

Course Outcomes		Cognitive Skills
At the end of the course students should be able to		
CO-01	To formulate the theorems about the concept of probability. To calculate probabilities using Conditional probability, Rule of total probability and Bayes' theorem. Express the features of discrete and continuous random variables. To calculate the moments and formulates the Moment Generating Function.	R,U,A,An,E, S
CO-02	Use discrete and continuous probability distributions, including requirements, mean and variance, and making decisions to solve simple practical problems.	R,U,A,An,E, S
CO-03	To acquire skills in handling situations involving more than one random variable and functions of random variables. To understand the central tendency, correlation and correlation coefficient and also regression.	R,U,A,An,E, S
CO-04	To understand the concept of random processes and to determine covariance and spectral density of stationary random processes. To use	R,U,A,An,E, S

	discrete time Markov chains to model computer systems.	
CO-05	To expose the basic characteristic features of a queuing system and acquire skills in analysing queuing models. To learn how to analyze a network of queues with Poisson external arrivals, exponential service requirements and independent routing.	R,U,A,An,E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

PO CO	PO- A	P O - B	PO -C	PO -D	PO -E	PO -F	PO -G	PO -H	P O - I	PO- J	PO -k	PO -L	PO- M
CO-01	M	S	M	S	S	N	M	M	S	S	M	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M	S
CO-03	S	L	S	S	L	L	S	S	M	M	S	S	M
CO-04	S	L	M	S	N	L	S	S	M	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M	M	S	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: Probability and Random Variable

9

Axioms of probability - Conditional probability – Independent Events - Total probability-Bayes's theorem-Random variable - Probability mass functions - Probability density functions -Distribution functions- Properties – Expectation – Moments - Moment generating function and properties.

UNIT II: Standard Distributions

9

Binomial, Poisson, Uniform, Exponential, Gamma and Normal distributions and their properties (Problems only)-Central Limit Theorem(without proof).

UNIT III: Two Dimensional Random Variables

9

Joint distributions - Marginal and Conditional distributions–Expectation-Independence-Covariance – Correlation and Regression .

UNIT IV: Random Processes and Markov Chains

9

Classification - Stationary process - Markov process– Markov chains - Transition probabilities-Limiting distributions.

UNIT V: Queuing Theory

9

Birth and Death process - Markovian queuing models – Little's formulae - M/M/1, M/M/C, finite and infinite capacity- M/G/1 queue (steady state solutions only)-Pollaczek-Khintchine formula.

TOTAL:30+15 = 45 PERIODS

TEXT BOOK

1. Veerarajan. T., "Probability, Statistics and Random Processes", Second Edition, Tata McGraw-Hill Publications, New Delhi, 2007.

REFERENCES

1. Ross, S., "A first course in Probability", Sixth Edition, Pearson Education, Delhi, 2011.
2. Allen, A.O., "Probability, Statistics and Queuing Theory", Second Edition, Academic press, New Delhi, 2010.
3. Medhi J., "Stochastic Processes", New Age Publishers, Second Edition, New Delhi, 2006. (Chapters 2 to 4)
4. Taha, H. A., "Operations Research-An Introduction", Seventh Edition, Pearson Education, Delhi, 2002 (Chapter 17).

BS3201	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES

- To understand the basic concepts in environmental science
- To gain the knowledge about structure and natural cycles of environment.
- To get an idea about control methods of pollution.
- To know the information about conservation methods of forest and wild life.

Course Outcome		Cognitive Skill
CO-01	Student will be able to demonstrate a general understanding of interdisciplinary nature of environmental uses and able to characterize natural resources.	U, A, An
CO-02	Students will be able to explain the effects of air, water, soil, noise and thermal pollution environment and suggest ways to reduce them.	R, E ,A
CO-03	Students will be able to explain the effects of air, water, soil, noise and thermal pollution environment and suggest ways to reduce them.	R, U, A
CO-04	Students will be able to understand the effects of human population and know about the awareness programme.	R, A, E
CO-05	Students apply systems concept and methodologies to analyse and understand interaction between social and environmental process.	R, A, An

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G	PO- H	PO- I	PO- J	PO- k	PO- L	PO- M
CO-01	S	M	S	M	M	S	S	S	M	S	S	M	S
CO-02	M	M	S	M	S	S	S	S	M	S	S	M	M
CO-03	M	M	S	M	S	S	S	S	M	S	S	M	M
CO-04	M	M	S	S	M	S	S	S	M	S	S	M	L
CO-05	M	M	S	S	L	S	M	S	M	S	S	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: NATURE OF ENVIRONMENT STUDIES AND NATURAL RESOURCES

9

Environment studies- definition – scope and importance- need for public awareness- Methods to create environmental awareness- Natural resources- Forest resources- energy resources- food resources- water resources – land resources - mineral resources.

Unit II: ECO SYSTEMS AND BIO-DIVERSITY

9

Concept and component of eco systems- producer, consumer, decomposer- structure and function of eco system- food chain and food web- energy flow model- aquatic eco system-forest eco system- desert eco system- pyramid of biomass- ocean eco system- grass land eco system- Bio diversity in India- value of bio diversity- biodiversity threatens- biodiversity protection- In-situ and Ex-situ conservation.

Unit III: ENVIRONMENTAL POLLUTION

9

Meaning of environmental pollution- air pollution- acid rain – global warming- water pollution- water pollution control- soil pollution- urban waste and soil pollution- marine pollution- noise pollution- thermal pollution- solid and hazardous waste management- waste disposal methods- solid waste and India- natural disaster and disaster management.

Unit IV: HUMAN POPULATION AND ENVIRONMENT

9

Population growth- distribution of population- factors affecting variation in population-theories of population- future of human population- family welfare programme- HIV and AIDS- environment and human health- human rights- value education- women and child welfare.

Unit V: SOCIAL ISSUES AND THE ENVIRONMENT

9

Unsustainable to sustainable development- sustainable development in India- water conservation, watershed management and water harvesting- environmental ethics- role of engineer in environmental protection.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Cunningham & Saigo: 'Environmental science :A global concern' 4th Ed. W.C. Brown Publishers. USA. 1997
2. Chauhan A.S, 'Environmental studies' 2nd revised ed. 2004, Jain Brother publishers, New Delhi

REFERENCES:

1. Benny Joseph : 'Environmental Science and Engineering', 2006, Tata McGraw-Hill Publication.
2. Siddique K.A. : Elements of Ecology and Environmental Pollution, 1st Ed. 2002, Kushal Publication, Varanasi. M

CS3205	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basics of networks, types of connections and reference model.
- To understand error detection and correction codes.
- To learn packet switching and routing protocols.
- To understand the duties of transport layer
- Familiarize with Domain Name System.

Course Outcome		Cognitive Skill
CO-01	Gain the knowledge of the basic computer technology	R, U
CO-02	Evaluate the performance of data link layer	E
CO-03	Ability to identify how data flows from one node to another	U, A
CO-04	Design protocols for various functions in the network.	A
CO-05	Apply and implement the working of various application layer protocols.	U, A

R-Remember, U-Understand, A-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	S	S	S
CO-02	S	S	S	S	S	S	S
CO-03	S	S	S	S	S	S	M
CO-04	S	S	S	S	S	S	S
CO-05	M	S	S	S	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Data Communications**9**

Components - Direction of Data flow networks - Components and Categories - Types of Connections - Topologies - Protocols and Standards -Example Networks: ARPANET, Internet, ISO / OSI model – Physical Layer: Transmission Media -twisted pairs- Coaxial Cable - Fiber Optics - Line Coding - Modems - RS232 Interfacing sequences.

Unit II: Data Link Layer**9**

Design Issues - Framing-Error detection and correction - Parity - LRC - CRC - Hamming code - low Control and Error control - stop and wait - go back-N ARQ - selective repeat ARQ- sliding window - HDLC - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 - FDDI - SONET - Bridge

Unit III: Network Layer**9**

Inter networks - Packet Switching and Datagram approach - IP addressing methods - Subnetting - Routing - Distance Vector Routing - Link State Routing – Routers-Congestion control algorithms.

Unit IV: Transport Layer**9**

Duties of transport layer - Multiplexing - De Multiplexing - Sockets - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Quality of services (QOS) - Integrated Services.

Unit V: Application Layer**9**

Domain Name Space (DNS) - SMTP - FTP - HTTP - WWW - Security - Cryptography.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, Fifth Edition, 2013.

REFERENCES

1. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2017.
2. Larry L. Peterson and Bruce S. Davie," Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, Inc., 2012.
3. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
4. Andrew S. Tanenbaum," Computer Networks", PHI, Fourth Edition, 2003.

CS3206	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.

- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
- To have an introductory knowledge about the emerging trends in the area of distributed DB- OODB- Data mining and Data Warehousing and XML.

Course Outcomes		Cognitive Skill
CO-01	Design and develop the data models using various data modeling concepts like network, hierarchical and ER models.	S
CO-02	Develop SQL queries to extract information from large, real time data sets.	S
CO-03	Analyze an information storage problem and evaluate an information model expressed in the form of B tree and B+ Tree.	An
CO-04	Apply the transaction processing techniques for computing systems that uses databases.	A
CO-05	Apply current trends, skills and tools for database systems.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis
Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	L	S	S	S
CO-02	S	L	S	L	S	S	S
CO-03	S	S	S	N	S	S	N
CO-04	S	M	S	M	S	S	S
CO-05	M	L	S	M	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Introduction and Conceptual Modeling

9

Introduction to File and Database Systems - Database System Structure - Data Models - Introduction to Network and Hierarchical Models - ER Model - Relational Model - Relational Algebra and Calculus

Unit II: Relational Model

9

SQL - Data Definition - Queries in SQL - Updates - Views - Integrity and Security - Relational Database Design - Functional Dependences and Normalization for Relational Databases (Up to BCNF).

Unit III: Data Storage and Query Processing**9**

RAID - Record Storage and Primary File Organization - Secondary Storage Devices - Operations on Files - Heap File - Sorted Files - Hashing Techniques - Index Structure for Files - Different Types of Indexes - B-Tree - B+Tree - Query Processing.

Unit IV: Transaction Management**9**

Transaction Processing - Introduction - Need for Concurrency Control - Desirable Properties of Transaction - Schedule and Recoverability - Serializability and Schedules - Concurrency Control - Types of Locks - Two Phases Locking - Deadlock - Time Stamp Based Concurrency Control - Recovery Techniques - Concepts - Immediate Update - Deferred Update - Shadow Paging.

Unit V: Current Trends**9**

Object Oriented Databases - Need for Complex Data types - OO data Model - Nested relations - Complex Types - Inheritance Reference Types - Distributed databases - Homogenous and Heterogenous - Distributed data Storage - XML - Structure of XML - Data - XML Document - Schema - Querying and Transformation - Data Mining and Data Warehousing.

TOTAL: 45 HOURS**TEXT BOOKS**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Edition, McGraw-Hill, 2021 (Electronic Edition).

REFERENCES

1. RamezElmasri and Shamkant B. Navathe, "Fundamental Database Systems", Seventh Edition, Pearson Education, 2015.
2. Raghu Ramakrishnan, "Database Management System", Third Edition, Tata McGraw-Hill Publishing Company, 2014.
3. Hector Garcia-Molina, Jeffrey D.Ullman and Jennifer Widom- "Database System Implementation"- Pearson Education- 2008.
4. Peter Rob and Corlos Coronel- "Database System, Design, Implementation and Management", Heinle - Tenth Edition, 2013.

