



JECRCTM
UNIVERSITY
BUILD YOUR WORLD

School of Engineering

Syllabi and Course Structure

B. Tech. (Computer Science & Engineering)
(2023-2027)(2024-2028)
(Blockchain)
Academic Programmes

June 2024

The curriculum and syllabus for B.Tech. Program conforms to outcome based teaching learning process. In general, several outcomes have been identified and the curriculum and syllabus have been planned in such a way that each of the courses meets one or more of these outcomes. Student outcomes illustrate the students are expected to know and be able to do by the time of graduation. These relate to the skills, understanding, and behaviours that students acquire as they progress through the program. Further each course in the program brings out clear instructional objectives which are mapped to the student outcomes.

B.Tech. (CSE) Program Educational Objective (PEO's):

A graduate of the Computer Science and Engineering Program should:

PEO- I

Students will develop themselves as effective professionals by solving real problems through the use of computer science knowledge and with attention to team work, effective communication, critical thinking and problem solving skills.

PEO- II

Students will develop professional skills that prepare them for immediate employment and for life-long learning in advanced areas of computer science and related fields.

PEO- III

Students will demonstrate their ability to adapt to a rapidly changing environment by having learned and applied new skills and new technologies.

PEO- IV

Students will be provided with an educational foundation that prepares them for excellence, leadership roles along diverse career paths with encouragement to professional ethics and active participation needed for a successful career.

Program Outcome (PO's)

A graduate of the Computer Science and Engineering Program will demonstrate:

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

PO2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Culture, Values and Ethics: Understand the importance of culture and Values along with the implications it has on learning, teaching, engineering practice, identity, and enculturation as an engineer. Apply ethical principles being committed to professional ethics, responsibilities and norms of the engineering practice.

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

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome:

PSO1: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, cyber security, machine learning and networking for efficient design and automation of computer-based systems of varying complexity. (Professional Skills)

PSO2: The ability to apply standard and modern practices like Python, R language, automation and strategies in software project development using open-ended programming environments to deliver a quality product for business success. (Problem-Solving Skills)

PSO3: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths in the field of AI and Machine learning, Cloud Computing, Robotic automation, cyber security to be an entrepreneur, and a zest for higher studies.(Successful Career and Entrepreneurship)

Course Structure for 2023-2027 Batch

Semester I

Subject Code	Subject	Contact Hours L-T-P	Credits	
DEN001A	Communication Skills	2-0-0	2	F
DEN001B	Communication Skills Lab	0-0-2	1	F
<i>DMA001A</i>	<i>Engineering Mathematics-I *</i>	3-1-0	4	F
<i>DPH001A</i>	<i>Applied Physics</i>	3-0-0	3	F
<i>DCO013A</i>	<i>Computer Programming and Logical Thinking *</i>	3-0-0	3	F
<i>DPH002A</i>	<i>Applied Physics Lab</i>	0-0-2	1	F
<i>DME001A</i>	<i>Engineering Graphics-Auto Cad</i>	0-0-2	1	F
<i>DCO014A</i>	<i>Computer Programming and Logical Thinking Lab*</i>	0-0-2	1	F
JIC001A	Entrepreneurship Development-I	0-0-2	1	ID
<i>DIN001A</i>	<i>Culture Education – 1</i>	2-0-0	2	F
<i>DCH001A/ DLW001A</i>	<i>Environmental Sciences/Indian Constitution</i>	2-0-0	NC	F
	TOTAL	15-1-10	19	

* In semester I common to all sections

NC- Non Credit Course, It is mandatory to clear for completion of degree.

Semester II

Subject Code	Subject	Contact Hours L-T-P	Credits	
DEN002A	Professional Skills	2-0-0	2	F
DEN002B	Professional Skills Lab	0-0-2	1	F
<i>DMA002A</i>	<i>Engineering Mathematics-II **</i>	3-1-0	4	F
BCO550A	<i>Object Oriented Programming(Java Based)</i>	4-0-0	4	F
JIC002A	Entrepreneurship Development- II	0-0-2	1	ID
DCO006A	Engineering Workshop CSE	0-0-2	1	F
<i>DIN 002A</i>	<i>Culture Education – 2</i>	2-0-0	2	F
BCO551A	<i>Object Oriented Programming(Java Based)</i>	0-0-2	1	F
<i>DCH001A/D LW001A</i>	<i>Environmental Sciences/Indian Constitution</i>	2-0-0	NC	F
	TOTAL	13-1-8	17	

** In semester II common to all sections

B.Tech CSE III Semester

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs.	Credits	Type
1	BCO 011A	Computer Networks	3	1	0	4	4	C
2	BCO546A	Data Structures	4	0	0	4	4	C
3	BAS 007B	Discrete Mathematics	3	0	0	3	3	F
4	BCO 232A	Software Engineering and Project Management	3	0	0	3	3	F
5	BCO547A	Web Development	3	0	0	3	3	S
6	BCO 008B	Operating Systems	3	0	0	3	3	C
7	BCO548A	Data Structure Lab	0	0	2	2	1	C
8	BCO 014B	Operating Systems Lab	0	0	2	2	1	C
9	BCO549A	Web Development Lab	0	0	2	2	1	C
10	DEN 003A	Life Skills - 1 (Personality Development)	1	0	2	3	2	F
11	DIN 003A	Value Education and Ethics -1	1	0	0	1	1	F
		Total	21	1	8	23	26	

B.Tech CSE Semester IV

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs.	Credits	TYPE
1		Open Elective-I	3	0	0	3	3	ID
2	BCO552A	Cryptography	4	0	0	4	4	S
3	BCO 009B	Computer Organization and Design	3	0	0	3	3	C
	BCO553A	Algorithm Analysis & Design Techniques	4	0	0	4	4	S
4	BCO 010C	Database Management Systems	3	1	0	4	4	C
5	BCO094B/ BCO101A	Google Cloud Computing Fundamental/Salseforce	3	0	0	3	3	S
6	BCO 013B	Database Management Systems Lab	0	0	2	2	1	C
	BCO554A	Algorithm Analysis & Design Techniques Lab	0	0	2	2	1	S
7	BCO55A	CryptographyLab	0	0	2	2	1	C
8	DMA 003A	Soft Skills - 2 (Aptitude)	1	0	2	3	2	F
9	DIN 004A	Value Education and Ethics – 2	1	0	0	1	1	F
		Total	22	1	8	31	27	

B.Tech. CSE Semester V

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs.	Credits	Type
1	BCO 017A	Formal Languages & Automation Theory	3	1	0	4	4	C
2	BCO556A	Frontend Development (on React)	3	0	0	3	3	
3	BCO 007A	Computer Graphics	3	0	0	3	3	S
4	BCO557A	Blockchain and its Applications	3	0	0	3	3	S
7		Open Elective II	3	0	0	3	3	ID
8	BCO558A	Frontend Development (on React) Lab	0	0	2	2	1	S
9	BCO559A	Blockchain and its Applications lab	0	0	2	2	1	S
	BCO 015B	Computer Graphics Lab	0	0	2	2	1	S
		Total	15	1	6	22	19	

B.Tech CSE Semester VI

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs.	Credits	TYPE
1	BCO 028A	Compiler Construction	3	1	0	4	4	C
2	BCO560A	Backend Development (on Node)	3	0	0	3	3	S
3	BCO497A	Competitive Programming	3	0	0	3	3	S
	BCO498A	Smart Contract Development	4	0	0	4	4	S
4		Compiler Design Lab	0	0	2	2	1	C
5	BCO561A	Backend Development (on Node) lab	0	0	2	2	1	S
	BCO498A	Competitive Programming lab	0	0	2	2	1	S
	BCO 499A	Smart Contract Development Lab	0	0	2	0	0	1
6		Open Elective III	3	0	0	3	3	ID
7	BCO 074B	Minor Project	0	0	8	8	4	C
		Total	16	1	16	29	24	

B.Tech. CSE Semester VII

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs.	Credits	Type
1	BCO562A	Decentralized Applications	3	0	0	3	3	S
2	BCO ****	Department Elective 7	3	0	0	3	3	S
3	BCO ****	Department Elective 8	3	0	0	3	3	S
4	BCO519A	Project	0	0	6	6	3	C
5	BCO563A	Decentralized Applications lab	0	0	2	2	1	S
6	BCO ****	Department Elective 8 Lab	0	0	2	2	1	S
7	BCO 207A	Research Paper Writing	0	0	2	2	1	S
		Total	9	0	12	21	15	

B.Tech. CSE Semester VIII

S. No.	Code	Subject	L	T	P	Contact Hrs.	Credits	Type
1	BCO 034B	Industrial Project/Dissertation	0	0	20	20	20	C
		TOTAL	0	0	20	20	20	

B. Tech. (common to all disciplines)-I/II Semester

Contact Hours (L-T-P): 2-0-2

L-T-P	Communication Skills	Credits 2-0-1 3
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Course Objectives

1. To enhance English language competence in reading, writing, listening and speaking.
2. Switch the approach from teacher-centred to student-centred one.
3. Minimize the Grammar Translation Method of ELT while trying to replace it with Direct Method.
4. Introduce Communicative Method of ELT and focusing the teaching pedagogy on the student-centred learning rather than on the teacher-centred learning.
5. To link communication skills with the organizational behaviour.
6. To inculcate skills that are very much required for employability and adjust in the professional Environment.

Course Outcomes (CO):

At the end of this course students will have:

CO1: Ability to design a language component or process to meet desired need within realistic, Constraints such as economic, environmental, social, political, ethical, scenario

CO2: Ability to analyze the usage of English words in different contexts.

CO3: An understanding of technical and academic articles' comprehension.

CO4: The ability to present oneself at multinational levels knowing the type of different standards of English

Syllabus: Theory

UNIT 1	Basics of Organizational Communication: Communication: Meaning, Elements, Process, Types, Flows of Communication and Barriers to communication, basics of professional communication and professional ethics including Time-management, Respect for deadlines and corporate culture
UNIT 2	Basic Writing Skills: Parts of Speech, Elements of Sentences, Sentence types based on meaning and structure, Tenses, Voice, Narration
UNIT 3	Composition: , Basics of Letter Writing, Email Writing, Précis Writing, Essay Writing,
UNIT 4	Vocabulary Building: Word Formation from one word form to another, Origin of Words, Affixes, Synonyms, Antonyms
UNIT 5	Professional and Technical Communication : Basics of Drafting a CV/Resume, Basics of Telephonic Interview and Online Interview, Basics of PPT presentation

Syllabus: Lab

UNIT 1	Basics of Organizational Communication: Role Plays and presentations related to different corporate related matters- How to greet, how to deny politely, how to handle different types of problems related to the types of communication, how to avoid grapevine and use it in a positive manner, how to keep positive mindset during work pressure, Activities to teach Time-management, Following Deadlines etc
UNIT 2	Write Dialogue from the different contexts of corporate culture: Employee and Employer, Customer and Service Provider, Customer and Product Review, How to react on Day to day corporate interactions- Memo, Notice, Email, Circular etc
UNIT 3	Composition: , Letter Writing, Email Writing, Précis Writing, Essay Writing, Practice sessions by using Ms Word- Following the process of Drafting- Redrafting, Proof Reading, Editing etc
UNIT 4	Vocabulary Building: Word Formation from one word form to another, Origin of Words, Affixes, Synonyms, Antonyms- Using video clips and comprehension passages to find out the difference between words, similarity between words, origin of words, neologism concepts etc
UNIT 5	Professional and Technical Communication : Drafting a CV/Resume, Practice Sessions on Telephonic Interview and Online Interview, Presenting projects, proposals etc through PPT Making,

Methodology for Evaluation

1. Internal Assessment (Theory)
 - a) Home Assignments: One from each Unit : 15 Marks
 - b) In Semester Tests (Minimum two) : 30 Marks
 - c) Attendance : 05 Marks
2. Term End (Theory) : 50 Marks
3. Internal Assessment (Lab)
 - (a) Daily Performance in the Lab : 50 Marks
4. Term End (Lab) : 50 Marks

Suggested Reading:

- A.** Practical English Usage. Michael Swan. OUP. 1995
- B.** Remedial English Grammar. F.T. Wood. Macmillan. 2007
- C.** Raymond V. Lesikar and Marie E. Flatley. Basic Business Communication, Tata McGraw Hill Pub. Co. New Delhi. 2005. Tenth Edition.
- D.** On Writing Well. William Zinsser. Harper Resource Book. 2001
- E.** Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- F.** Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

- G.** Exercises in Spoken English. Parts. I-III, Hyderabad. Oxford University Press.
- H.** Syamala, V. Speak English in Four Easy Steps, Improve English Foundation Trivandrum: 2006
- I.** More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.
- J.** The BBC and British Council online resources

B. Tech. (common to all disciplines)-I Semester
Contact Hours (L-T-P): 3-1-0

BAS001C	Engineering Mathematics-I	3: 1: 0	4
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OBJECTIVE:

The objectives of this course are to make the students:

- To increase the student's appreciation of the basic role played by mathematics in modern technology.
- Incorporate the knowledge of advanced mathematics to support their concurrent and subsequent engineering studies.
- To develop the concepts and tools that will serve as building blocks towards tackling more advanced level of mathematics that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector

UNIT 1	Point of inflexion and curve tracing (Cartesian coordinates only), curvature, convexity, concavity, point of inflexion and curve tracing.
UNIT 2	Limit, continuity and partial derivatives, Euler's theorem on homogenous functions, total derivative, approximate calculations; Maxima and minima of two and more independent variables; Method of Lagrange multipliers.
UNIT 3	Beta and Gamma functions and their properties. Surface and volumes of solids of revolutions. Double integrals, change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes.
UNIT 4	Vectors covering, laws of vector algebra, operations- dot, cross, triple products; Vector function- limits, continuity and derivatives, geometric interpretation; Gradient, divergence and cur- formulae.
UNIT 5	Line integrals, simple connected regions, Line integrals, surface integrals, volume integral, Green's theorem, Stokes theorem and Gauss theorem.

Text Books:

1. B.V.Ramana, Higher Engineering Mathematics, Tata McGraw Hill, 2011.

Reference Books:

1. Erwin Kreyszig , Advanced Engineering Mathematics, Wiley 9th Edition, 2008
2. Maurice D. Weir and Joel Hass, Thomas Calculus, Pearson, 11th Edition, 2005.
3. Higher Engineering Mathematics- B. S. Grewal, Khanna Publications.

Course Outcomes

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

- CO1 Understand the concepts of Asymptotes, curvature and curve tracing.
- CO2 Understand the functions of more than one independent variable and calculate partial derivatives along with their applications .Also obtain an idea for finding the extreme values of functions of more the one variable.
- CO3 Will able to integrate a continuous function of two or three variables over a bounded region and able to trace the curves.
- CO4 Understand the representation of vector and its properties.
- CO5 Understand line integral, surface integrals, volume integral, Green’s theorem, Stokes theorem and Gauss theorem

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	H	H			M		M					M	H	L	
CO2		M		L	M		H				L	M	M		
CO3	H	H		M	M		H			L		M	M	M	
CO4	H	M		M	L		M					M		M	
CO5	H	H			M		H					M	H	M	

H = Highly Related; M = Medium L = Low

B. Tech. (common to all disciplines)-I/II Semester**Contact Hours (L-T-P): 3-0-2**

BAS 010E	APPLIED PHYSICS	Total Credits: 3
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Course Objectives:

1. Students will be able to demonstrate competency and profound understanding of the concepts in Quantum Mechanics and its applications, and band formation.
2. Students will be able better to understand and learn to design the laser system and its component, or process to meet desired needs within realistic constraints such as health and safety, manufacturability.
3. The graduates will able to understand the applications of quantum optics through Holography and communication through optical fibers.
4. Students will be able to know the application of optical technologies and the development of new technologies like photonics, spintronics, quantum computing and Nano-technology.

UNIT 1	<p>Quantum Mechanics: Overview- Development of Quantum Mechanics, Compton Scattering, Wave Particle Duality, Uncertainty's Principle, Phase and Group velocities, Wave Packet, - Physical significance and its properties, Operators, Expectation values. Schrödinger's Time dependent and time independent Equations.</p> <p>Applications: Schrödinger's Equation and its Solution for particle in one-dimensional box and three-dimensional box. Degeneracy. Quantum statistics.</p> <p>*Overview of Alpha Decay, Scanning and Tunnelling Microscopes.</p>
UNIT 2	<p>Free Electron Gas Model and its Applications: Overview – Classical theory of Free electron, Quantum theory of free electrons, Density of energy states, Fermi energy levels. Band Theory of solids: formations of band, Band Gap in solids, Semiconductors: Intrinsic and Extrinsic, Carrier Concentrations, Position of Fermi levels in semiconductors, Conductivity and Mobility due to electrons and holes. Solar cells and Photo cells.</p>
UNIT 3	<p>Quantum Optics: Coherence: Spatial and Temporal coherence, Coherence length, Coherence time. Visibility as a Measure of Coherence. Spatial Coherence and Size of the Source. Temporal Coherence and Spectral Purity.</p> <p>Laser: Einstein's coefficients, Threshold conditions for laser action. Types of Lasers- Ruby laser, He-Ne laser. Semiconductor laser. Elementary ideas of Q-switching and Mode Locking. Idea of Homojunction and Hetrojunction lasers.</p>
UNIT 4	<p>Holography: Holography versus photography. Basic theory of Holography. Applications of Holography in Microscopy and Interferometry.</p> <p>Optical Communication: Optical fiber as optical wave-guide. Construction, Numerical Aperture and Angle of Acceptance. Applications and Types of optical fibres.</p>
UNIT 5	<p>Applications of Optical Technologies: Determination of thickness of thin films using interference technique. Elementary idea of anti-reflection coating. Optical filters. Applications of Diffraction: Bragg's law of X-Ray Diffraction. Polaroids and their industrial applications.</p> <p>Overview of Upcoming Technologies</p>

* Photonics * Spintronics * Quantum Computers * Nanotechnology and Nano-materials. Carbon Nano-tubes (CNTs).
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Course Outcomes

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

- CO1: To learn the fundamental concepts on Quantum behaviour of matter in its micro state and its applications.
- CO2: Analyze and apply band theory of Solids in Solid State Physics and Electronics.
- CO3: Understand and apply techniques of LASER and coherent radiations in industry, medical, and day-to-day life activities.
- CO4: Apply concepts learnt in Quantum optics in Industry and in real life.
- CO5: Understand and importance of Spintronics to develop storage device with low threshold power, spin based transistor, Photonics for techno-farming, and Nano-technology for saving environment, advances in medical and energy efficiency in fuel cell.

Suggested Books

1. Arthur Beiser, **Perspectives in Modern Physics**, McGraw Hill International.
2. H. S. Mani and G. K. Mehta, **Modern Physics**, East-West Press.
3. H Malik and AK Singh, **Engineering Physics**, McGraw Hill Education.
4. A. K. Ghatak, **Optics**, Tata McGraw Hill.
5. D. K. Bhattacharya and A. Bhaskaran: **Engineering Physics**, Oxford University Press.
6. S. Mani Naidu, **Engineering Physics**, Pearson.
7. A. K. Ghatak and Thyagrajan, **Fiber Optics**, Oxford University Press.
8. S. O. Pillai, **Solid State Physics**, Wiley Eastern.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1			H		L		H		L					L	
CO2			L		M		L		M	H		L		H	

CO3		M								L		M			M
CO4					H								H		
CO5			H				M						H		

H = Highly Related; M = Medium L = Low

B. Tech. (common to all disciplines)-I/II Semester
Contact Hours (L-T-P): 3-0-0

BES023A	Computer Programming in C++	3: 0: 0	3
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OBJECTIVE:

- To perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- To demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- To demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- To learn syntax and features of exception handling
- To demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using applets

UNIT 1	C++ Overview, C++ Characteristics, Object-Oriented Terminology, Polymorphism, encapsulation ,inheritance, Object-Oriented Paradigm, Abstract Data Types, I/O Services, Standard Template Library, Standards Compliance, Functions and Variables. Declaration and Definition
UNIT 2	Variables: Dynamic Creation and Derived Data, Arrays and Strings in C++,Classes in C++, Defining Classes in C++, Classes and Encapsulation, Member Functions, Friend function ,Inline function
UNIT 3	Using Constructors, Multiple Constructors and Initialization Lists, Using Destructors to Destroy Instances, Using Destructors to Destroy Instances, Operator Overloading: operator overloading of unary and binary operator, Function Overloading, Working with Overloaded Operator Methods
UNIT 4	Constant and Static Class Members, Inheritance, Overview of Inheritance, Defining Base and Derived Classes, Single, Multiple, multilevel, hybrid hierarchical inheritance. Constructor and Destructor Calls in inheritance, virtual function, virtual base class,
UNIT 5	Input and Output in C++ Programs, Standard Streams, Manipulators, Unformatted Input and Output. Working with files.