CS3207	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To have an overview of different types of operating systems
- To know the components of an operating system.
- To have a thorough knowledge of process management
- To have a thorough knowledge of storage management
- To know the concepts of I/O and file systems.

Course Outcome		Cognitive Skill
CO-01	Remember and understand various types of systems and recognize process management and scheduling concept.	R, U
CO-02	Understand scheduling concept and scheduling algorithm then apply real time values in algorithms	U, A
CO-03	Remember and Analyze deadlock detection, avoidance and memory management methods.	R,An
CO-04	Remember and Apply file system mounting, sharing and protection	R, A
CO-05	Analyze file systems and implementation, and various file allocation methods	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	N	L	S	L	L
CO-02	M	S	S	S	M	L	L
CO-03	S	M	S	S	S	N	N
CO-04	M	S	S	S	M	L	L
CO-05	S	M	S	S	S	N	N

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: PROCESS CONCEPTS

9

Introduction - Mainframe systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Hardware Protection - System Components – Operating System Services – System Calls – System Programs - Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication.

UNIT II: SCHEDULING

9

Threads – Overview – Threading issues - CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Real Time Scheduling - The Critical-Section Problem – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Critical regions – Monitors.

UNIT III: DEADLOCK AND MEMORY MANAGEMENT

9

System Model – Deadlock Characterization – Methods for handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks -

Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging.

UNIT IV: VIRTUAL MEMORY

9

Virtual Memory – Demand Paging – Process creation – Page Replacement – Allocation of frames – Thrashing - File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection

UNIT V: FILE SYSTEM & OPERATING SYSTEM CASE STUDY

9

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management. Kernel I/O Subsystems - Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management. Case Study: The Linux System, Windows

TOTAL: 45 PERIODS

TEXT BOOK

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, Sixth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2003.

REFERENCES

1. Harvey M. Deitel, “Operating Systems”, Second Edition, Pearson Education Pvt. Ltd, 2002.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Prentice Hall of India Pvt. Ltd, 2003.
3. William Stallings, “Operating System”, Prentice Hall of India, 4th Edition, 2003.
4. Pramod Chandra P. Bhatt – “An Introduction to Operating Systems, Concepts and Practice”, PHI, 2003.

CS3208	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn process models, software requirements, software design, software testing, and software process/product metrics, risk management, quality management and UML diagrams
- To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.

Course Outcome		Cognitive Skill
CO-01	To understand the software engineering process and process models	R,U
CO-02	Analyze the requirements and system models	An
CO-03	Analyze and implement design concepts and UML model	An

CO-04	Evaluate Testing strategies' and metrics for maintenance	E
CO-05	Apply risk managements and reviews	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	S	S	M	S	M	L
CO-02	S	S	S	S	S	M	S
CO-03	S	L	M	S	S	M	S
CO-04	N	M	L	S	L	S	S
CO-05	S	S	L	L	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I:Introduction

9

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Unit II:Software Requirements And Models

9

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods.

Unit III:Design Engineering and UML

9

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Unit IV:Testing And Metrics

9

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

Unit V: Risk And Quality Management

9

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Richard Fairley, "Software Engineering Concepts", McGraw Hill, 2017 (Electronic Edition).
2. Roger S. Pressman, "Software engineering- A practitioner's Approach", McGraw-Hill International Edition, 9th edition, 2019.

REFERENCE BOOKS:

1. Ian Sommerville, "Software engineering, Pearson education Asia", 6th edition, 2000.
2. Pankaj Jalote- An Integrated Approach to Software Engineering, Springer Verlag, 1997.
3. John D. Musa, "Software Reliability", McGrawHill, 1985
4. David Gustafson, "Software Engineering", Schaum's outlines, Tata McGraw-Hill, 2003.
5. David Farley, "Modern Software Engineering: Doing What Works to Build Better Software Faster", Addison-Wesley Professional, 2021.

CS3274	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

Course Outcome		Cognitive Skill
CO-01	Implement various protocols using TCP and UDP.	A
CO-02	Compare the performance of different transport layer protocols.	An, U
CO-03	Use simulation tools to analyze the performance of various network protocols.	U, An
CO-04	Analyze various routing algorithms.	An
CO-05	Implement error correction codes.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	S	L	M	N
CO-02	S	L	S	S	L	M	S
CO-03	M	S	S	L	L	M	S
CO-04	S	S	L	N	N	M	M
CO-05	S	S	L	M	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF PROGRAMS

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

TOTAL: 45 PERIODS

PLATFORM NEEDED

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

CS3275	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To implement the basics of SQL and construct queries using SQL.
- To emphasize the importance of normalization in databases.
- To facilitate students in Database design.
- To design various real time systems.

Course Outcome		Cognitive Skill
CO-01	Apply DDL and DML commands in RDBMS	A
CO-02	Apply High-level language extension with Cursors and Triggers	A
CO-03	Apply Procedures and Functions	A
CO-04	Implement the design E-R model and Normalization	S
CO-05	Apply the design and implementation of various real time systems	A, S

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis
Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	S	S	M	L	M
CO-02	M	S	S	S	M	M	M
CO-03	M	S	S	S	S	S	M
CO-04	S	S	S	S	M	L	M
CO-05	L	S	S	S	M	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EXPERIMENTS

1. Data Definition Language (DDL) commands in RDBMS.
2. Data Manipulation Language (DML) and Data Control Language (DCL) commands in RDBMS.
3. High-level language extension with Cursors.
4. High level language extension with Triggers
5. Procedures and Functions.
6. Embedded SQL.
7. Database design using E-R model and Normalization.
8. Design and implementation of Payroll Processing System.
9. Design and implementation of Banking System.
10. Design and implementation of Library Information System.

TOTAL: 45 PERIODS

PLATFORM NEEDED

- Oracle, Visual Basic

CS3276	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To understand and implement Shell Programming
- To analyze the process scheduling strategy

Course Outcome		Cognitive Skill
CO-01	Understand and apply the basic commands in shell programming.	U, A
CO-02	Execute the commands in UNIX operating system.	U, A
CO-03	Display and print the Gantt chart for FCFS, SJF. Compute average waiting, Turnaround time.	U, An
CO-04	Display and print the Gantt chart for priority, round robin scheduling.	U, An
CO-05	Implement producer consumer problem, memory management scheme1, 2.	U, A,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	S	M	S	S	S	L
CO-02	S	S	S	L	L	M	M
CO-03	S	S	L	S	S	S	L
CO-04	S	L	M	S	S	S	N
CO-05	S	L	S	S	S	S	L

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Shell programming
 - Command syntax
 - write simple functions
 - Basic tests
2. Shell programming
 - loops
 - Patterns
 - Expansions
 - Substitutions
3. Write programs using the following system calls of UNIX operating system:
Fork, exec, getpid, exit, wait, close, stat, opendir, readdir
4. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)

5. Write C programs to simulate UNIX commands like ls, grep, etc.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
7. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
8. Implement the Producer – Consumer problem using semaphores.
9. Implement some memory management schemes – I
10. Implement some memory management schemes – II

TOTAL: 30 PERIODS

PLATFORM NEEDED

- C/C++/JAVA/Equivalent compiler.
- LINUX/WINDOWS platform

SEMESTER V

CS3209	BLOCK CHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of Blockchain.
- To obtain knowledge about technologies of Blockchain.
- To incorporate the models of Blockchain- Ethereum.
- To learn the models of Hyperledger Fabric.

Subject Code: CS3209		Subject Name: Block Chain Technologies	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Define and Explain the fundamentals of Blockchain.		U, R
CO-02	Illustrate the technologies of Blockchain.		A
CO-03	Describe the models of Blockchain.		R, A
CO-04	Analyze and demonstrate the Ethereum.		A, An
CO-05	Analyze and demonstrate Hyperledger fabric.		A, An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	L	M	L	M	M
CO-02	M	M	S	M	M	M	L
CO-03	M	M	M	M	M	S	S
CO-04	S	S	S	M	M	S	S
CO-05	S	S	M	M	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION

9

Basic Cryptographic primitives used in Blockchain –Secure- Collision- Resistant hash functions – Digital signature – Public key cryptosystems –Zeroknowledge proof systems – Need for Distributed Record Keeping – Modelling faults and adversaries- Byzantine Generals problem – Consensus algorithms and their scalability problems – Why Nakamoto Came up with Blockchain based cryptocurrency.

Unit II: TECHNOLOGIES BORROWED IN BLOCKCHAIN

9

Technologies Borrowed in Blockchain –hash pointers- Consensus- Byzantine Models of fault tolerance- Digital cash etc.- Bitcoin blockchain – Wallet – Blocks – Merkley Tree – hardness of mining – Transaction verifiability – Anonymity – forks – Double spending – Mathematical analysis of properties of Bitcoin – Bitcoin- the challenges and solutions.

Unit III: MODELS FOR BLOCKCHAIN

9

Models f-GARAY model -RLA Model -Proof of Work (PoW) as random oracle – Formal treatment of consistency- Liveness and Fairness – Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS) – Bitcoin scripting language and their use.

Unit IV: ETHEREUM

9

Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity Smart Contracts – The Turing Completeness of Smart Contract Languages and verification challenges- Using smart contracts to enforce legal contracts- Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts.

Unit V: HYPERLEDGER FABRIC

9

Hyperledger fabric- the plug and play platform and mechanisms in permissioned block chain – Beyond Cryptocurrency – applications of block chain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms – Limitations of block chain as a technology and myths vs reality of blockchain technology.

TOTAL: 45 PERIODS

TEXT BOOKS

1. S.Shukla,M.Dhawan,S.Sharma,S. Venkatesan “Blockchain Technology: Cryptocurrency and Applications” ,Oxford University Press 2019 .

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press, 2016.

REFERENCES

1. Joseph Bonneau et al, SoK: "Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy, 2015
2. J.A. Garay et al, "The bitcoin backbone protocol – analysis and applications", EUROCRYPT 2015, Volume 2.
3. R. Pass et al, "Analysis of Blockchain protocol in Asynchronous networks", EUROCRYPT 2017.
4. Pass et al, "Fruitchain- a fair blockchain", PODC 2017.

CS3210	ARTIFICIAL INTELLIGENCE AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning.

Subject Code: CS3210		Subject Name: Artificial Intelligence and Applications	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Discuss intelligent agents and environments		U
CO-02	Understand how to handle the search space.		U, A
CO-03	Apply knowledge engineering in first order logic.		U, A
CO-04	Analyze the different learning methods		An
CO-05	Use artificial intelligence in various fields.		A, E

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	N	L	S	S	M
CO-02	S	M	L	M	M	S	S
CO-03	S	S	M	M	L	S	S
CO-04	M	S	M	M	M	S	S
CO-05	L	M	L	M	S	L	M

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: INTRODUCTION**9**

Introduction to AI - AI Applications - Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

Unit II: SEARCHING TECHNIQUES**9**

Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.

Unit III: KNOWLEDGE REPRESENTATION**9**

First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation -Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects

Unit IV: LEARNING**9**

Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods - Learning with complete data - Learning with hidden variable - EM algorithm - Instance based learning - Neural networks - Reinforcement learning – Passive reinforcement learning - Active reinforcement learning - Generalization in reinforcement learning.

Unit V: APPLICATIONS**9**

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks- Probabilistic language processing - Probabilistic language models – Information retrieval – Information Extraction – Machine translation.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education, 2007.
3. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008

REFERENCES

1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Second Edition, Tata McGraw-Hill, 2003.
2. George F. Luger, “Artificial Intelligence-Structures and Strategies For Complex Problem Solving”, Pearson Education / PHI, 2002.
3. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Second Edition, Harcourt Asia Pvt. Ltd., 2000.