Course Outcome (CO):

At the end of this course, students will demonstrate ability to:

CO1: Understand object-oriented programming features in C++,

CO2: Apply these features to program design and implementation,

CO3: Develop applications using Object Oriented Programming Concepts.

CO4: Implement features of object oriented programming to solve real world problems.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M												M	
CO2			H		H									H
CO3			H		M				M		M		H	
CO4				L								M		L

Text Books

1. Let Us C: BalaGuruswamy, TATA McGraw Hill.
2. Programming with C, C++: Yashwant Kanetkar

Reference Books

1. C++:The Complete Reference.
2. The C++ Programming Language:Bjarne Stroustrup

B. Tech. (common to all disciplines)-I/II Semester**Contact Hours (L-T-P): 3-0-2**

BAS012E	APPLIED PHYSICS LAB	Total Credits: 1
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List of Experiments

Students are required to perform any ten experiments out of the following list of experiments.

1	To convert a Galvanometer into an Ammeter of given range and calibrate it.
2	To convert a Galvanometer into a Voltmeter of given range and calibrate it.
3	To study the variation in resistance of a Semiconductor with temperature and to determine its energy bandgap.
4	To determine specific Resistance of a wire by Carrey-Foster's Bridge.
5	To determine the height of an unknown object using Sextant.
6	To determine Resolving power of Telescope.
7	To determine Dispersive Power of a Prism using Mercury light source and Spectrometer.
8	To determine the wavelength of prominent lines of Mercury by using plane Diffraction Grating and Spectrometer.
9	To measure Numerical Aperture of an Optical Fiber.
10	To determine the profile of He-Ne LASER beam.
11	To determine wavelength of Sodium light source using Newton's Rings experiment.
12	To study shift in fringes in interference experiment using Michelson's interferometer
13	To study the characteristics of Solar Cell
14	To study the photoelectric effect and determine the Planck's constant "h".
15	To verify the Brewster's law and to find the Brewster's angle
16	To study the polarization of Laser light using polarimeter.

Course Outcomes-

While graduating, students of the Applied Physics Lab program would be able to:

CO1: Demonstrate the working knowledge of fundamental Physics, that of Electricity, Electronics and Mechanics and their applications in engineering disciplines.

CO2: The ability to formulate, conduct, analyze and interpret experiments in engineering physics.

CO3: Use modern engineering physics techniques and tools, including laboratory instrumentation.

CO4 Communicate their ideas effectively, both orally and in writing; and function effectively in multidisciplinary teams.

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Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H		L		H		L					L	
CO2			L		M		L		M	H		L		H	
CO3		M								L		M			M
CO4					H								H		

H = Highly Related; M = Medium L = Low

CO3		M												
CO4					H								H	

H = Highly Related; M = Medium L = Low

Text Books:

1. Bhat, N.D.& M. Panchal (2008), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & B.C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson Education

Reference Books:

- 1 Dhawan, R.K. (2007), A Text Book of Engineering Drawing, S. Chand Publications
- 2 Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

1. Write a program for understanding of C++ program structure without any CLASS declaration. Program may be based on simple input output, understanding of keyword using.
2. Write a Program to Understand Structure & Unions.
3. Write a C++ program to demonstrate concept of declaration of class with public & private member, constructors, object creation using constructors, access restrictions, defining member functions within and outside a class. Scope resolution operators, accessing an object's data members and functions through different type of object handle name of object, reference to object, pointer to object, assigning class objects to each other.
4. Write a Program, involving multiple classes (without inheritance) to accomplish a task & demonstrate composition of class.
5. Write a Program to Demonstrate Friend function, classes and this pointer.
6. Write a Program to Demonstrate Inline functions.
7. Write a Program to Demonstrate pointers to derived classes.
8. Write a Program to demonstrate dynamic memory management using new & delete & static class members.
9. Write a Program to demonstrate an operator overloading, operator functions as member function and/ or friend function, overloading stream insertion and stream extraction, operators, overloading operators etc.
10. Write a Program to demonstrate use of protected members, public & private protected classes, multilevel inheritance etc.
11. Write a Program for multiple inheritance, virtual functions, virtual base classes, abstract classes
12. Write a Program to Demonstrate use of Constructors and Destructors.
13. Write a Program to Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism.

Contact Hours (L-T-P): 2-0-0

L-T-P	Cultural Education I	Credits	2-0-0	2
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Course Objectives

1. To make the students feel gratitude towards the rich religious and cultural heritage of India.
2. To understand the role of great personalities and movements in the progress of India.

Course Outcomes (CO):

At the end of this course students will have:

CO1: Ability to acknowledge and appreciate the richness of Indian Culture

CO2: Ability to represent the culture ethics in real life

UNIT-I Holy Scriptures-A

1. Introduction to Vedanta and Bhagavad Gita, Goals of Life – Purusharthas, Introduction to different Dhram Granthas (Various religious scriptures from Hindu, Muslim, Christian, Bodh, Jain religions)
2. Introduction to Yoga, Overview of Patanjali’s Yoga Sutras

UNIT-II Society and Culture-I

3. Introduction to Indian Culture and Major Symbols of Indian Culture
4. Major Indian Cultural and Ethical Values- Respect, Compassion, Kindness, Forgiveness, Introspection, Honesty, Justice, Loyalty, Devotion, Self Sacrifice, Hospitality, Vasudhev Kutumbkum

UNIT-III India in Progress-I

5. Education , Science and Technology in Ancient India
6. Values from Indian History- War of Mahabharta, War of Kalinga, Freedom Struggle of India, Major Farmer Movements, Major Religious and Social Upliftment Movements

UNIT-IV Great Indian Personalities-I

7. Life and works of the Great People of India- Sushruta, Dadhichi, Ashtvakra, Anusuya, Panini, Charaka, Kalidas, Aryabhatta, Samudragupta, Ashoka, Chandragupt Mourya, Porus, Satyabhama, Dhruv, Prahlad,Chankya,Varahmihira, Bhisim, Karan, Dronacharya, MeeraBai, Surdas, Dadudayal, Kabir, Mahatma Budhha, Mahavir,Guru Nanak Dev, Guru Gobind Singh, Mohammad Saheb, Jesus Christ, Veer Shivaji, MaharanaPratap, Maharani LaxmiBai, MaharaniPadmini, Hadi Rani ShalKanwar, PannaDhai

*Each student shall write a detailed Report/ Critique on one topic from section -A to C and one Great Personality from Section- D leading to publication of Newspaper/ Magazine article or a review paper in a Research Journal. In addition to s/he will be required to make a Power Point Presentation on the learning and face Viva-voce by committee of teachers.

Suggested Reading:

1. Glory of Indian Culture (English) Paperback by Giriraj Shah
2. Historicity of Vedic and Ramayan Eras: Scientific Evidences from the Depths of Oceans to the Heights of Skies by Saroj Bala , Kulbhushan Mishra

References

<https://knowindia.gov.in/culture-and-heritage/lifestyle-values-and-beliefs.php>

B. Tech. (common to all disciplines) II Semester

Contact Hours (L-T-P): 2-0-2

L-T-P	Professional Skills	Credits 2-0-1 3
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Course Objectives

1. To enhance Professional competence in reading, writing, listening and speaking.
2. Switch the approach from providing information about the language to use the language.
3. Minimize the Grammar Translation Method of ELT while trying to replace it with Direct Method.
4. Introduce Communicative Method of ELT and focusing the teaching pedagogy on the student-centred learning rather than on the teacher-centred learning.
5. Ability to master three major forms of communications which are vital in academic and professional settings namely professional presentations, interviews and group communications respectively.
6. Providing a deep insight into the techniques for delivering effective presentations, winning job interviews, and actively participating in various forms of group communication.

Course Outcomes (CO):

At the end of this course students will have:

CO1: Ability to design a language component or process to meet desired need within realistic, Constraints such as economic, environmental, social, political, ethical, scenario

CO2: Ability to analyze the usage of English words in professional scenario.

CO3: An understanding of technical and academic articles' comprehension.

CO4: The ability to present oneself at multinational levels as per the demand of the corporate culture

Syllabus: Theory

UNIT 1	Professional Grooming and Professional Culture: Basics of corporate culture, Dressing sense-personal hygiene, Cultural adaptability, Body language components: undesirable and desirable body language, Team-ship, Leadership, Stress and Conflict management
UNIT 2	Advanced Grammar: Common errors related to prepositions, articles, models, Conditionals, Determiners etc, Punctuation, Proof-reading and Editing of Documents
UNIT 3	Composition: , Memo, Notice, Circular, Book Review, Research Article, Reports
UNIT 4	Vocabulary Building: Words often misspelt, One Word Substitution, Phrasal Verbs, Idioms

UNIT 5	Reading Comprehension: Reading different types of documents including Passages, Reports, Technical Essays, Speeches, Research Articles, Newspaper articles, Interviews etc-Skimming and Scanning-Inference and Deduction,
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Syllabus: Lab

L-T-P	Professional Skills Lab	Credits	2-0-1	3
UNIT 1	Professional Grooming and Professional Culture: Role plays and Activities on Dressing sense-personal hygiene, Cultural adaptability, Body language components: undesirable and desirable body language, Team-ship, Leadership, Stress and Conflict management			
UNIT 2	Advanced Grammar: Exercise Sessions for Common errors related to prepositions, articles, models , Conditionals, Determiners etc, Punctuation, Proof-reading and Editing of Documents			
UNIT 3	Composition: , Memo, Notice, Circular, Book Review, Research Article, Reports – Giving Assignments based on practical applications, Practice sessions on different topics			
UNIT 4	Vocabulary Building: Words often misspelt, One Word Substitution, Phrasal Verbs, Idioms- Activities related to the appropriate use of words			
UNIT 5	Reading Comprehension: Practice Reading Unseen Paragraphs- Finding Suitable title, Summarizing, Analyzing, Finding new words etc			

Methodology for Evaluation

1. Internal Assessment (Theory)
 - a) Home Assignments: One from each Unit : 15 Marks
 - b) In Semester Tests (Minimum two) : 30 Marks
 - c) Attendance : 05 Marks
2. Term End (Theory) : 50 Marks
3. Internal Assessment (Lab)
 - (a) Daily Performance in the Lab : 50 Marks
4. Term End (Lab) : 50 Marks

Suggested Readings:

1. Felixa Eskey. Tech Talk, University of Michigan. 2005
2. Michael Swan. Practical English Usage, Oxford University Press. 2005
3. Anderson, Paul. Technical Communication: A Reader Centered Approach, V Edition, Hercourt, 2003.
4. Thampi, G. Balamohan. Meeting the World: Writings on Contemporary Issues. Pearson, 2013.