CS3211	WEB TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand different Internet Technologies
- To learn java-specific web services architecture
- To Develop web applications using frameworks

Subject Code: CS3211		Subject Name: Web Technologies	
Course Outcome – COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Construct a basic website using HTML and Cascading Style Sheets	U	
CO-02	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.	R,U	
CO-03	Develop server side programs using Servlets and JSP.	A	
CO-04	Construct simple web pages in PHP and to represent data in XML format.	R,A	
CO-05	Develop interactive web applications.	An	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	S	S	S
CO-02	M	M	S	S	M	M	M
CO-03	L	L	S	S	M	S	S
CO-04	M	S	S	S	L	M	M
CO-05	L	M	S	S	L	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0

9

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers –

HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework

Unit II:CLIENT SIDE PROGRAMMING

9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling- Validation- Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files.

Unit III: SERVER SIDE PROGRAMMING

9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.

Unit IV: PHP and XML

9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL.

Unit V: INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS

9

Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django- UI & UX.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.
2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing

REFERENCES

1. Stephen Wynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2011.
4. UttamK.Roy, “Web Technologies”, Oxford University Press, 2011.
5. Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1st edition,O'Reilly

CS3212	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the architecture and programming of 8085 and 8086 microprocessor.
- To introduce the interfacing of peripheral devices with 8085 microprocessor.
- To introduce the architecture and programming of Pentium and ARM processors.
- To introduce the architecture, programming and interfacing of 8051 micro controller.
- To introduce the architecture, programming and interfacing of PIC micro controller.

Subject Code: CS3212		Subject Name: Microprocessors and Microcontrollers	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the architecture, instructions of 8085 and 8086 microprocessor and apply the instructions to create and analyze various applications.		U, A
CO-02	Design the interfacing circuits and develop the programming skills to interface the i/o devices for the system.		U, A
CO-03	Understand and remember the architecture, instructions of Pentium and ARM processors and apply the skills for the computing system.		U, R,A
CO-04	Understand the 8051 microcontroller basics, instructions and apply them to create application programs for the engineering application domain.		U, A
CO-05	Understand the PIC microcontroller basics, instructions and apply them to create application programs for the engineering application domain.		U, A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	M	L	L	M	S	S
CO-02	L	M	M	L	M	S	M
CO-03	S	M	M	L	L	M	S
CO-04	M	L	M	M	L	M	S
CO-05	S	M	M	M	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT 18-BIT MICROPROCESSOR AND 16- BIT MICROPROCESSOR 9

8085 Architecture – Instruction set – Addressing modes – Assembly language programming – Intel 8086 Internal Architecture – 8086 Addressing modes- Instruction set- 8086 Assembly language Programming–Interrupts.

UNIT II I/O INTERFACING

9

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

UNIT III ADVANCED PROCESSORS- PENTIUM & ARM

9

High Performance CISC Architecture- Pentium- CPU Architecture- Bus Operations – Pipelining –Multitasking – Exception and Interrupts – Instruction set – Addressing modes - High Performance RISC Architecture – ARM- Core & Architectures - Registers – Pipeline - Interrupts – ARM organization- ARM instruction set.

UNIT IV 8051 MICROCONTROLLER

9

Architecture - Pin Configuration - Addressing Modes - Instruction Set Programming - Timers – Counters - Programming - Interrupts- Communication Interfaces - Interfacing With DAC, ADC, Stepper Motor.

UNIT IV PIC MICROCONTROLLER

9

PIC Family - PIC16F84A: Features - Architecture – Data Memory Organization RAM - Program Memory - ROM – Instruction Types And Addressing Modes- Instruction Cycle - Ports - Introduction To Programming PIC Microcontrollers Using MPLAB.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 6th Edition, Penram International Publishing, New Delhi, 2013.
2. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
3. Steve Furber , “ARM System –On –Chip architecture, Pearson Education,2014.
4. James L. Antonakos , “ The Pentium Microprocessor”, Pearson Education, 2002.
5. Mohammed Ali Mazidi and Janice GillispieMazidi, “The 8051 Microcontroller and Embedded Systems”, Pearson Education Asia, New Delhi, 2011.
6. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers, Newnes Publisher, ISBN:9780080961842, 2009.
7. PIC: 18F2420, 16F84A data sheet ,by Microchip.

REFERENCES

1. A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2002.
2. M. Rafi Quazzaman, Microprocessors Theory and Applications: Intel and Motorola Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

MS3201	PROFESSIONAL AND BUSINESS ETHICS	L	T	P	C
		2	0	0	2

Course Description

The course on Professional and Business Ethics is designed to cultivate ethical awareness and moral and social values in BE students. It aims to help students recognize legal and ethical issues in business decision-making, enhance analytical problem-solving skills, and foster ethical decision-making abilities.

Course Objectives

1. To Recognize legal and ethical issues in business decision-making.
2. To Understand and apply ethical rules and constraints.
3. To Enhance analytical problem-solving skills and ethical decision-making abilities.

Course Outcomes

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

1. Explain the connection between ethics, morals, and values in the workplace.
2. Assess the ethical implications of business activities and competing demands on businesses.
3. Critically analyze real-world contexts and conduct research projects on topics related to business ethics.

UNIT I:HUMAN VALUES

6

Morals, Values, and Ethics - Integrity and Work Ethic - Caring, Sharing, and Honesty - Commitment, Empathy, and Self-Confidence.

UNIT II:ENGINEERING ETHICS

6

Senses of 'Engineering Ethics' and Moral Issues -Moral Autonomy and Ethical Theories - Models of Professional Roles.

UNIT III: ENGINEERING AS SOCIAL EXPERIMENTATION

6

Engineering as Experimentation - Engineers as Responsible Experimenters - Codes of Ethics and Legal Perspectives.

UNIT IV: SAFETY, RESPONSIBILITIES, AND RIGHTS

6

Safety, Risk, and Risk Assessment - Collegiality, Loyalty, and Respect for Authority - Professional and Employee Rights.

UNIT V: GLOBAL ISSUES

6

Multinational Corporations and Environmental Ethics - Engineers as Managers, Consultants, and Expert Witnesses.

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering," McGraw-Hill, New York, Latest edition: 4th edition (2022).
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics," Prentice Hall of India, New Delhi, Latest edition: 2nd edition (2021).

REFERENCES:

1. Charles D. Fleddermann, "Engineering Ethics," Pearson Education/Prentice Hall, New Jersey, Latest edition: 4th edition (2022).
2. Charles E Harris, Michael S. Protchard, and Michael J Rabins, "Engineering Ethics - Concepts and Cases," Wadsworth Thompson Learning, United States, Latest edition: 2nd edition (2023).
3. John R Boatright, "Ethics and the Conduct of Business," Pearson Education, New Delhi, Latest edition: 8th edition (2021).
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers," Oxford University Press, Oxford, Latest edition: 2nd edition (2022).

CS3277	WEB TECHNOLOGIES LABORATORY	L	T	P	C
		0	0	4	2

AIM

To understand and implement the HTML and Java programs.

OBJECTIVES

- To understand different Internet Technologies
- To learn java-specific web services architecture
- To Develop web applications using frameworks

Course Outcome – COs The students will be able to,		Cognitive Skill
CO-01	Construct a basic website using HTML and Cascading Style Sheets	U,R
CO-02	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.	R
CO-03	Develop server side programs using Servlets and JSP.	A
CO-04	Construct simple web pages in PHP and to represent data in XML format.	A, An
CO-05	Develop interactive web applications.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	S	S	S
CO-02	M	M	S	S	M	M	M
CO-03	L	L	S	S	M	S	S

CO-04	M	S	S	S	L	M	M
CO-05	L	M	S	S	L	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF PROGRAMS

1. Create a web page with the following using HTML.
 - a. To embed an image map in a web page.
 - b. To fix the hot spots.
 - c. Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Program using PHP database functions.
5. Installation of Apache Tomcat web server.
6. Write programs in Java using Servlets:
 - i. To invoke servlets from HTML forms.
 - ii. Session Tracking.
7. Write programs in Java to create three-tier applications using JSP and Databases
 - i. For conducting on-line examination.
 - ii. For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
8. Programs using XML – Schema – XSLT/XSL.

TOTAL:45 PERIODS

PLATFORM NEEDED: JAVA,HTML.

CS3278	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	2	1

AIM

To understand the functionalities of microprocessors and microcontrollers.

OBJECTIVES

- To Introduce ALP concepts, features and coding methods.
- To write ALP for arithmetic and logical operations in 8085, 8086 and 8051
- To differentiate Serial and Parallel Interface.
- To interface different I/O with Microprocessors.
- To be familiar with MASM.

Subject Code: CS3278 Subject Name: Microprocessors and Microcontrollers Laboratory

Course Outcome – COs		Cognitive Skill
The students will be able to,		
CO-01	Understand the instructions of 8085, 8086 and 8051 and perform arithmetic and logical operations.	U, A
CO-02	Remember and apply the designs and concepts of 8086 microprocessor to perform string operations and move a data block without overlap.	R, U, A
CO-03	Apply the interfacing circuit design concept and perform interfacing with 8085/8086 microprocessor.	R, U, A
CO-04	Remember and apply the serial communication and interface the stepper motor and traffic light controller using 8085/8086 programming.	R, A
CO-05	Understand and perform arithmetic and Logical operations using MASM software.	U, A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	M	S	M
CO-02	S	M	L	L	L	M	S
CO-03	S	L	L	M	M	S	S
CO-04	M	M	L	L	L	M	S
CO-05	S	M	L	L	M	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Programs for 8/16 bit Arithmetic and Logical operations (Using 8085, 8086 and 8051).
2. Programs for Sorting and Searching (Using 8085, 8086 and 8051).
3. Programs for String manipulation operations (Using 8086).
4. Program to move a data block without overlap (Using 8086).
5. Arithmetic and Logical Operations using MASM Software.
6. Interfacing ADC and DAC.
7. Interfacing and Programming 8279, 8259, and 8253.
8. Interfacing and Programming of Stepper Motor and Traffic Light Controller.

TOTAL: 30 PERIODS

PLATFORM NEEDED MASM Software

8085 Microprocessor Kit, 8086 Microprocessor Kit, 8051 Microcontroller Kit

SEMESTER VI

CS3213	COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the design principles of a Compiler.
- To learn the various parsing techniques and different levels of translation
- To learn how to optimize and effectively generate machine codes

Subject Code: CS3213		Subject Name: Compiler Design	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the major phases of compilation and the use of a tool to generate lexical analyzer.		U, A
CO-02	Understand and Apply context-free grammar and to design parsers		U, A
CO-03	Design and implement intermediate code generation		A
CO-04	Create frameworks for code generation		A
CO-05	Analyze various code optimization techniques and code generation		An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	S	S	L
CO-02	S	S	S	S	M	S	S
CO-03	S	S	S	S	L	S	S
CO-04	M	M	S	L	S	M	N
CO-05	S	S	S	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Introduction to Compilers & Lexical Analysis

9

Introduction – Translators - Compilation and Interpretation - Language processors - The phases - Cousins - The grouping of phases - Compiler construction tools - The role of the lexical analyzer- Input Buffering-Specification of tokens - Recognition of tokens - Finite Automata – Regular Expressions to Automata NFA, DFA – Minimizing DFA - Language for Specifying Lexical Analyzers – Lex tool.

Unit II: Syntax Analysis**9**

Syntax Analysis - The role of the parser - Context-free grammars - Writing a grammar - Top-down parsing – Bottom-up Parsing - LR parsers - Constructing an SLR (1) parsing table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer - YACC tool - Design of a syntax Analyzer for a Sample Language.

Unit III: Intermediate Code Generation**9**

Syntax directed Definitions - Construction of Syntax Tree - Bottom - up Evaluation of S-Attribute Definitions - Type Checking - Type Systems-Specification of a simple type checker Intermediate language - Intermediate representation –Three address code (Quadruples, Triples, Indirect Triples) – Declarations - Assignment statements - Boolean expressions - Case statements – Flow of control statements – Back patching.

Unit IV: Run-Time Environment and Code Generation**9**

Run-Time Environments - Source language issues – Storage organization – Storage allocation strategies - Issues in the design of a code generator - The target machine - Run-time storage management - Basic blocks and flow graphs - Next-use information - A simple code generator -Register allocation and assignment - The DAG representation of basic blocks - Generating code from DAGs.

Unit V: Code Optimization**9**

Introduction - The principal sources of optimization - Peephole optimization - Optimization of basic blocks - Loops in flow graphs - Introduction to global data - flow analysis - Code improving transformations.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education, 2009.

REFERENCES

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

CS3214	CLOUD COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.

- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

Subject Code: CS3214		Subject Name: Cloud Computing Techniques	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the concepts of virtualization and virtual machines	U	
CO-02	Understand the various issues in cloud computing. Remember the concept and developing the model of cloud services and tools.	U, R	
CO-03	Experiment with virtualization of hardware resources and Docker.	R, U	
CO-04	Apply the cloud computing concept with suitable communication purpose.	A	
CO-05	Understand the security issues in the cloud environment.	U	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	S	S	L
CO-02	S	S	S	S	M	S	M
CO-03	S	M	S	S	L	S	S
CO-04	M	M	S	L	S	M	M
CO-05	S	S	S	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Cloud Architecture Models and Infrastructure

9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

Unit II: Virtualization Basics

9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines – Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

Unit III: Virtualization Infrastructure and Docker

9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource

Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

Unit IV: Programming Model

9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack - Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster

Unit V: Cloud Security

9

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud – Cloud Security and Trust Management.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, “The Docker Book”, O’Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010.

REFERENCES

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

CS3215	CYBER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

- The course also gives an exposure to the different types of mechanisms to sanitize the cyber space by adopting standardized operating procedures while transacting business/commerce online, and also to ensure security of information handled over the net.
- Introduction to the cyber laws and the ipc equips the students with sufficient legal knowledge about deterrence in preventing cyber crimes.

Subject Code: CS3215		Subject Name: Cyber Security	
Course Outcome – Cos			Cognitive Skill
CO-01	Remember and understand the principles of computer organization and communicate effectively to discuss about the OS and architectures.		R, U
CO-02	Understand and identify the information security fundamentals and apply them in E-commerce.		U, A
CO-03	Remember and understand the security threats and test the programming bugs in computing systems.		R, U
CO-04	Explain the basics of cyber security, cyber crime and cyber law		R, U
CO-05	Understand various cyber crimes and cyber security.		U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G
CO							
CO-01	N	L	M	L	M	S	L
CO-02	N	L	M	S	M	S	M
CO-03	S	L	M	L	L	M	S
CO-04	L	L	M	M	M	S	M
CO-05	S	S	M	M	L	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I COMPUTER ORGANIZATION & ARCHITECTURE AND OPERATING SYSTEMS

9

Computer Organization, Architecture, Operating Systems, Process Management, CPU Scheduling, I/O Memory Management, filesystems and deadlocks. LAN, MAN, WAN, ISO/OSI seven layer architecture.

UNIT-III INFORMATION SECURITY FUNDAMENTALS

9

Background, Importance, statistics, national and international scenarios. Identification and authentication, confidentiality, privacy, integrity, non-repudiation. Goals of security : prevention, detection and recovery. E-commerce security. Critical Infrastructure Protection.

Overview of security threats, various kinds of threats; Authentication-weak passwords. Insecure internet connection- internet cookies, viruses and other infections. Security of hard drives, security of laptops; sniffers, backdoors and Trojans. Buffer overflow and other programming bugs. Common attacks- DoS, man-in-the-middle, brute force attacks.

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

1. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: Cryptographic Principles & Application", Thomson Delmar Learning, 2004.
2. Bernadette H Schell, Clemens Martin, "Cyber Crime", ABC-CLIO Inc, California, 2004.
3. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.
4. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall, 2008.
5. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.
6. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.

1. Silberschatz A, Galvin P, Gagne G, "Operating Systems Concepts", John Wiley & Sons, Singapore, 2006.
2. Principles and Practices of Information Security by Michael E. Whiteman and Herbert J. Mattord.
3. Cyber Laws by Aparna Viswanathan.
4. Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005.

CS3279	COMPILER DESIGN LABORATORY	L	T	P	C
		0	0	4	2

AIM

To understand and implement the structure of compiler design programs.

OBJECTIVES

- To understand the techniques in different phases of a compiler
- To design a lexical analyzer for a sample language and learn to use the LEX tool.
- To apply different parsing algorithms to develop a parser and learn to use YACC tool.
- To understand semantics rules (SDT), intermediate code generation and run-time environment.
- To implement code generation and apply code optimization techniques.

Subject Code: CS3279		Subject Name: Compiler Design	
Laboratory			
Course Outcome – Cos			Cognitive Skill
The students will be able to,			
CO-01	Implement Symbol table.	A, E	
CO-02	Design Lexical analyzer for given language using C and LEX tools	A	
CO-03	Design and convert BNF rules into YACC form to generate various parsers.	A	
CO-04	Generate machine code from the intermediate code forms.	A, An	
CO-05	Implement code optimization techniques.	A, E	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO - A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	S	L	M	S	S	L
CO-02	S	M	S	S	M	S	S
CO-03	M	S	S	S	L	M	S
CO-04	M	M	S	L	S	M	S
CO-05	S	S	S	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Implementation of symbol table.
2. Develop a lexical analyzer to recognize a few patterns in C (ex. Identifiers, constants, comments, operators etc.)
3. Implementation of lexical analyzer using lex tool
4. Convert the BNF rules into YACC form and write code to generate abstract syntax tree.
5. Generate YACC specification for a few syntactic categories.
 - a. Program to recognize a valid arithmetic expression that uses operator +, -, * and /.
 - b. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
 - c. Program to recognize a valid control structures syntax of C language (For loop, while loop, if-else, if-else-if, switch-case, etc.).
 - d. Implementation of calculator using LEX and YACC
6. Implement type checking using LEX and YACC.
7. Implement control flow analysis and data flow analysis.
8. Implement any one storage allocation strategies (heap, stack, static)
9. Construction of DAG
10. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)

TOTAL:45 PERIODS

PLATFORM NEEDED C for Windows/Linux, LEX & YACC tool for Linux

CS3280	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- Understand the design challenges in the cloud.
- Apply the concept of virtualization and its types.
- Experiment with virtualization of hardware resources and Docker
- Develop and deploy services on the cloud and set up a cloud environment.

Subject Code: CS3280 Subject Name: Cloud Computing Laboratory		
Course Outcome – Cos		Cognitive Skill
The students will be able to,		
CO-01	Understand the installation of Hypervisors and its types. Also understand how to create virtual machines with guest OS.	U, A
CO-02	Develop and deploy services on the cloud and set up a cloud environment.	A, E
CO-03	Apply the Virtualization for real-world applications	A

CO-04	Experience Docker with virtualization of hardware resources	A, An
CO-05	Create cloud organization using simulator and open-source software's.	A, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	S	S	S
CO-02	S	M	S	S	M	S	S
CO-03	M	S	S	S	L	M	S
CO-04	M	M	S	L	S	S	S
CO-05	S	S	S	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Install VirtualBox/VMware/ Equivalent open-source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Client-server communication between two virtual machine instances, execution of chat application.
3. Find a procedure to transfer the files from one virtual machine to another virtual machine.
4. Implementation of simple network protocols using open-source network controllers (like Open Daylight).
5. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open-Source cloud software's like Open stack, Eucalyptus, Open Nebula with Role-based access control
6. Creating and Executing Your First Container Using Docker.
7. Run a Container from Docker Hub
8. Implementation of various scheduling mechanisms using open-source cloud simulator.
9. Create a Cost-model for a web application using various services and do Cost-benefit analysis
10. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.
11. Install Google App Engine. Create a hello world app and other simple web applications using python/java.

TOTAL:45 PERIODS

PLATFORM NEEDED

VMware, Docker, Open Stack, Open Nebula, Eucalyptus, Oracle VirtualBox

SEMESTER VII

AI3205	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Vision and Introduction to IoT.
- Understand IoT Market perspective.
- Understand State of the Art – IoT protocols.
- Build simple IoT Systems using Arduino and Raspberry Pi.
- Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Subject Code:AI3205		Subject Name: Internet of Things	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Remember and Understand the fundamentals of IoT.		R,U
CO-02	Analyze the market perspective for IoT.		An
CO-03	Evaluate the different IoT protocols.		E
CO-04	Understand and design a PoC of an IoT system using Rasperry Pi/Arduino		U,A
CO-05	Analyze applications of IoT in real time scenario		R,An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO -A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	L	M	S	L	M	M	L
CO-02	L	S	L	L	M	S	S
CO-03	M	L	S	M	L	L	M
CO-04	S	L	L	S	M	M	L
CO-05	S	S	L	L	M	S	L

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: FUNDAMENTALS OF IoT**9**

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

Unit II: M2M TO IOT – A MARKET PERSPECTIVE**9**

Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit III: IOT PROTOCOLS**9**

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

Unit IV: BUILDING IoT WITH RASPBERRY PI & ARDUINO**9**

Building IOT with RASPBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

Unit V: CASE STUDIES AND REAL-WORLD APPLICATIONS**9**

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, First Edition, Academic Press, 2014.

REFERENCES

1. Arshdeep Bahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.

3. Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012.
5. Vijay Madiseti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, First Edition, VPT, 2014.
6. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, First Edition, A Press Publications, 2013.

MS3202	PRINCIPLES OF MANAGEMENT	L	T	P	C
		2	0	0	2

Objectives

- To introduce students to the basic concepts and functions of management.
- To understand the role and responsibilities of managers in various organizational settings.
- To develop an understanding of the planning, organizing, leading, and controlling functions of management.
- To examine the impact of management theories and practices on organizational performance.
- To equip students with the skills necessary to manage people and processes effectively in a technical environment.