5. Lynch, Tony. Study Listening. New Delhi: CUP, 2008.
6. Kenneth, Anderson, Tony Lynch, Joan Mac Lean. Study Speaking. New Delhi: CUP, 2008.
7. Marks, Jonathan. English Pronunciation in Use. New Delhi: CUP, 2007.
8. Syamala, V. Effective English Communication For You (Functional Grammar, Oral and Written Communication): Emerald, 2002.

Contact Hours (L-T-P): 0-0-2

BAS 002C	Engineering Mathematics-II	3:1:0 [4]
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Objective: At the end of the course, the student should be able to:

- To provide a brief, hands-on overview of ordinary differential equations and Higher order linear differential equation with constant coefficients.
- To understand the second order linear differential equations with variable coefficients.
- To make utilization of Linear Partial differential equations – some important equations Heat, wave and Laplace equation.
- To understand the Laplace transform, Inverse Laplace transform and their applications
- To familiarize and Analyze numerical solution of a differential equation by Euler's, Modified Euler's, Predictor Corrector and Runge Kutta fourth order Methods.

UNIT1	Introduction, Elementary row and column transformations ,Linear dependence, Consistency of linear system of equations, Inverse of a matrix, Rank of a Matrix, System of linear equations (Homogenous and Non-homogeneous); Eigen values and eigen vectors, Cayley's Hamilton theorem.
UNIT2	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.
UNIT3	Ordinary differential equation (first order first degree), Homogenous differential Equation, Linear differential equation, Exact differential equation, Higher order linear differential equation with constant coefficients.
UNIT4	Linear equations with variable coefficients: Homogenous form, Exact form, Change of dependent variable, Normal form, Change of independent variable and method of variation of parameters.
UNIT 5	Series solutions of second order linear differential equations with variable coefficients (Complementary functions only). First order partial differential equations, solutions of first order linear and non-linear PDEs.

Text Books: 1. B.V.Ramana, Higher Engineering Mathematics, Tata McGraw Hill, 2011.**Reference Books:**

- Recommended Books:**
1. Erwin Kreyszig , Advanced Engineering Mathematics, Wiley 9th Edition, 2008
 2. Thomas and Finney, Calculus and Analytical Geometry, Narosa Publishing House. New Delhi, 2002.
 3. M.Ray and Chaturvedi, A Text Book of Differential Equations, Students Friends & Co. Publisher, Agra, 1998.
 4. Maurice D. Weir and Joel Hass, Thomas Calculus, Pearson, 11th Edition, 2005.

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

CO1: Use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra. Understand the definitions of Vector Space and its linear Independence. Solve Eigen value problems and apply Cayley Hamilton Theorem.

CO2: Understanding convergence of sequence and series.

CO3: Identify, analyze and subsequently solve physical situations whose behavior can be described by First order and first degree ordinary differential equations and Higher order linear differential equation with constant coefficients.

CO4: Determine solutions to second order linear differential equations with variable coefficients.

CO5: Understanding the series solutions of second order linear differential equations with variable coefficients

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	H	M	L	L	M				L			L	M		
CO2	H	M	M	M	M				L			L	H		
CO3	H	M	M	M	M		M		L			L		H	M
CO4	H	H	M	M	M			L	L			L			M
CO5	H	H	M	M	M	L			L			L	H		

H = Highly Related; M = Medium L=Low

R. S. Sedha (2010), A Text Book of Electronic Devices and Circuits, S.Chand& Co.R. T. Paynter (2009), Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education

1.

BCO 035B	Programming in Java	3:0:0 [3]
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Objective

- Cover issues related to the definition, creation and usage of classes, objects and methods.
- Discuss the principles of inheritance and polymorphism and demonstrate through problem analysis assignments how they relate to the design of methods, abstract classes and interfaces.
- Provide the foundation of good programming skills by discussing key issues to the design of object-oriented software, including programming design patterns, automatic documentation techniques and programming testing.
- Cover the basics of creating APIs as well as allow students to explore the Java Abstract Programming Interface (API) and Java Collection Framework through programming assignments.
- Discuss basic principles and tools of collaborating programming (versioning systems, code review) and study their usage through group programming projects.

UNIT 1	Java Fundamentals: Features of Java ,OOPs concepts , Java virtual machine , Reflection byte codes ,Byte code interpretation , Data types, variable, arrays, expressions, operators, and control structures , Objects and classes
UNIT 2	Java Classes: Abstract classes ,Static classes ,Inner classes ,Packages,Wrapper classes Interfaces ,This ,Super ,Access control
UNIT 3	Exception handling: Exception as objects ,Exception hierarchy ,Try catch finally ,Throw, throws
UNIT 4	IO package: Input streams ,Output streams ,Object serialization ,De serialization ,Sample programs on IO files ,Filter and pipe streams
UNIT 5	Multi threading: Thread Life cycle ,Multi threading advantages and issues ,Simple thread program ,Thread synchronization .GUI: Introduction to AWT programming, Layout and component managers ,Event handling ,Applet class ,Applet life-cycle ,Passing parameters embedding in HTML ,Swing components – JApplet, JButton, JFrame, etc. Sample swing programs

Course Outcome:

At the end of this course student will:

CO1: Understand how object-oriented concepts are incorporated into the Java programming language

CO2: Develop problem-solving and programming skills using OOP concept

CO3: Understand the benefits of a well structured program

CO4: Develop the ability to solve real-world problems through software development in high-level programming language like Java

CO5: Develop efficient Java applets, threading and applications using OOP concept

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1		M		M	H				M		H		M	H	
CO2	L		M		H		L	L		M		M		H	M
CO3		M		H	M	L		L		M	H		M	H	
CO4			H	M			L		M		H		M	H	
CO5			H	M		L						M	H	H	

H = Highly Related; M = Medium L = Low

References:

1. Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies
2. Java Programming John P. Flynt Thomson 2nd
3. Java Programming Language Ken Arnold Pearson
4. The complete reference JAVA2, Herbert schildt. TMH

BAS011E	Engineering Chemistry	3-0-0
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Objectives of Chemistry

- 1.The purpose of this course is to emphasize the relevance of fundamentals and applications of chemical sciences in the field of engineering.
- 2.The courses have been conceived in such a way that they take into account appropriate combinations of old and new emerging concepts in the chemical sciences area and their current and potential uses in engineering.
- 3.The Course attempt to address the principles of general chemistry and specific topics relevant to various engineering disciplines, wherein the students can apply this learning in their respective areas of expertise.

UNIT 1	<p>Water and Analysis : Types of impurities in Water, Hardness of Water, Disadvantages of Hard Water, Temporary and Permanent hardness. Units and inter conversions of Units. Estimation of hardness by EDTA Methods.. Methods of Treatment of Water for Domestic Purposes - Sedimentation, Coagulation, Filtration, Disinfection, Sterilization, Chlorination, Break point chlorination, Ozonization. Water for Industrial purpose, Water for Steam Making-Boiler Troubles, Carry Over, Priming and Foaming, Boiler Corrosion, Scales and Sludges, Caustic Embrittlement. Water Treatment: Internal Treatment methods, Colloidal, Phosphate, Calgon, Carbonate, Sodium aluminate Conditioning of Water. External Treatment methods, Lime-Soda Process, Zeolite Process, Ion- Exchange Process, Numerical Problems on EDTA Methods and Lime-Soda process.</p>
UNIT 2	<p>Fuels : Classification of Fuels, Calorific value,Determination of calorific value of a solid and liquid fuel, Bomb & Boy’s Gas Calorimeter, Carbonization, Beehive Oven Method, Ottohaffman’s Byproduct Method, Petroleum,Cracking- fluidized catalytic cracking. Reformation of petrol, Knocking, Octane number, Cetane number, Synthetic petrol, Bergius process and Fischer-Tropsch process.</p> <p>Lubricants: Principles and function of lubricants - Types of Lubrication and Mechanism -Thick Film or Hydrodynamic Lubrication, Thin Film or Boundary Lubrication, Extreme Pressure Lubrication. Classification and properties of lubricants-Viscosity, flash and fire point, cloud and pour point, aniline point and Neutralization Number, Precipitation No.</p>
UNIT 3	<p>Electrochemistry and Corrosion Electrochemical Cell, EMF of Cell, Electrode potential. Electrochemical Series. Chemical (Dry) and Electrochemical(Wet) corrosion. Types of corrosion; stress corrosion, stress cracking, water line corrosion, bimetallic corrosion etc. Factors affecting corrosion, Protection from corrosion, Protective coatings, cathodic</p>

	protection, sacrificial Anodic protection and modification in designs.
UNIT 4	Nano particles& New engineering materials: Terminology- scales of nano-systems- nanoparticles: introduction-atoms to molecules-quantum dots-shrinking of bulk materials to quantum dots. Different types of nanoparticles. Various approaches in nanoparticle synthesis Characterisation of nanomaterials : Important methods for the characterisation of nanomaterials Applications of nanomaterials :Catalysis, Electronics & Telecommunication, Medicines, Composites, Energy sciences Molecular electronic devices, An Introduction to polymers for electronic industry, Organic conducting polymers
UNIT 5	Principles and Concepts of Green Chemistry: Sustainable development, atom economy, reducing toxicity. Waste: production, problems and prevention. Green Synthesis and Catalysis; Environmentally benign processes, Green oxidation and photochemical reactions, Microwave and Ultrasound assisted reactions. Water as a reaction medium. Green chemistry in material science, synthesis of porous polymers, green nanotechnology. Green energy sources, efficiency and sustainability, energy from biomass and solid waste, Biofuels, alcohol, hydrogen production technology, biofuels from Jatropa. Industrial case studies.

Suggested Books

1. Engineering Chemistry by J C Kuriacose and J. Rajaram, Tata McGraw-Hill Co, New Delhi (2004)
2. B.K. Sharma, "Engineering Chemistry", Krishna Prakasam Media (P) Ltd., Meerut, 2001.
3. A text book of Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company, New Delhi(15 Edition) (2006).
4. An introduction to Electrochemistry by Samuel Glasstone,Affiliated east west press private Ltd.
5. C. N. R. Rao and A.Govindraj, Nanotubes and Nanowires, Royal Society of Chemistry
6. Chemistry of Engineering Materials by C.P. Murthy, C.V. Agarwal and A. Naidu BS Publication Hyd. 2007.
7. Text book of Engineering Chemistry by Shashi Chawala, Dhanpat Rai Publishing Company, 15th edition New Delhi (2004).
- 8.Green Chemistry: An Introductory Text: Edition 3 Author: Mike Lancaster

Course outcome

CO-1 Students will be able to explain the impurities of water (mainly hardness) and boiler troubles and also different methods to remove hardness of water.

CO-2 Students will be able to analyze the basic knowledge of various types of Fuels, Lubricants their properties and Industrial Applications.

CO-3 Students will be able to understand relate electrochemistry and corrosion.

CO-4 Students will be able to understand about different types of nano materials and polymers

CO-5 Students will be able to understand the basic concept of Green chemistry and its emrging applications in Industries and for protection of environment.

JECRC University
Department of Chemistry
Engineering Chemistry Lab- 2021-25

BAS015B	Chemistry Laboratory	0-0-2
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List of Experiments

1. Determination of cell constant and conductance of solutions.
2. Calibration of pH meter and determination of pH of a solution
3. Identification of a drug using thin layer chromatography (TLC) and Column chromatography
4. Estimation of total hardness of water-EDTA method
5. Estimation of dissolved oxygen by Winkler's method
6. Estimation of chloride in water
7. Estimation of fluoride content in water by SPANDANS method
8. Determination of the viscosity of a lubricating oil by using Redwood viscometer
9. Determination of the Flash & Fire point of a lubricating oil by using Pensky Martin's apparatus
10. Determination of the Cloud & pour point of a lubricating oil
11. Determination of wavelength of absorption maximum and colorimetric estimation of Fe³⁺ in solution
12. Flame photometric estimation of Na⁺ to find out the salinity in sand
13. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin and their characterization
14. Adsorption of acetic acid on charcoal and Isotherm study
15. Preparation of Biodiesel from vegetable oil

Suggested Books

1. Text book of Engineering Chemistry Practicals by Shashi Chawala, Dhanpat Rai Publishing Company, 15th edition New Delhi (2004).
2. Vogel's text book for quantitative analysis
3. Vogel's text book for qualitative analysis

BES003B	ENGINEERING WORKSHOP	0-0-4(2)
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Mechanical Engineering Group

Module 1 : (Compulsory for Mechanical Engineering Students)	
	To Prepare a job on lathe machine by performing turning, facing and chamfering as per given drawing. To drill holes in metal sheet as per given drawing.
	To make a Square fit from the given mild steel pieces. To Prepare cylinder as per given drawing by using sheet metal working
	To Prepare a T-lap/Cross lap joint using carpentry.
	To Prepare a /butt joint in arc welding shop. To join and cut thin metal sheet with the help gas welding.
Module 2 : (Optional for All)	
	To prepare NC Part Programming for Given Drawing . To prepare the Job on CNC Milling M/C
	Fault Analysis of House hold Refrigerator Analysis of Air Conditioner of Air Conditioner
	Maintenance Service of Petrol Engine with assembly procedures. Maintenance Services of Diesel Engine with assembly procedures

Electrical Engineering Group:

Experiment 1: Dismantling and assembly of ceiling fan.

Experiment 2: Dismantling and assembly of geyser.

Experiment 3: Dismantling and assembly of blower.

Experiment 4: Dismantling and assembly of AC/refrigerator.

Electronics Engineering Group:

Experiment 01	Electronics Work Bench Software-Designing of Electronic Circuits and PCB designing using software.
Experiment 02	Breadboard Circuit Designing -Circuit designing and to determine static resistance and dynamic resistance of p-n junction diode and plot

	the-I characteristics.
Experiment 03	Digital ICs- Verification of Truth table of basic & universal Logic Gates using Bread board and Integrated Circuits (ICs).
Experiment 04	C.R.O and Function Generator –To Generate a sine wave using a function generator and measure its amplitude and frequency using C.R.O.
Experiment 05	Digital Multimeter-Measurement of AC and DC voltage, current, capacitance and resistance using Digital Multimeter
Experiment 06	Observe output waveform of half wave rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor.
Experiment 07	Observe output waveform of full wave rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor.
Experiment 08	Designing of Bridge rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor.
Experiment 09	Design a half wave rectifier using discrete components on a breadboard and measure DC voltage, DC current, ripple factor, with and without filter capacitor
Experiment 10	Design full wave rectifier using discrete components on a breadboard and measure DC voltage, DC current, ripple factor with and without filter capacitor.

Computer Science & Engineering Group:

1. Introduction to PC Hardware
 - a. RAM, ROM, Motherboard, SMPS, Processor
2. Hardware installation and assembly of PC
 - a. Desktop
 - b. Laptop
3. PC debugging, troubleshooting and Maintenance
4. Software installation and Configuration
 - a. Installation of operating System (Windows, Linux/UNIX, Server)
 - b. Basic utility and maintenance software
5. Working and functioning of different Buses, I/O Ports, graphic cards.
6. Installation of printer / modem /scanner and other input and output devices.
7. Configuring BIOS set up, Recovery, Preventive maintenance & Anti-Virus
8. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool

9. Configuring and Practically implement Network Devices
 - a. Repeater
 - b. Hub
 - c. Switch
 - d. Bridge
 - e. Router
 - f. Gate Way
10. Install and Configure Wired and Wireless NIC and transfer files between systems in LAN and Wireless LAN.
11. Connect the computers in Local Area Network.
12. Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network
13. Installation of Ms Office 200x.

Semester-II
Cultural Education II

Common to all disciplines
Contact Hours (L-T-P): 2-0-0

L-T-P	Cultural Education II	Credits	2-0-0	2
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Objectives

1. To make the students feel gratitude towards the rich religious and cultural heritage of India.
2. To understand the role of great personalities and movements in the progress of India.

Course Outcomes (CO):

At the end of this course students will have:

CO1: Ability to acknowledge and appreciate the richness of Indian Culture

CO2: Ability to represent the culture ethics in real life

UNIT-I Holy Scriptures-II

1. Bhagavad Gita and Life Management
2. Highlights of Indian Scriptures - Major Incidents and terms from various religious scriptures including Ramayana, Mahabharata, Guru Granth Saheb, Bible, Quran, Jain Scriptures, Bodh Scriptures
3. Historicity of Ramayana and Mahabharata

UNIT-II Society and Culture-II

4. Indian Society: Its Strengths and Weaknesses
5. Health and Lifestyle related issues
6. Conservation of cultural heritage

UNIT-III India in Progress-II

7. Role & Position of Women in Indian Society- Rituals like Sati, Dakin, Kanyavadh, Pardah, Devdasi, Child Marriage, Measures of Women Empowerment including Education, Constitutional and other Rights
8. Indian Models of Economy, Business and Management

UNIT-IV Great Indian Personalities-II

9. Life and works of the Great People of India- Raja Ram Mohan Roy, Swami Vivekanand, Madan Mohan Malviya, Ishwarchand VidyaSagar, JyotibaPhule, HomiBhabha, B.R. Ambedkar, Mahatma Gandhi, Chandra Shekhar Aazad, Abdul Hamid, Badshah Khan, Bhagat Singh, Ashfaqullah, Vir Sawarkar, Vir Banda Bahadur, Vir Haqiqat Rai, Subhash Chandra Bose, Mother Teresa, Jagdish Chandra Basu, JRD Tata, Ratan Tata, Dada Saheb Phalke, Major Dhayan

Chand, A P J Abdul Kalaam, Kailash Satyarthi, Aruna Roy, Mahasweta Devi, Udaya Kumar, Narayan Murthy, Azim Premji

*Each student shall write a detailed Report/ Critique on one topic from section -A to C and one Great Personality from Section- D leading to publication of Newspaper/ Magazine article or a review paper in a Research Journal. In addition to s/he will be required to make a Power Point Presentation on the learning and face Viva-voce by a committee of teachers.

Suggested Reading:

1. Glory of Indian Culture (English) Paperback by Giriraj Shah
2. Historicity of Vedic and Ramayan Eras: Scientific Evidences from the Depths of Oceans to the Heights of Skies by Saroj Bala , Kulbhushan Mishra

References

<https://knowindia.gov.in/culture-and-heritage/lifestyle-values-and-beliefs.php>

Non Credit Course

BCE051A	Environmental Sciences	2-0-0	0
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The objectives of Environment science are to-

1. Create an awareness about environmental problems among students
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate public through students to participate in environment protection and environment improvement.
5. Acquiring skills to help the concerned individuals in identifying and solving environmental problems.