Subject Code:MS3202		Subject Name: Principles of Management	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Define and explain the key concepts and functions of management.	R,U	
CO-02	Analyze the roles and responsibilities of managers in different organizational contexts.	An	
CO-03	Evaluate the effectiveness of different management theories and practices.	E	
CO-04	Apply planning, organizing, leading, and controlling principles to real-world scenarios.	U,A	
CO-05	Demonstrate management skills necessary for leading teams and projects in a technical environment.	R,An	

Unit I: Introduction to Management**7**

Definition, nature, and importance of management - Functions of management: Planning, Organizing, Leading, Controlling - Roles and skills of managers - Evolution of management thought: Classical, Behavioral, and Modern theories - Scientific Management (Taylor) - Administrative Theory (Fayol) - Human Relations Movement (Mayo) - Contemporary approaches (Systems Theory, Contingency Theory)

Unit II: Planning**5**

Nature and purpose of planning - Types of plans: Strategic, Tactical, Operational - Planning process and techniques - SWOT Analysis, SMART Goals, Scenario Planning - Decision making: Process, types, and tools- Rational Decision-Making Model - Bounded Rationality - Group Decision-Making Techniques (Brainstorming, Delphi Technique)

Unit III: Organizing**5**

Organizational structure and design - Types of organizational structures: Functional, Divisional, Matrix, Network - Authority, responsibility, and delegation - Coordination and communication within organizations - Formal and Informal Communication Channels - Role of Technology in Organizational Communication (Emails, Video Conferencing, Collaborative Tools)

Unit IV: Leading**7**

Leadership theories and styles - Trait Theory - Behavioral Theories (Ohio State Studies, Michigan Studies) - Contingency Theories (Fiedler's Model, Path-Goal Theory) - Transformational vs. Transactional Leadership - Motivation theories and practices, Maslow's Hierarchy of Needs, Herzberg's Two-Factor Theory, McClelland's Theory of Needs, Modern Approaches (Self-Determination Theory) -Group dynamics and team management - Stages of Team Development (Forming, Storming, Norming, Performing) - Managing Virtual Teams

Unit V: Controlling**6**

Nature and purpose of control - Control process and techniques, Establishing Standards, Measuring Performance, Correcting Deviations - Types of control: Feed forward, Concurrent, Feedback - Quality control and management, Total Quality Management (TQM), Six Sigma, Lean Management, Use of Data Analytics in Quality Control

TOTAL: 30 PERIODS**Recommended Textbooks (Latest Editions)**

1. Robbins, S. P., Coulter, M., & DeCenzo, D. A. (2020). Fundamentals of Management (11th ed.). Pearson.
2. Griffin, R. W. (2022). Management: Principles and Practices (12th ed.). Cengage Learning.
3. Jones, G. R., & George, J. M. (2021). Essentials of Contemporary Management (9th ed.). McGraw-Hill Education.

Reference Books (Latest Editions)

1. Daft, R. L. (2021). Management (14th ed.). Cengage Learning.
2. Bateman, T. S., & Snell, S. A. (2020). Management: Leading & Collaborating in a Competitive World (14th ed.). McGraw-Hill Education.
3. Schermerhorn, J. R. (2021). Management (14th ed.). Wiley.
4. Hill, C. W. L., Schilling, M. A., & Jones, G. R. (2020). Strategic Management: Theory & Cases (13th ed.). Cengage Learning.
5. Kinicki, A., & Williams, B. K. (2021). Management: A Practical Introduction (10th ed.). McGraw-Hill Education.

CS3281	DATA SCIENCE & ANALYTICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To develop data analytic code in python
- To be able to use python libraries for handling data
- To develop analytical applications using python
- To perform data visualization using plots

Subject Code: CS3281		Subject Name: DATA SCIENCE & ANALYTICS LABORATORY	
Course Outcome – Cos			Cognitive Skill
CO-01	Make use of the python libraries for data science		U
CO-02	Make use of the basic Statistical and Probability measures for data science.		An,U
CO-03	Present and interpret data using visualization packages in Python and R		U
CO-04	Perform descriptive analytics on the benchmark data sets using R		An
CO-05	Perform correlation and regression analytics on standard data sets using R		E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

LIST OF PROGRAMS

1. Basic plots using Matplotlib
2. Frequency distributions, Averages, Variability
3. Normal curves, Correlation and scatter plots, Correlation coefficient
4. Reading and writing different types of dataset.
5. Descriptive statistics
6. Visualizations
7. Correlation and Covariance
8. Regression

TOTAL:30 PERIODS

TOOLS NEEDED

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

SEMESTER VIII

CS3216	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand big data.
- To learn Mapreduce analytics using Hadoop.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics

Subject Code: CS3216		Subject Name: Big Data Analytics	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Identify the importance of Big Data and Hadoop	U	
CO-02	Access and Process Data on Distributed File System	A	
CO-03	Manage Job Execution in Hadoop Environment	A, An	
CO-04	Develop Big Data Solutions by setting up Hadoop cluster	U	
CO-05	Apply Big Data using Tools	A	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	M	S	S
CO-02	S	S	S	S	M	M	M
CO-03	S	S	S	S	M	S	S
CO-04	M	S	S	S	M	S	S
CO-05	S	S	S	S	L	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: INTRODUCTION TO BIG DATA AND HADOOP

9

Introduction to BigData Platform – Challenges of Conventional Systems – Intelligent data analysis - Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools.

Unit II: HDFS**9**

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications-Algorithms using map reduce.

Unit III: HADOOP**9**

History of Hadoop - The Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS- How Map Reduce Works-Anatomy of a Map Reduce Job runFailures- Job Scheduling-Shuffle and Sort – Task execution – Map Reduce Features

Unit IV: HADOOP CLUSTER**9**

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance

Unit V: APPLICATIONS**9**

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - Fundamentals of HBase and ZooKeeper.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

REFERENCES

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press, 2013.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media 2013, Oracle press.

ELECTIVE I

CS32A1	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

Subject Code: CS32A1		Subject Name: Data Warehousing And Data Mining	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand data warehouse concepts, architecture, business analysis and tools.		U

CO-02	Remember and Understand data pre-processing and data visualization techniques	R,U
CO-03	Analyze and Evaluate algorithms for finding hidden and interesting patterns in data.	An,E
CO-04	Understand and analyze various classification and clustering techniques.	U, An
CO-05	Apply various data mining techniques using WEKA tool.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	S	L	M
CO-02	M	M	S	S	S	S	L
CO-03	M	M	S	S	S	M	M
CO-04	S	S	S	S	S	M	L
CO-05	S	S	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Data Warehousing

9

Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

Unit II: Data Mining

9

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

Unit III: Data Mining – Frequent Pattern Analysis

9

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

Unit IV: Classification and clustering

9

Classification – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines- Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods- Clustering High Dimensional Data

Unit V:Weka Tool**9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database -Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association-rule learners.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

REFERENCES

1. Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining and OLAP, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition, 2005

CS32A2	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

Subject Code: CS32A2Subject Name: Recommender Systems		
Course Outcome – COs		Cognitive Skill
At the end of the course students should be able to,		
CO-01	Understand the basic concepts of recommender systems.	R,U
CO-02	Implement machine-learning and data-mining algorithms in recommender systems data sets.	A
CO-03	Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.	An
CO-04	Design and implement a simple recommender system.	E
CO-05	Learn about advanced topics of recommender systems.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	S	S	S	L	L
CO-02	L	M	S	S	S	L	N
CO-03	M	S	S	S	S	L	L
CO-04	S	M	S	S	S	L	M
CO-05	L	L	S	S	S	L	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: INTRODUCTION

9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

Unit II: CONTENT-BASED RECOMMENDATION SYSTEMS

9

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

Unit III: COLLABORATIVE FILTERING

9

A systematic approach, Nearest-neighbour collaborative filtering (CF), user-based and item-based CF, components of neighbourhood methods (rating normalization, similarity weight computation, and neighbourhood selection)

Unit IV: ATTACK-RESISTANT RECOMMENDER SYSTEMS

9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

Unit V: EVALUATING RECOMMENDER SYSTEMS

9

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

TOTAL: 45 PERIODS

TEXT BOOKS

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press First Edition, 2011.

REFERENCES

1. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, First Edition, Springer 2011.

2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, Third Edition, Cambridge University Press, 2020

CS32A3	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

AIM

To explore the different techniques in Data Science for drawing useful conclusions from large and diverse data sets through exploration, prediction, and inference.

OBJECTIVES

- To obtain a comprehensive knowledge of various tools and techniques for Data transformation and visualization
- To learn the probability and probabilistic models of data science
- To learn the basic statistics and testing hypothesis for specific problems
- To learn about the prediction models

Subject Code: CS32A3 Subject Name: FOUNDATIONS OF DATA SCIENCE		
Course Outcome – Cos		Cognitive Skill
CO-01	Understand the fundamental concepts of data science	R,U
CO-02	Evaluate the data analysis techniques for applications handling large data	E
CO-03	Demonstrate the various machine learning algorithms used in data science process	U,An
CO-04	Understand the basic statistics and testing hypothesis for specific problems and different prediction models.	U
CO-05	Visualize and present the inference using various tools	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	S	S	S	L	L
CO-02	L	M	S	S	S	L	N
CO-03	M	S	S	S	S	L	L
CO-04	S	M	S	S	S	L	M
CO-05	L	L	S	S	S	L	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION

9

What is Data Science? Big Data and Data Science – Datafication - Current landscape of perspectives - Skill sets needed; Matrices - Matrices to represent relations between data,

and necessary linear algebraic operations on matrices -Approximately representing matrices by decompositions (SVD and PCA); Statistics: Descriptive Statistics: distributions and probability - Statistical Inference: Populations and samples - Statistical modeling - probability distributions - fitting a model - Hypothesis Testing - Intro to R/ Python.

UNIT II DATA PREPROCESSING

9

Data cleaning - data integration - Data Reduction Data Transformation and Data Discretization.Evaluation of classification methods – Confusion matrix, Students T-tests and ROC curves-Exploratory Data Analysis - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA - The Data Science Process.

UNIT III BASIC MACHINE LEARNING ALGORITHMS

9

Association Rule mining - Linear Regression- Logistic Regression - Classifiers - k-Nearest Neighbors (k-NN), k-means -Decision tree - Naive Bayes- Ensemble Methods - Random Forest. Feature Generation and Feature Selection - Feature Selection algorithms - Filters; Wrappers; Decision Trees; Random Forests.

UNIT IV CLUSTERING

9

Choosing distance metrics - Different clustering approaches - hierarchical agglomerative clustering, k-means (Lloyd's algorithm), - DBSCAN - Relative merits of each method - clustering tendency and quality.

UNIT V DATA VISUALIZATION

9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Cathy O'Neil and Rachel Schutt, “Doing Data Science, Straight Talk From The Frontline”, O'Reilly, 2014.
2. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining: Concepts and Techniques”, Third Edition. ISBN 0123814790, 2011.
3. Mohammed J. Zaki and Wagner Miera Jr, “Data Mining and Analysis: Fundamental Concepts and Algorithms”, Cambridge University Press, 2014.
4. Matt Harrison, “Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization”, O'Reilly, 2016.
5. Joel Grus, “Data Science from Scratch: First Principles with Python”, O'Reilly Media, 2015.
6. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O'Reilly Media, 2012.

REFERENCES

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014.
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.

4. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
5. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.

CS32A4	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

Subject Code: CS32A4		Subject Name: Image and Video Analytics	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the basics of image processing techniques for computer vision and video analysis.	U	
CO-02	Explain the techniques used for image pre-processing.	U,R	
CO-03	Develop various object detection techniques.	A	
CO-04	Understand the various face recognition mechanisms.	U	
CO-05	Elaborate on deep learning-based video analytics.	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO -A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	L	S	S	S	M	M
CO-02	M	M	S	S	M	S	S
CO-03	L	M	S	S	M	S	M
CO-04	L	M	S	S	M	S	S
CO-05	S	M	S	S	L	M	L

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION**9**

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

Unit II: IMAGE PRE-PROCESSING**9**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

Unit III: OBJECT DETECTION USING MACHINE LEARNING**9**

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures.

Unit IV: FACE RECOGNITION AND GESTURE RECOGNITION**9**

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recognition.

Unit V: VIDEO ANALYTICS**9**

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem- RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture- Improvement in Inception v2-Video analytics-RestNet and Inception v3.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
3. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
4. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press,2012.

ELECTIVE II

CS32A5	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

Subject Code: CS32A5		Subject Name: Neural Networks and Deep Learning	
Course Outcome – COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Apply Convolution Neural Network for image processing.		A
CO-02	Understand the basics of associative memory and unsupervised learning networks.		U
CO-03	Apply CNN and its variants for suitable applications.		A
CO-04	Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.		An
CO-05	Apply autoencoders and generative models for suitable applications.		A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO -A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	M	S	S	S	S	S
CO-02	S	L	S	S	S	S	M
CO-03	S	S	S	S	S	S	S
CO-04	S	S	S	S	S	S	S
CO-05	L	L	S	S	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: INTRODUCTION**9**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

Unit II: ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS**9**

Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

Unit III: THIRD-GENERATION NEURAL NETWORKS**9**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

Unit IV: DEEP FEEDFORWARD NETWORKS**9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

Unit V: RECURRENT NEURAL NETWORKS**9**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
2. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021

REFERENCES

1. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.

3. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, First Edition, 2018.
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.
5. S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications”, PHI Learning, 2017.
6. James A Freeman, David M S Kapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.

CS32A6	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

Subject Code:		Subject Name: App Development	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Develop Native applications with GUI Components.		A
CO-02	Develop hybrid applications with basic event handling.		An,A
CO-03	Implement cross-platform applications with location and data storage capabilities.		A
CO-04	Implement cross platform applications with basic GUI and event handling.		U,A
CO-05	Develop web applications with cloud database access.		A,An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	S	S	L	S	L
CO-02	M	S	S	S	M	M	S
CO-03	M	M	S	S	L	M	M
CO-04	S	L	S	S	L	S	L
CO-05	S	S	S	S	L	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION**9**

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design.

Unit II: NATIVE APP DEVELOPMENT USING JAVA**9**

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props.

Unit III: HYBRID APP DEVELOPMENT**9**

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

Unit IV: CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE**9**

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross-platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props.

Unit V: NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS**9**

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition, 2015
2. Apache Cordova in Action, Raymond K. Camden, Manning Publication, 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing, 2019

REFERENCES

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition, 2015
2. Native Mobile Development by Shaun Lewis, Mike Dunn, 2019
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras, 2016
4. Apache Cordova 4 Programming, John M Wargo, 2015
5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition, 2019.

CS32A7	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

Subject Code: CS32A7		Subject Name: Software Testing and Automation	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the basic concepts of software testing and the need for software testing	U	
CO-02	Design Test planning and different activities involved in test planning	R	
CO-03	Design effective test cases that can uncover critical defects in the application	A	
CO-04	Carry out advanced types of testing	A,An	
CO-05	Automate the software testing using Selenium and TestNG	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	L	M	M
CO-02	M	S	S	S	M	L	L
CO-03	M	M	S	S	S	L	L
CO-04	M	L	S	S	L	L	S
CO-05	M	M	S	S	S	L	L

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: FOUNDATIONS OF SOFTWARE TESTING

9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

Unit II: TEST PLANNING**9**

The Goal of Test Planning, High Level Expectations, Inter-group Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

Unit III: TEST DESIGN AND EXECUTION**9**

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

Unit IV: ADVANCED TESTING CONCEPTS**9**

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

Unit V: TEST AUTOMATION AND TOOLS**9**

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

REFERENCES

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing.

CS32A8	DEVOPS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

Subject Code: CS32A8		Subject Name: DevOps	
Course Outcome – COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand different actions performed through Version control tools like Git. 132	U	
CO-02	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle	U,R	
CO-03	Ability to Perform Automated Continuous Deployment	A	
CO-04	Ability to do configuration management using Ansible	A,An	
CO-05	Understand to leverage Cloud-based DevOps tools using Azure DevOps	U,R	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	S	S	S
CO-02	S	S	S	S	S	S	L
CO-03	S	S	M	S	S	L	S
CO-04	S	M	M	M	M	M	S
CO-05	S	S	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION TO DEVOPS

9

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github

Unit II: COMPILE AND BUILD USING MAVEN & GRADLE 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle

Unit III: TEST DESIGN AND EXECUTION 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

Unit IV: CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

Unit V: BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

TOTAL: 45 PERIODS

TEXT BOOKS

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014

REFERENCES

1. Hands-On Azure Devops: Cidc Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. MariotTsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.
5. <https://www.jenkins.io/user-handbook.pdf>
6. <https://maven.apache.org/guides/getting-started/>

Elective III

CS32A9	VIRTUAL REALITY	L	T	P	C
		3	0	0	3

OBJECTIVES

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

Subject Code: CS32A9		Subject Name: Virtual Reality	
Course Outcome – COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the basic concepts of VR	U	
CO-02	Understand the tools and technologies related to VR	U	
CO-03	Know the Content Creation Considerations for VR	U, R	
CO-04	Design of various models of VR on Web and Mobile	A	
CO-05	Develop VR applications in different domains	A, An	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	M	M	L	M	M
CO-02	M	L	L	M	M	M	M
CO-03	S	M	M	M	L	S	M
CO-04	S	M	S	M	M	S	S
CO-05	S	M	M	M	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION

9

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

UNIT II: VR DEVELOPMENT PROCESS**9**

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

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

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

UNIT IV: VR ON THE WEB AND VR ON THE MOBILE**9**

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

UNIT V: APPLICATIONS**9**

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

TOTAL : 45 PERIODS**TEXT BOOKS:**

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

REFERENCES:

1. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; First Edition, 2016.
2. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; First Edition, 2015.
3. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, O'Reilly Media; First Edition, 2014.
4. Learning Three.js: The JavaScript 3D Library for WebGL - Second Edition, Jos Dirksen, Packt Publishing - ebooks Account; 2nd Revised ed. Edition 2015.

CS32B1	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To grasp the fundamental knowledge of multimedia elements and systems.
- To get familiar with Multimedia file formats and standards.
- To learn the process of authoring multimedia presentations.
- To learn the techniques of animation in 2D and 3D and for the mobile UI.
- To explore different popular applications of multimedia.

Subject Code: CS32B1		Subject Name: Multimedia and Animation	
Course Outcome – COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Get the bigger picture of the context of Multimedia and its applications		U
CO-02	Use the different types of media elements of different formats on content pages		R
CO-03	Author 2D and 3D creative and interactive presentations for different target multimedia applications.		A
CO-04	Use different standard animation techniques for 2D, 2 1/2 D, 3D applications		A
CO-05	Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,		U, A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	N	M	M	M	M	S	S
CO-02	S	M	L	L	M	S	M
CO-03	S	M	M	M	M	M	S
CO-04	S	S	M	M	M	M	S
CO-05	S	S	M	M	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION TO MULTIMEDIA

9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II: MULTIMEDIA FILE FORMATS AND STANDARDS

9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III: MULTIMEDIA AUTHORIZING

9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV: ANIMATION**9**

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V: MULTIMEDIA APPLICATIONS**9**

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia”, Third Edition, Springer Texts in Computer Science, 2021.

REFERENCES

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling& Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, “Multimedia Computing”, Cambridge University Press, 2018.
3. Prabhat K.Andleigh, Kiran Thakrar, “Multimedia System Design”, Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, “Multimedia Cloud Computing Systems”, Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, “3D Graphics and Animation”, Second Edition, New Riders, 2002.
6. Rogers David, “Animation: Master – A Complete Guide (Graphics Series)”, Charles River Media, 2006.
7. Rick parent, “Computer Animation: Algorithms and Techniques”, Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, “UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native”, Packt Publishing, 2022.

CS32B2	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

Subject Code: CS32B2		Subject Name: Video Creation and Editing	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Compare the strengths and limitations of Nonlinear editing.	An	
CO-02	Identify the infrastructure and significance of storytelling.	U, R	
CO-03	Apply suitable methods for recording to CDs and VCDs.	A	
CO-04	Address the core issues of advanced editing and training techniques.	A	
CO-05	Address the core issues of advanced editing and training techniques.	A, E	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	L	M	L	S	M
CO-02	L	S	L	M	M	M	L
CO-03	M	L	M	L	M	M	S
CO-04	S	M	L	M	M	S	M
CO-05	S	S	M	M	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: FUNDAMENTALS

9

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

Unit II: STORYTELLING

9

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

Unit III: USING AUDIO AND VIDEO

9

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

Unit IV: WORKING WITH FINAL CUT PRO

9

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

Unit V: WORKING WITH AVID XPRESS DV 4**9**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003.

CS32B3	COMPUTER VISION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection.
- To become familiar with feature based alignment and motion estimation.
- To develop skills on 3D reconstruction.
- To understand image based rendering and recognition.

Subject Code: CS32B3		Subject Name: Computer Vision	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	To understand basic knowledge, theories and methods in image processing and computer vision.		U
CO-02	To implement basic and some advanced image processing techniques in OpenCV.		A
CO-03	To apply 2D a feature-based based image alignment, segmentation and motion estimations.		A
CO-04	To apply 3D image reconstruction techniques.		U
CO-05	To design and develop innovative image processing and computer vision applications.		An, E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	M	M	L	M	M
CO-02	S	M	M	M	M	M	S

CO-03	S	M	M	M	L	S	S
CO-04	S	M	S	M	M	S	M
CO-05	S	M	M	M	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

Unit II: FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

Unit III: FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

Unit IV: 3D RECONSTRUCTION 9

Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos.

Unit V: IMAGE-BASED RENDERING AND RECOGNITION 9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCES

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

CS32B4	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

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

Subject Code:CS32B4		Subject Name: Optimization Techniques	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Formulate and solve linear programming problems (LPP).	R,U	
CO-02	Evaluate Integer Programming Problems, Transportation and Assignment Problems.	A	
CO-03	Obtain a solution to network problems using CPM and PERT techniques.	An	
CO-04	Able to optimize the function subject to the constraints.	E	
CO-05	Identify and solve problems under Markovian queuing models.	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO						
	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	L	L	M
CO-02	S	L	S	S	M	S	M
CO-03	M	S	S	S	S	M	S
CO-04	M	M	S	S	L	S	L
CO-05	M	L	S	S	S	M	L

T-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: LINEAR MODELS

9

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

UNIT II: INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS⁹

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

UNIT III: PROJECT SCHEDULING**9**

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

UNIT IV: CLASSICAL OPTIMIZATION THEORY**9**

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

UNIT V: QUEUING MODELS**9**

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

TOTAL: 45 PERIODS**TEXT BOOKS**

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

REFERENCES

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

ELECTIVE IV

CS32B5	CLOUD SERVICES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
- Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.
- Solve the real world problems using cloud services and technologies.

Subject Code: CS32B5		Subject Name: Cloud Services Management
Course Outcome – Cos At the end of the course students should be able to,		Cognitive Skill
CO-01	Understand Cloud Service Management terminology, definition & concepts	U
CO-02	Analyze cloud service management with traditional IT service management	An
CO-03	Apply the strategies to reduce risk and eliminate issues associated with adoption of cloud services	A
CO-04	Select appropriate structures for designing, deploying and running cloud-based services in a business environment	E
CO-05	Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems	An, E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO - A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	L	L	M	M	L	M	M
CO-02	M	L	L	M	M	M	M
CO-03	S	M	M	M	L	S	S
CO-04	S	M	S	M	M	S	M
CO-05	S	M	M	M	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: CLOUD SERVICE MANAGEMENT FUNDAMENTALS

9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

Unit II: CLOUD SERVICES STRATEGY

9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

Unit III: CLOUD SERVICE MANAGEMENT

9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

Unit IV: CLOUD SERVICE ECONOMICS**9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

Unit V: CLOUD SERVICE GOVERNANCE & VALUE**9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications, 2020.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour, 2017.