UNIT 1	The Multidisciplinary Nature of Environmental Studies: The Multidisciplinary Nature of Environmental Studies Definition, scope and importance need for public awareness.
UNIT 2	Natural Resources Renewable and Non-renewable Resources: •Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, Case studies. (e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. (f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.
UNIT 3	Ecosystems, Biodiversity and Its Conservation: •Concept of an ecosystem. •Structure and function of an ecosystem. •Producers, consumers and decomposers. • Energy flow in the ecosystem. Ecological succession. •Food chains, food webs and ecological pyramids. •Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland ecosystem (c)

	<p>Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)</p> <p>Biodiversity and Its Conservation</p> <ul style="list-style-type: none"> • Introduction, definition: genetic, species and ecosystem diversity. • Biogeographical classification of India. • Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. • Biodiversity at global, National and local levels. • India as a mega-diversity nation. Hot-spots of biodiversity. • Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. • Endangered and endemic species of India. • Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.
<p>UNIT 4</p>	<p>Environmental Pollution: • Definition, Causes, effects and control measures of</p> <p>(a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards</p> <ul style="list-style-type: none"> • Solid waste management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. • Pollution case studies. • Disaster management: Floods, earthquake, cyclone and landslides.
<p>UNIT 5</p>	<p>Social Issues and the Environment, Human Population and the Environment, Field Work: • From unsustainable to sustainable development.</p> <ul style="list-style-type: none"> • Urban problems related to energy. • Water conservation, rain water harvesting, watershed management. • Resettlement and rehabilitation of people; its problems and concerns. Case studies. • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. • Wasteland reclamation. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and Control of Pollution) Act. • Wildlife Protection Act. • Forest Conservation Act. • Issues involved in enforcement of environmental legislation. • Public awareness. <p>Human Population and the Environment</p> <ul style="list-style-type: none"> • Population growth, variation among nations. • Population explosion—Family Welfare Programme. • Environment and human health.

	<ul style="list-style-type: none"> • Human rights. • Value education. <p>HIV/AIDS.</p> <ul style="list-style-type: none"> • Women and Child Welfare. • Role of Information Technology in environment and human health. <p>Field Work</p> <ul style="list-style-type: none"> • Visit to a local area to document environmental assets—river/forest/grassland/hill/ mountain. • Visit to a local polluted site—Urban/Rural/Industrial/Agricultural. • Study of common plants, insects, birds. • Study of simple ecosystems—pond, river, hill slopes, etc. (Field work equal to 5 lecture hours) • Case Studies.
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Course Outcome (CO)

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

CO-1: Recognize the history, structure, function, interactions and trends of key socio-environmental systems on personal, organizational and intellectual level regarding our surroundings through different media.

CO-2: Examine the generation of scientific knowledge and how that knowledge is presented, evaluated, framed and applied for environmental protection by conservation of Natural resources.

CO-3: Articulate a coherent philosophy of the environment and consider ethical bases for responding to environmental questions.

CO-4: Understand the role of conservation of resources and public awareness in prevention of pollution and ultimately for the sustainable development of society.

CO-5: Understand the social responsibility towards protection of environment and society

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO-1	H	M	H	H	H	H	M
CO-2	M	H	H	M	M	H	M
CO-3	M	H	H	L	H	H	H
CO-4	M	M	H	M	H	H	H
CO-5	H	H	H	H	H	H	H

DEPARTMENT OF LAW ; JECRC UNIVERSITY

RECOMMENDED SYLLABUS FOR B TECH FIRST YEAR

CONSTITUTIONAL LAW

Ser No	Recommended Subject	Number of Proposed Lecture
1.	Salient Features of the Indian Constitution	01
2.	Preamble of the Constitution	01
3.	Nature of the Constitution	01
4.	<u>Fundamental Rights</u>	
	(a) Articles 12 & 13	01
	(b) Articles 14 to 18	01
	(c) Articles 19	02
	(d) Articles 21	02
	(e) Articles 32 and Writs	01
5.	Directive Principles and Fundamental Duties	02

B.Tech CSE Semester III

BCO 011A	COMPUTER NETWORKS	3-1-0 [4]
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OBJECTIVES:

- To build an understanding of the fundamental concepts of computer networking.
- To familiarize the student with the basic taxonomy and terminology of the computer networking area.
- To introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
- To allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

UNIT 1	Introduction -Hardware and software, Data communication, Networking, Protocols and standards. Data transmission concepts. Analog and digital transmission. Transmission impairments. Layered Architecture of Computer Networks, OSI and TCP/IP architectures Physical Layer- Guided transmission media and wireless transmission, Data encoding - Digital and analog data. Data communication interface - asynchronous and synchronous transmission, Data link layer - Flow control. Error detection and error control. HDLC and other data link protocols. Multiplexing – Frequency-division, synchronous time-division, and statistical time-division multiplexing
UNIT 2	Link Layer: Medium Access Control: CDMA, ALOHA, and Ethernet; Link Layer Addressing and Forwarding; Spanning Trees; The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband Wireless, Bluetooth, Data Link Layer Switching, Switched networks. Circuit-switched networks, switching concepts, Routing in circuit-switched networks. Control signaling. Packet switching principles. Routing and congestion control
UNIT 3	Network Layer: Network layer design issues. Routing algorithms , Flooding, Shortest path routing, Link State routing, Hierarchical routing, Broadcast and multicast routings, Routing in the Internet, Path Vector routing, OSPF routing. The network layer in the Internet: IP protocol: ARP and RARP, BOOTP, ICMP, DHCP, Network Address Translation(NAT) Internetworking
UNIT 4	Transport Layer:TCP introduction, Reliable/Un- Reliable Transport, TCP, UDP, Congestion Control, Intra-Domain Routing: Distance-Vector, Intra-Domain Routing: Link- State, Wireless Networks: 802.11 MAC, Efficiency considerations
UNIT 5	Application Layer: DNS-The Domain Name System, Electronic Mail, HTTP, FTP, Simple network management protocol (SNMP), The World Wide Web

Course Outcome (CO) of Computer Network

At the end of this course students will have:

CO1: To provide an in-depth understanding of the terminology of network and concepts of OSI reference model and TCP/IP model.

CO2: To equip our students with technical concept of protocols, network interfaces, and design/performance issues in networks.

CO3: To be familiar with contemporary issues in networking technologies.

CO4: To be familiar with network tools and to enhance analytical skills to develop innovative solutions.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			L									H		
CO2	M		H									L		L	
CO3		M							M				M		L
CO4					H										L

H = Highly Related; M = Medium L = Low

Text Books:

1. Computer Networks, by Andrew S Tanenbaum, PHI. (2010)

Reference Books:

- Data Communications, Computer networking on OSI , by Fred Halsall, Addison Wesley Publishing Co.1998
- Computer Networking -A Top-Down Approach Featuring the Internet ,James F. Kurose and Keith W. Ross ,Addison Wesley Publishing Co. 2004
- Computer Networks: Protocols standards and interfaces , by Uyles Black, Prentice Hall.2002
- Data communication & Networks , by Behrou A. Forouzan, Tata McGraw Hill. 2002
- Data and Computer Communications, by Walliam Stallings, PHI. (2002)

BCO 002B	DATA STRUCTURES AND ALGORITHMS	3-1-0 [4]
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OBJECTIVE:

- To study various data structure concepts like Stacks, Queues, Linked List, Trees and Files
- To overview the applications of data structures.
- To be familiar with utilization of data structure techniques in problem solving.
- To have a comprehensive knowledge of data structures and algorithm.
- To carry out asymptotic analysis of algorithm.

UNIT 1	<p>Introduction: Notions of data type, abstract data type and data structures. Importance of algorithms and data structures in programming. Notion of Complexity covering time complexity, space complexity, Worst case complexity & Average case complexity. BigOh Notation, Omega notation, Theta notation. Examples of simple algorithms and illustration of their complexity.</p> <p>Sorting- Bubble sort, selection sort, insertion sort, Quick sort; Heap sort; Merge sort; Analysis of the sorting methods. Selecting the top k elements. Lower bound on sorting.</p>
UNIT 2	<p>Stack ADT, Infix Notation, Prefix Notation and Postfix Notation. Evaluation of Postfix Expression, conversion of Infix to Prefix and Postfix Iteration and Recursion- Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion.</p>
UNIT 3	<p>List ADT. Implementation of lists using arrays and pointers. Stack ADT. Queue ADT. Implementation of stacks and queues. Dictionaries, Hash tables: open tables and closed tables. Searching technique- Binary search and linear search, link list- single link list, double link list, Insertion and deletion in link list.</p>
UNIT 4	<p>Binary Trees- Definition and traversals: preorder, post order, in order. Common types and properties of binary trees. Binary search trees: insertion and deletion in binary search tree worst case analysis and average case analysis. AVL trees. Priority Queues -Binary heaps: insert and delete min operations and analysis.</p>
UNIT 5	<p>Graph: Basic definitions, Directed Graphs- Data structures for graph representation. Shortest path algorithms: Dijkstra (greedy algorithm) and Operations on graph, Worshall's algorithm , Depth first search and Breadth-first search. Directed acyclic graphs. Undirected Graphs, Minimal spanning trees and algorithms (Prims and Kruskal) and implementation. Application to the travelling salesman problem.</p>

Course OUTCOME (CO):

CO1: Show the understanding of various data structure concepts like Stacks, Queues, Linked List, Trees and Files

CO2: Understand the applications of data structures.

CO3: Understand with utilization of data structure techniques in problem solving.

CO4: Use comprehensive knowledge of data structures and algorithm.

CO5: Use asymptotic analysis of algorithm.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H												M		
CO2			H		M								M		
CO3		H							M			L		H	
CO4	H	M											L		L
CO5		M		H											L

H = Highly Related; M = Medium; L = Low

Text Books:

1. Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft , Addison-Wesley Series (1983)

Reference Books:

1. T.H. Cormen, C.E. Leiserson, and R.L. Rivest. Introduction to Algorithms.The MIT Press and
2. McGraw-Hill Book Company, Cambridge, Massachusetts, 1990 (Available in Indian Edition).
3. Steven S. Skiena. The Algorithm Design Manual.Springer, Second Edition, 2008.
4. Data Structures and Algorithm Analysis in Java (3rd Edition) by Mark Allen Weiss, Addison Wesley(2011).

BAS 007B	DISCRETE MATHEMATICS	3-0-0 [3]
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Objective:

- To introduce a number of Discrete Mathematical Structures (DMS) found to be serving as tools even today in the development of theoretical computer science.
- To solve problems occurred in the development of programming languages.
- To familiarize students with concepts and techniques of graph theory, and sets apart from languages of logic and proof methods.

UNIT 1	Sets: Definition and types, Set operations, Partition of set, Cardinality (Inclusion-Exclusion & Addition Principles), Recursive definition of set. Functions: Concept, Some Special Functions (Polynomial, Exponential & Logarithmic, Absolute Value, Floor & Ceiling, Mod & Div Functions), Properties of Functions, Cardinality of Infinite Set, Countable & Uncountable Sets,
UNIT 2	Graph Theory: Graphs – Directed, Undirected, Simple,. Adjacency & Incidence, Degree of Vertex, Subgraph, Complete graph, Cycle & Wheel Graph, Bipartite & Complete Bipartite Graph, Weighed Graph, Union of Simple Graphs. Complete Graphs. Isomorphic Graphs, Path, Cycles & Circuits Eulerian& Hamiltonian Graphs. Planar Graph: Kuratowski’s Two Graphs, Euler’s Formula, Kuratowski’s Theorem. Trees: Spanning trees- Kruskal’s Algo, Finding Spanning Tree using Depth First Search, Breadth First Search, Complexity of Graph, Minimal Spanning Tree.
UNIT 3	Semigroups, Groups and Coding: Binary Operations, Semigroups, Products and Quotients of Semigroups, Groups, Product and Quotients of Groups, Coding of Binary Information and Error Correction, Decoding and Error Correction. Language of Logic: Proposition, Compound Proposition, Conjunction, Disjunction, Implication, Converse, Inverse & Contrapositive, Biconditional Statements, tautology, Contradiction & Contingency, Logical Equivalences, Quantifiers, Arguments.
UNIT 4	Proof Methods: Vacuous, Trivial, Direct, Indirect by Contrapositive and Contradiction, Constructive & Non-constructive proof, Counterexample. The Division Algorithm, Divisibility Properties (Prime Numbers & Composite Numbers), Principle of Mathematical Induction, The Second Principle of Mathematical Induction, Fundamental Theorem of Arithmetic. Algorithm Correctness: Partial Correctness, Loop Invariant. Testing the partial correctness of linear & binary search, bubble & selection sorting.
UNIT 5	Relations: Boolean Matrices, Binary Relation, Adjacency Matrix of Relation, Properties of Relations, Operations on Relations, The Connectivity Relations, Transitive Closure-Warshall’s Algorithm, Equivalence relations- Congruence Relations, Equivalence Class, Number of Partitions of a Finite Set, Partial & Total Orderings.

Course Outcome (CO):

At the end of this course, students will demonstrate ability to:

CO1: Demonstrate complete knowledge on various discrete structures available in literature.

CO2: Realization of some satisfaction of having learnt that discrete structures are indeed useful in computer science and engineering and thereby concluding that no mistake has been done in studying this course.

CO3: Gaining of some confidence on how to deal with problems which may arrive in computer science and engineering in near *future*.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		H		M						L				
CO2		H		H								M	M		
CO3								H	M	L				H	

- H = Highly Related; M = Medium L = Low

Text Books

1. B.Kolman et.al- Discrete mathematical Structures, 5th Edn, Pearson Education, New Delhi - 2004.

Reference Books

1. K.H. Rosen – Discrete Mathematics and Its Applications – 4th Edn, Tata McGraw Hill, New Delhi – 2001
2. J.P. Tremblay et.al – Discrete Mathematical Structures with Applications to Computer Science, TMH, New Delhi – 2004.
3. Mott. J.L., Kandel A. and Baker, T.P. "Discrete mathematics", for computer scientists and Mathematicians", Second Edition, Prentice Hall 1986.
4. Tremblay J.P. and Manohar, R. "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill, 1975.

BCO 008B	OPERATING SYSTEMS	3-0-0 [3]
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OJECTIVE:

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

UNIT 1	Introduction : Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multiprocess Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Monolithic and Microkernel Systems.
UNIT 2	Process Management-Process & Threads – Process States - Process Control Block – Process Scheduling – Operations on Processes, Threads, CPU Scheduler – Preemptive and Non- Preemptive; Dispatcher, Scheduling Criteria, Scheduling Algorithms – Process Management in UNIX
UNIT 3	Process Synchronization & Inter process Communication-Concurrent Processes, Co-operating Processes, Precedence Graph, Hierarchy of Processes, Critical Section Problem – Two process solution, Synchronization Hardware, Semaphores – Deadlock- detection, handling, prevention, avoidance, recovery, Starvation, Critical Regions, Monitors, Inter process communication
UNIT 4	Memory Management-Objectives and functions, Simple Resident Monitor Program (No design), Overlays – Swapping; Schemes – Paging – Simple, Multi-level Paging; Internal and External Fragmentation; Virtual Memory Concept, Demand Paging – Page Interrupt Fault, Page Replacement Algorithms; Segmentation – Simple, Multi-level, Segmentation with Paging, Memory Management in UNIX.
UNIT 5	I/O Management and Disk Scheduling: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.

Course Outcome (CO):

At the ends of this course studentswill have:

CO1: Classify Unix Kernel mode with user mode & contrast between Kernel structures.

CO2: Identify and estimate process management & thread management strategies along with their different operations

CO3:Implement different system calls for various file handling operations.

CO4:determine paging and Caching techniques related to Virtual Memory.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M				L			L		H		L
CO2		M	L						M					M	
CO3			M		M									M	M
CO4	M		L									L			

H = Highly Related; M = Medium L = Low

Text Books:

1. Operating Systems Concepts – Silberschatz, Galvin, Wiley Publications (2008)
2. Modern Operating Systems - Andrew S. Tanenbaum, Pearson Education Asia / PHI(2005)

Reference Books:

1. Operating Systems – William Stallings, Pearson Education Asia (2002)
2. UNIX System Programming Using C++, by Terrence Chan: Prentice Hall India, 1999.
3. Advanced Programming in UNIX Environment, by W. Richard Stevens: 2nd Ed, Pearson Education, 2005

BCO 232A	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	3-0-0 [3]
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Objective

- To learn about generic models of software development process.
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the different design techniques and their implementation.
- To learn various testing and maintenance measures

UNIT 1	Introduction- Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Engineering aspects of Software production – necessity of automation .Job responsibilities of Programmers and Software Engineers as Software developers. Software Development Life Cycle (SDLC)
UNIT 2	Process Models and Program Design Techniques- Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model. Software Requirement Specifications (SRS), Management of User Needs, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Software Modeling Tools –Data flow Diagrams, UML and XML.
UNIT 3	Software Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Verification and Validation: Testing of Software Products – Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs –Cyclomatic Complexity. Maintenance and its need and types of maintenance. CASE tools & graphical reporting tools.
UNIT 4	Project Management: project, project specification parameters, principle &life cycle, project management Plan, why the project is delayed? and scheduling activities, critical Path, PERT& CPM. Monitoring & Control: Change Control, Software Configuration Management (SCM).
UNIT 5	Quality Management and People Management- Introduction, Understanding Behavior, Organizational Behavior, Selecting The Right Person For The Job, Motivation, The Old man – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.

Course Outcome (CO):

At the end of this course students will have:

CO1: An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

CO2: An ability to identify, formulate, and solve engineering problems. CO3: An understanding of professional and ethical responsibility.

CO4: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		H		M						L				
CO2		H		H								M	M		
CO3								H	M	L				H	
CO4	L		L			L	M								L

H = Highly Related; M = Medium L = Low

Text Books:

- Fundamentals of Software Engineering – Carlo Ghezzi et al.
- Software Engineering – Design, Reliability Management – Pressman.
- Bob Hughes, Mike Cotterell, “Software Project Management”, Tata McGraw Hill. (2009)

Reference Books:

- Software Engineering – Ian Sommerville.
- Software Engineering - Shoeman.

- Software Engineering with Abstraction – Berzins and Luqi
- Pankaj Jalote, Software Engineering, Wiley.
- Royce, “Software Project Management”, Pearson Education. (2005).
- Robert K. Wysocki, “Effective Software Project Management”, Wiley.(2006)

BCO 014B	OPERATING SYSTEMS LAB	0-0-2 [2]
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List of Experiments

Experiment No	Aim
1	Write a C program to implement the various process scheduling mechanisms such as FCFS scheduling.
2	Write a C program to implement the various process scheduling mechanisms such as SJF Scheduling.
3	Write a C program to implement the various process scheduling mechanisms such as Round Robin Scheduling.
4	Write a C program to implement the various process scheduling mechanisms such as Priority Scheduling.
5	To implement deadlock avoidance & Prevention by using Banker's Algorithm.
6	To implement page replacement algorithms FIFO (First In First Out).
7	To implement page replacement algorithm LRU (Least Recently Used).
8	To implement page replacement algorithms Optimal (The page which is not used for longest time)
9	To implement the memory management policy- Paging.
10	To implement the memory management policy-segmentation.
11	Write a C Program to implement Sequential File Allocation method.
12	Write a C Program to implement Indexed File Allocation method.
13	Write a C Program to implement Linked File Allocation method.
14	Write a program to implement multi program variable task (MVT).
15	Write a program to implement multi program fixed task (MFT).

Course Outcome (CO):

At the ends of this course students will have:

CO1: Classify Unix Kernel mode with user mode & contrast between Kernel structures.

CO2: Identify and estimate process management & thread management strategies along with their different operations

CO3: Implement different system calls for various file handling operations.

CO4: Determine paging and Caching techniques related to Virtual Memory.

CO5: construct shell scripts.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M				L			L		H		L
CO2		M	L						M					M	
CO3			M		M									M	M
CO4	M		L									L			

H = Highly Related; M = Medium L = Low

List of Experiments

1. Write a program to implement following searching algorithms using array data structure
 - 1.1 Matrix Addition and Subtraction
 - 1.2 Matrix Multiplication and Transpose
2. Write a program to implement following searching algorithms using array data structure
 - 2.1. Linear Search
 - 2.2. Binary Search
3. Write a program to implement following searching algorithms using array data structure
 - 3.1. Insertion Sort
 - 3.2 Bubble Sort
4. Write a program to implement following searching algorithms using array data structure
 - 4.1. Selection Sort
 - 4.2 Quick Sort
5. Write a program to implement following operations on stack using array data structure.
 - 5.1 Traversing
 - 5.2 Push
 - 5.3 POP
6. Write a program to implement following examples of recursion
 - 6.1 Fibonacci Series
 - 6.2 Factorial Function
 - 6.3 Tower of Hanoi
7. Write a program to implement Merge Sort.
8. Write a program to implement following operations on Queue using array data structure.
 - 8.1 Insertion
 - 8.2 Deletion
 - 8.3 Traversing
9. Write a program to implement Postfix evaluation.
10. Write a program to implement Infix to Postfix Notation.
11. Write a program to implement following operations on Link List data structure.
 - 11.1 Insertion at beginning
 - 11.2 Insertion at last
 - 11.3 Insertion at any location
12. Write a program to implement following operations on Link List data structure.
 - 12.1 Deletion at beginning
 - 12.2 Deletion at last
 - 12.3 Deletion at any location
13. Write a program to implement Doubly Link List
 - 13.1 Insertion
 - 13.2 Traversing
14. Write a program to implement Breadth First Search Algorithm.