REFERENCES

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing, 2020.
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi, 2013.

CS32B6	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- Characterize the functionalities of logical and physical components of storage.
- Describe various storage networking technologies.
- Identify different storage virtualization technologies.
- Discuss the different backup and recovery strategies.
- Understand common storage management activities and solutions.

Subject Code: CS32B6		Subject Name: Storage Technologies	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.	U, R	
CO-02	Illustrate the usage of advanced intelligent storage systems and RAID.	A	
CO-03	Interpret various storage networking architectures - SAN, including storage subsystems and virtualization.	An	

CO-04	Examine the different role in providing disaster recovery and remote replication technologies.	E
CO-05	Infer the security needs and security measures to be employed in information storage management.	An, E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	M	M	L	M	M
CO-02	M	L	L	M	M	M	M
CO-03	S	M	M	M	L	S	S
CO-04	S	M	S	M	M	S	M
CO-05	S	M	M	M	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: STORAGE SYSTEMS

9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

Unit II: INTELLIGENT STORAGE SYSTEMS AND RAID

9

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale-out storage Architecture.

Unit III: STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

9

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

Unit IV: BACKUP, ARCHIVE AND REPLICATION**9**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

Unit V: SECURING STORAGE INFRASTRUCTURE**9**

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. EMC Corporation, Information Storage and Management, Wiley, India, 2012.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, 2017.
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

CS32B7	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the need for SDN and its data plane operations.
- To understand the functions of control plane.
- To comprehend the migration of networking functions to SDN environment.
- To explore various techniques of network function virtualization.
- To comprehend the concepts behind network virtualization.

Subject Code: CS32B7		Subject Name: Software Defined Networks	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Describe the motivation behind SDN		R
CO-02	Identify the functions of the data plane and control plane		A
CO-03	Design and develop network applications using SDN		A, E
CO-04	Orchestrate network services using NFV		A
CO-05	Explain various use cases of SDN and NFV		A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	M	M	L	M	L
CO-02	M	L	L	M	M	M	S
CO-03	S	M	M	M	M	S	S
CO-04	M	M	M	S	M	S	S
CO-05	S	M	M	M	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: SDN: INTRODUCTION

9

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane.

Unit II: SDN DATA PLANE AND CONTROL PLANE

9

Data Plane functions and protocols - OpenFlow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers.

Unit III: SDN APPLICATIONS

9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking.

Unit IV: NETWORK FUNCTION VIRTUALIZATION

9

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture.

Unit V: NFV FUNCTIONALITY

9

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV.

TOTAL : 45 PERIODS

TEXT BOOKS

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.

REFERENCES

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kaufman, 2016.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.

5. Oswald Coker, Siamak Azodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

CS32B8	STREAM PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Introduce data processing terminology, definition & concepts.
- Define different types of data processing.
- Explain the concepts of real-time data processing.
- Select appropriate structures for designing and running real-time data services in a business environment.
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems.

Subject Code: CS32B8		Subject Name: Stream Processing	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the applicability and utility of different streaming algorithms.	U	
CO-02	Describe and apply current research trends in data-stream processing.	A	
CO-03	Analyze the suitability of stream mining algorithms for data stream systems.	An	
CO-04	Program and build stream processing systems, services and applications.	E	
CO-05	Solve problems in real-world applications that process data streams.	An, E	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	L	M	L	M	M
CO-02	S	L	L	M	M	S	S
CO-03	S	M	M	M	L	S	S
CO-04	S	M	S	M	M	S	M
CO-05	S	M	M	M	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: FOUNDATIONS OF DATA SYSTEMS**9**

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges.

Unit II: REAL-TIME DATA PROCESSING**9**

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage.

Unit III: DATA MODELS AND QUERY LANGUAGES**9**

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many-to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL.

Unit IV: EVENT PROCESSING WITH APACHE KAFKA**9**

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

Unit V: REAL-TIME PROCESSING USING SPARK STREAMING**9**

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication, 2018.
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media, 2017.
3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing, 2017.

REFERENCES

1. <https://spark.apache.org/docs/latest/streaming-programming-guide.html>
2. [Kafka.apache.org](https://kafka.apache.org)

ELECTIVE V

CS32B9	ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To practice tools to perform ethical hacking to expose the vulnerabilities
- To explore the options for network protection
- To understand hacking options available in Web and wireless applications
- To expose the enumeration and vulnerability analysis methods
- To explore different foot printing, reconnaissance and scanning methods
- To understand the basics of computer-based vulnerabilities

Subject Code: CS32B9		Subject Name: Ethical Hacking	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	To express knowledge on basics of computer-based vulnerabilities		R, U
CO-02	Ability to gain understanding on different foot printing, reconnaissance and scanning methods.		U, A
CO-03	To demonstrate the enumeration and vulnerability analysis methods		A
CO-04	To gain knowledge and analyze hacking options available in Web and wireless applications		U, An
CO-05	To acquire knowledge on the options for network protection and use tools to perform ethical hacking to expose the vulnerabilities.		E

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO - A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	M	S	S	M	M	S	S
CO-02	S	M	S	M	M	S	S
CO-03	M	M	S	L	M	S	M
CO-04	M	S	S	M	L	S	S
CO-05	S	L	S	L	S	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Introduction

9

Ethical Hacking Overview - Role of Security and Penetration Testers- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing - Network and Computer Attacks -

Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

Unit II: Foot Printing, Reconnaissance and Scanning Networks

9

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

Unit III: Enumeration and Vulnerability Analysis

9

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

Unit IV: System Hacking

9

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – WardrivingWireless Hacking - Tools of the Trade.

Unit V: Network Protection Systems

9

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

CS32C1	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory
- To understand authentication and Hash functions.

- To know the network security tools and applications.
- To understand the system level security used.

Subject Code: CS32C1		Subject Name: Cryptography and Network Security
Course Outcome – Cos		Cognitive Skill
CO-01	Remember the basic concepts of networks and to know the methods of conventional encryption.	R
CO-02	Understand the concepts of public key encryption and number theory	U
CO-03	Apply the different cryptographic operations of symmetric cryptographic algorithms.	A
CO-04	Apply the different cryptographic operations of public key cryptography and Analyze the algorithm.	A, An
CO-05	Apply the various Authentication schemes to simulate different applications. Understand various Security practices and System security standards	A,U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	L	S	L	M	L
CO-02	L	M	S	S	S	S	S
CO-03	M	N	M	S	N	S	S
CO-04	L	S	S	L	L	M	N
CO-05	N	S	L	L	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I INTRODUCTION 9

OSI Security Architecture - Classical Encryption techniques – Cipher Principles – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality

UNIT II PUBLIC KEY CRYPTOGRAPHY 9

Key Management - Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography - Introduction to Number Theory – Confidentiality using Symmetric Encryption – Public Key Cryptography and RSA.

UNIT III AUTHENTICATION AND HASH FUNCTION 9

Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm – RIPE MD – HMAC Digital Signatures – Authentication Protocols – Digital Signature Standard

UNIT IV APPLICATION LAYER SECURITY 9

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail.
Wireless Network Security: Mobile Device Security.

UNIT V SECURITY PRACTICES

9

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

TOTAL: 45 PERIODS

TEXT BOOK

1. William Stallings, “Cryptography And Network Security – Principles and Practices”, Pearson Education, Seventh Edition, 2016.

REFERENCES

1. Behrouz A. Foruzan, Cryptography and Network Security, Third Edition, Tata McGraw Hill 2015.
2. Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Third Edition, Pearson Education, 2003.

CS32C2	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about Modern Cryptography
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

Subject Code: CS32C2		Subject Name: Modern Cryptography	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	To learn about Modern Cryptography		R, U
CO-02	To focus on how cryptographic algorithms and protocols work and how to use them.		A
CO-03	To build a Pseudorandom permutation.		A, An
CO-04	To construct Basic cryptanalytic techniques.		E
CO-05	To provide instruction on how to use the concepts of block ciphers and message authentication codes.		A, E

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	S	S	L	S
CO-02	S	S	S	S	M	M	M
CO-03	L	L	S	S	M	M	M
CO-04	S	L	S	S	M	S	M
CO-05	M	S	S	S	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Introduction

9

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

Unit II: Formal Notions of Attacks

9

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM-CCA2, Inter-relations among the attack model.

Unit III: Random Oracles

9

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo-random Functions (PRF)

Unit IV: Building a Pseudorandom Permutation

9

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

Unit V: Message Authentication Codes

9

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes:

TOTAL : 45 PERIODS

TEXT BOOKS

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag.

2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCES

1. Shaffi Goldwasser and Mihir Bellare, Lecture Notes on Cryptography, Available at <http://citeseerx.ist.psu.edu/>.
2. Oded Goldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23.
3. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006.

CS32C3	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the importance and need for software security.
- To know about various attacks.
- To learn about secure software design.
- To understand risk management in secure software development.
- To know the working of tools related to software security.

Subject Code: CS32C3		Subject Name: Engineering Secure Software Systems	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Identify various vulnerabilities related to memory attacks.		R, U
CO-02	Apply security principles in software development.		A
CO-03	Evaluate the extent of risks.		An, E
CO-04	Involve selection of testing techniques related to software security in the testing phase of software development.		E
CO-05	Use tools for securing software.		A, E, S

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	L	L	S
CO-02	M	S	S	S	M	M	M
CO-03	M	L	S	S	S	M	M

CO-04	S	S	S	S	M	S	M
CO-05	M	S	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Need of Software Security and Low-Level Attacks

9

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory-Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

Unit II: Secure Software Design

9

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating the Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modelling and Security Design Principles

Unit III: Security Risk Management

9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

Unit IV: Security Testing

9

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing with Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client-Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing

Unit V: Secure Project Management

9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL : 45 PERIODS

TEXT BOOKS

1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012.

REFERENCES

1. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012.
2. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing, 2012.

ELECTIVE VI

CS32C4	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES

- The primary objective is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

Subject Code: CS32C4		Subject Name: Digital Marketing	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Examine and explore the role and importance of digital marketing in today's rapidly changing business environment.	An	
CO-02	Analyze how digital marketing can be utilized by organizations and how its effectiveness can be measured.	A	
CO-03	Understand the key elements of a digital marketing strategy.	U	
CO-04	Study how the effectiveness of a digital marketing campaign can be measured	U	
CO-05	Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.	An, E	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P O - A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	L	S	M	M	L	S	S
CO-02	S	M	M	M	L	M	S
CO-03	L	M	M	M	L	S	L
CO-04	S	M	S	M	M	S	M
CO-05	S	M	M	M	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: INTRODUCTION TO ONLINE MARKET

9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

Unit II: SEARCH ENGINE OPTIMISATION

9

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

Unit III: E- MAIL MARKETING**9**

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns- Profiling and targeting.

Unit IV: SOCIAL MEDIA MARKETING**9**

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

Unit V: DIGITAL TRANSFORMATION**9**

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition, 2017.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press, 2015.
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition , 2017.
4. Ryan, D, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited, 2014.

REFERENCES

1. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning, 2017.
2. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education, 2015.

CS32C5	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To attain knowledge in Cost Management process and Costing System.
- Ability to understand the basic concepts of Project planning, execution, and cost control.
- Discuss about Various types of costs and its behaviour along with Quality Management
- Identify various types of Budgets involved in Cost Management process
- Broaden the career potential of available techniques and problems available in Cost Management.

Subject Code: CS32C5		Subject Name: Cost Management of Engineering Projects	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Discuss various construction costs to manage a construction project.		U
CO-02	Summarize different construction activities and its application related to cost based on the field requirements.		I
CO-03	Identify Cost Behaviour of various types of cost and Quality Management		A
CO-04	Identifying various construction Budgets involved Cost Management process.		An
CO-05	Discussing various types of Techniques and Problem-solving techniques involved in Construction		An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	S	L	S	S	M
CO-02	S	M	S	L	S	S	S
CO-03	M	S	S	L	S	S	S
CO-04	M	S	S	L	S	S	S
CO-05	M	S	S	L	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I INTRODUCTION

9

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost, Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit II PROJECT

9

Project: Meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit III PROFIT PLANNING**9**

Cost Behaviour and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Unit IV BUDGETARY CONTROL**9**

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit V QUANTITATIVE TECHNIQUES**9**

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TOTAL : 45 PERIODS**REFERENCES**

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster, Advanced Management Accounting.
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher.

CS32C6	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

Subject Code: CS32C6		Subject Name: Game Development	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Explain the concepts of 2D and 3d Graphics		R, U
CO-02	Design game design documents		U
CO-03	Implementation of gaming engines		An
CO-04	Survey gaming environments and frameworks		A, E
CO-05	Implement a simple game in Pygame		R, U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G
CO-01	S	M	L	L	L	M	S
CO-02	L	L	S	M	M	M	M
CO-03	L	L	L	M	L	L	M
CO-04	S	S	S	M	M	L	M
CO-05	S	S	S	M	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: 3D Graphics for Game Design

9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

Unit II: Game Design Principles

9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

Unit III: Game Engine Design

9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

Unit IV: Overview of Gaming Platforms and Frameworks

9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and multi-Player games.

Unit V: Game Development Using Pygame

9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley,2013.
2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress,2007.
3. Paul Craven, “Python Arcade games”, Apress Publishers,2016”.

REFERENCES

1. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press, 2006.
2. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

CS32C7	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

Subject Code: CS32C7		Subject Name: Exploratory Data Analysis	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the fundamentals of exploratory data analysis.		U,R
CO-02	Implement the data visualization using Matplotlib.		R
CO-03	Perform univariate data exploration and analysis.		A,An
CO-04	Apply bivariate data exploration and analysis.		A
CO-05	Use Data exploration and visualization techniques for multivariate and time series data.		R,A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO							
	P O - A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G
CO-01	S	M	S	S	S	S	S
CO-02	S	L	S	S	S	M	M
CO-03	S	S	S	S	S	S	S
CO-04	S	S	S	S	S	S	S
CO-05	L	L	S	S	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: EXPLORATORY DATA ANALYSIS**9**

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

Unit II: EDA USING PYTHON**9**

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.

Unit III: UNIVARIATE ANALYSIS**9**

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.

Unit IV: BIVARIATE ANALYSIS**9**

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.

Unit V: MULTIVARIATE AND TIME SERIES ANALYSIS**9**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES

2. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
3. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019.
4. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

OPEN ELECTIVE COURSES

CS32D1	INFORMATION TECHNOLOGY IN AGRICULTURAL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students to areas of agricultural systems in which IT and computers play a major role.
- To also expose the students to IT applications in precision farming, environmental control systems, agricultural systems management and weather prediction models.

Subject Code:		Subject Name: IT IN AGRICULTURAL SYSTEM	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	The students shall be able to understand the applications of IT in remote sensing applications such as Drones etc.		R,U
CO-02	The students will be able to get a clear understanding of how a greenhouse can be automated and its advantages.		A
CO-03	The students will be able to apply IT principles and concepts for management of field operations.		An
CO-04	The students will get an understanding about weather models, their inputs and applications.		E
CO-05	The students will get an understanding of how IT can be used for e-governance in agriculture.		A

S-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis
T-

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	M	S	S	S	S
CO-02	S	S	M	S	S	S	S
CO-03	M	S	M	M	S	S	S
CO-04	S	S	M	S	S	S	S
CO-05	M	S	M	S	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: PRECISION FARMING

9

Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

Unit II: ENVIRONMENT CONTROL SYSTEMS**9**

Artificial light systems, management of crop growth in greenhouses, simulation of CO₂ consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

Unit III: AGRICULTURAL SYSTEMS MANAGEMENT**9**

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.

Unit IV: WEATHER PREDICTION MODELS**9**

Importance of climate variability and seasonal forecasting, Understanding and predicting world's climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.

Unit V: E-GOVERNANCE IN AGRICULTURAL SYSTEMS**9**

Expert systems, decision support systems, Agricultural and biological databases, e-commerce, ebusiness systems & applications, Technology enhanced learning systems and solutions, e-learning, Rural development and information society.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. National Research Council, "Precision Agriculture in the 21st Century", National Academies Press, Canada, 1997.
2. H. Krug, Liebig, H.P. "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", 1989.

REFERENCES

1. Peart, R.M., and Shoup, W. D., "Agricultural Systems Management", Marcel Dekker, New York, 2004.
2. Hammer, G.L., Nicholls, N., and Mitchell, C., "Applications of Seasonal Climate", Springer, Germany, 2000.

CS32D2	RENEWABLE ENERGY SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Provide knowledge about various renewable energy technologies
- To enable students to understand and design a PV system.
- To provide knowledge about wind energy system.
- To Provide knowledge about various possible hybrid energy systems
- To gain knowledge about application of various renewable energy technologies

Subject Code:		Subject name: Renewable Energy System	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Attain knowledge about various renewable energy technologies		R,U

CO-02	Ability to understand and design a PV system.	A
CO-03	Understand the concept of various wind energy system.	An
CO-04	Gain knowledge about various possible hybrid energy systems.	E
CO-05	Attain knowledge about various application of renewable energy technologies	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	N	M	S	S	S	M
CO-02	S	M	M	S	S	S	M
CO-03	S	M	M	S	S	S	M
CO-04	S	M	M	S	S	S	M
CO-05	S	M	S	S	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I RENEWABLE ENERGY vs NON-RENEWABLE ENERGY 9

Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

UNIT II INTRODUCTION TO SOLAR ENERGY 9

Solar Radiation and its measurements, Solar Thermal Energy Conversion from plate Solar Collectors, Concentrating Collectors and its Types, Efficiency and performance of collectors,. Direct Solar Electricity Conversion from Photovoltaic, types of solar cells and its application of battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. Recent Advances in PV Applications: Building Integrated PV, Grid Connected PV Systems.

UNIT III INTRODUCTION TO WIND ENERGY 9

Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications.

UNIT IV INTRODUCTION TO BIO-ENERGY 9

Energy from biomass, Principle of biomass conversion technologies/process and their classification, Bio gas generation, types of biogas plants, selection of site for biogas plant,

classification of biogas plants, Advantage and disadvantages of biogas generation, thermal gasification of biomass, biomass gasifies, Application of biomass and biogas plants and their economics.

UNIT V OTHER TYPES OF ENERGY

9

Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini- hydel power plants and their economics.

TOTAL: 45 PERIODS

REFERENCES

1. Twidell&Wier, 'Renewable Energy Resources' CRC Press(Taylor & Francis), Second Edition, 2015.
2. Tiwari and Ghosal/ Narosa, 'Renewable energy resources: Basic Principles and Applications', 2004.
3. D.P.Kothari, K.C.Singhal, 'Renewable energy sources and emerging technologies', P.H.I.
4. D.S.Chauhan, S.K. Srivastava, 'Non – Conventional Energy Resources', New Age Publishers, 2006.
5. B.H.Khan, 'Non – Conventional Energy Resources', Tata Mc Graw Hill, 2006.

CS32D3	INTRODUCTION TO CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concepts in Cloud Computing and its Security
- To understand the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To explain and apply levels of services of Cloud
- To describe the security aspects in cloud.

Subject Code: CS32D3		Subject Name: Introduction to Cloud Computing	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the concepts in Cloud Computing and its Security	U	
CO-02	Understand the evolving computer model caned cloud computing.	A	
CO-03	Introduce the various levels of services that can be achieved by cloud.	A, An	
CO-04	Explain and apply levels of services of Cloud	U	
CO-05	Analyze the security aspects in cloud.	An	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	M	M	M	S	S
CO-02	S	S	M	M	M	M	M
CO-03	S	S	M	M	M	S	S
CO-04	M	S	M	M	M	S	S
CO-05	S	S	M	M	L	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: INTRODUCTION TO CLOUD COMPUTING

9

Cloud Computing Foundation: Introduction to Cloud Computing – Move to Cloud Computing – Types of Cloud – Working of Cloud Computing

Unit II: VIRTUALIZATION

9

Cloud Computing Architecture : Cloud Computing Technology – Cloud Architecture – Cloud Modeling and Design - Virtualization : Foundation – Grid, Cloud and Virtualization – Virtualization and Cloud Computing

Unit III: CLOUD SERVICES

9

Data Storage and Cloud Computing : Data Storage – Cloud Storage – Cloud Storage from LANs to WANs – Cloud Computing Services : Cloud Services – Cloud Computing at Work

Unit IV: CLOUD SECURITY

9

Cloud Computing and Security : Risks in Cloud Computing – Data Security in Cloud – Cloud Security Services – Cloud Computing Tools : Tools and Technologies for Cloud – Cloud Mashups – Apache Hadoop – Cloud Tools

Unit V: CLOUD APPLICATIONS

9

Cloud Applications – Moving Applications to the Cloud – Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services.

TOTAL : 45 PERIODS

TEXT BOOKS

1. A.Srinivasan and J.Suresh, “Cloud Computing – A Practical Approach for Learning and Implementation”, Pearson India Publications 2014.

REFERENCES

1. Rajkumar Buyya, James Broberg, Andrzej, “Cloud Computing: Principles and Paradigms”, Wiley India Publications 2011.
2. Arshdeep Bahga and Vijay Madisetti, “Cloud Computing – A Hands on Approach”, Universities Press (India) Pvt Ltd. 2014.

CS32D4	IOT CONCEPTS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To give a basic knowledge of IoT that paves a platform to understand physical and logical design of IOT
- To analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things (IoT).
- To explain how to code for an IoT application using Arduino/Raspberry Pi open platform.

Subject Code: CS32D4		Subject Name: IoT Concepts and Applications	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Remember and Understand the fundamentals of IoT.		R,U
CO-02	Understand the communication models and various protocols for IoT.		An
CO-03	Design portable IoT using Arduino/Raspberry Pi /open platform.		E
CO-04	Apply data analytics and use cloud offerings related to IoT.		U,A
CO-05	Analyze applications of IoT in real time scenario		R,An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	M	S	L	M	M	L
CO-02	L	S	L	L	M	S	S
CO-03	M	L	S	M	L	L	M
CO-04	S	L	L	S	M	M	L
CO-05	S	S	L	L	M	S	L

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION TO INTERNET OF THINGS

9

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT.

Unit II: COMPONENTS IN INTERNET OF THINGS**9**

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee, Wifi, GPS, GSM Modules)

Unit III: PROTOCOLS AND TECHNOLOGIES BEHIND IOT**9**

IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

Unit IV: OPEN PLATFORMS AND PROGRAMMING**9**

IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

Unit V: IOT APPLICATIONS**9**

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.
3. Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
4. Perry Lea, “Internet of things for architects”, Packt, 2018