15. Write a program to implement Depth First Search Algorithm.

Course Outcomes:

Having successfully completed this course, the student will be able to:

- CO1: Apply knowledge of computing and mathematics to choose the data structures that effectively model the information in a problem.
- CO2: Solve problems by using iterative and recursive methods
- CO3: Write various operations like searching, sorting, insertion, deletion, traversing etc. on different data structure.
- CO4: Apply programming concepts to solve different problems based on data structures.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H												M		
CO2			H		M								M		
CO3		H							M			L		H	
CO4	H	M											L		L
CO5		M		H											L

H = Highly Related; M = Medium; L = Low

B.Tech CSE Semester IV

BCO 009B	COMPUTER ORGANIZATION AND DESIGN	3-1-0 [4]
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OBJECTIVE:

- To understand the number system conversions and logic gates.
- To study the design of logic unit and bus memory transfer.
- To study the addressing modes and instruction set architecture, register transfer RISC/CISC
- To study the hierarchical memory system including cache memories and its address mapping.
- To study the different ways of communicating with I/O devices and standard I/O interfaces.

UNIT 1	Introduction to number system, methods of base conversions; Binary, octal and hexadecimal arithmetic; Basic organization of computers; logic gates, Information representation, Fixed-Point Arithmetic: Floating point representation (Single & double precision), Complements.
UNIT 2	Using Karnaugh map methods, SOP, POS simplification, Logic design: Half adder, full adder, Adder–Subtractor. Multiplexer/ de-multiplexer, decoders. Fetch, decode and execute cycle. RTL, Bus & Memory Transfer, Tri state Buffer.
UNIT 3	Instruction set architectures, addressing modes, instruction cycles, Differentiate RISC versus CISC architectures. Arithmetic Micro-operation: Addition, Subtraction, Multiplication (Booth’s Algorithm), Array Multiplier
UNIT 4	Memory Technology, static and dynamic memory, Random Access and Serial Access Memories, Cache memory and Memory Hierarchy, Address Mapping, Cache updation schemes,
UNIT 5	I/O subsystems: Interfacing with IO devices, keyboard and display interfaces; Basic concepts Bus Control, Read Write operations, Programmed IO, Concept of handshaking, Polled and Interrupt-driven I/O, DMA data transfer.

Course Outcome (CO):

At the ends of this course students will have:

CO1: Awareness of computer organization.

CO2: Design and architecture of machine.

CO3: Implement different system calls for various units.

CO4: Logical representation of storage, representation and management.

CO5: Analysis of I/O subsystem.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H											M	H		
CO2			H		M									M	
CO3				M					M				L		
CO4				H						M			M		L
CO5				H						M					L

H = Highly Related; M = Medium L = Low

Text Book:

1. Digital Design, M.Morris Mano, Pearson
2. Computer System Architecture by Mano, Pearson

Reference books:

1. Modern Digital Electronics, R.P. Jain, TMH
2. Computer Organization by V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic , McGraw-Hill series(2002)
3. Digital Fundamental, Floyd & Jain, Pearson.
4. Computer Architecture and Organization, by Hayes, J.P.1998, McGraw-Hill
5. Digital Logic And Computer Design, Mano, Pearson

BCO 010C	DATABASE MANAGEMENT SYSTEMS	3-1-0 [4]
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OJECTIVE:

- To provide knowledge of relational model
- To learn about ER diagrams.
- To learn about Query Processing and Transaction Processing

UNIT 1	Introduction - Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators. Transaction Management, Components of a Database management System. Entity-Relationship Model – Basic Concepts, Constraints, Keys, Design Issues, E-R Diagrams.
UNIT 2	Relational Model- Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, Data Dictionary. Relational Algebra, Relational Calculus. SQL – Basic Structures, Query Handling, Triggers, Nested SQL Query, Embedded SQL,
UNIT 3	Relational Database Design- Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations.
UNIT 4	Fundamental Concepts of Transaction Management, ACID property. Serializability and testing for serializability, concurrency control schemes, lock-based protocols, two-phase locking protocols, graph-based protocols, time stamp-based protocols, deadlocks.
UNIT 5	File System: File organization- Heap File, Sequential File, Hash File, Clustered file, file operations, indexing, B-tree, B+ tree, Introduction to Data Mining, Data Farming, Data Warehousing

Course Outcome (CO):

At the ends of this course students will have:

- CO1: Awareness of database management basics and different models that we use for database.
CO2: Design and architecture of relational model, relational algebra and SQL queries.
CO3: Implement different form of normalization.
CO4: Logical representation of internet database.
CO5: Analysis and concepts of transaction, concurrency and recovery systems.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM
OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H												H	M	
CO2			H		M				M						<u>L</u>
CO3				H		M							M		
CO4				M								M		L	L
CO5	M	L		H					L				M		

H = Highly Related; M = Medium L = Low

Text Books:

1. Database Systems Concepts – Korth, TMH
2. An Introduction to Database Design – Date

Reference Books:

1. Fundamentals of Database Systems – Elmasri and Navathe
2. Database Management and Design – Hansen and Hansen .
3. Object-Oriented Database Design – Harrington

List of Experiments

- 1 Installation of MySQL
- 2 Analyze the problem and come with the entities in it. Identify what Data has to be persisted in the databases.
- 3 Represent all entities in a tabular fashion. Represent all relationships in a tabular fashion.
- 4 Creating of Tables on given problem
- 5 Applying Not Null, Check, Unique Constraints on database Tables.
- 6 Applying Primary Key, References, Foreign Key Constraints on database Tables.
- 7 Applying Insert, Select, Distinct Clause, Where Clause on database Tables.
- 8 Applying Update, Delete, Drop, on database Tables.
- 9 Applying table creation with select, Insert data using select, Renaming on database Tables.
- 10 Practice Queries using MINUS, UNION, INTERSECT, % operator.
- 11 Practice Queries using Group Functions.
- 12 Practice Queries using Group By, Having, Order By Functions.
- 13 Practice Queries using Arithmetic Operators, Comparison Operator.
- 14 Practice Queries using Logical Operator.
- 15 Practice Queries using any four String Functions.
- 16 Practice Queries using any four String Functions.
- 17 Practice Queries using Numeric Functions.
- 18 Practice Queries using Date Functions.

Course Outcome (CO):

At the ends of this course students will have:

- CO1: Awareness of database management basics and different models that we use for database.
- CO2: Design and architecture of relational model, relational algebra and SQL queries.
- CO3: Implement different form of normalization.
- CO4: Logical representation of internet database.
- CO5: Analysis and concepts of transaction, concurrency and recovery systems.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM
OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H												H	M	
CO2			H		M				M						<u>L</u>
CO3				H		M							M		
CO4				M								M		L	L
CO5	M	L		H					L				M		

H = Highly Related; M = Medium L = Low

BCO 017A	FORMAL LANGUAGES & AUTOMATION THEORY	3-1-0 [4]
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Objective:

- To understand various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine.
- To understand Decidability and Undesirability of various problems
- To construct pushdown automata and the equivalent context free grammars.
- To prove the equivalence of languages described by pushdown automata and context free grammars.
- To construct Turing machines and Post machines and prove the equivalence of languages described by Turing machines and Post machines.

UNIT 1	Basics of Strings and Alphabets, Finite Automata – DFA, transition graphs, regular languages, non-deterministic FA, equivalence of DFA and N DFA, Mealy and Moore Machine, minimization of Finite Automata,
UNIT 2	Regular grammars, regular expressions, equivalence between regular languages, properties of regular languages, pumping lemma. Relationship between DFA and Regular expression.
UNIT 3	Context Free Languages – Leftmost and rightmost derivation, parsing and ambiguity, ambiguity in grammar and languages, simplification of CFG, Normal forms
UNIT 4	Pushdown Automata – NDPDA, DPDA, context free languages and PDA, comparison of deterministic and non-deterministic versions, closure properties, pumping lemma for CFL,
UNIT 5	Turing Machines, variations, halting problem, PCP, Chomsky Hierarchy, Recursive and Recursive enumerable language, Rice Theorem.

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

CO1: Understand and construct finite state machines and the equivalent regular expressions.

CO2: Prove the equivalence of languages described by finite state machines and regular expressions.

CO3: Construct pushdown automata and the equivalent context free grammars.

CO4: Prove the equivalence of languages described by pushdown automata and context free grammars.

CO5: Construct Turing machines and Post machines and prove the equivalence of languages described by Turing machines and Post machines

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L										H		
CO2		H											L		
CO3	H		H												M
CO4		H		M											
CO5	H											H		L	

H = Highly Related; M = Medium L = Low

Text Books:

1. Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory,Languages and Computations”, Second Edition, Pearson Education, 2008.

Reference Book:

1. Mishra K L P and Chandrasekaran N, “Theory of Computer Science – Automata, Languages and Computation”, Third Edition, Prentice Hall of India, 2004.
2. Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.
3. Peter Linz, “An Introduction to Formal Language and Automata”, Third Edition, Narosa Publishers, New Delhi, 2002.
4. Kamala Krithivasan and Rama. R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education 2009.
5. John C Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007.

BCO 023A	DESIGN AND ANALYSIS OF ALGORITHMS	3-0-0 [3]
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OBJECTIVES:

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

- Design effective, efficient, elegant, and readable algorithms for various classes of computing problems
- Determine space and time complexity of algorithms by the use various algorithm design techniques like (divide and conquer, backtracking, greedy, etc.)

UNIT 1	Introduction, algorithms specification, time and space complexity, performance analysis, recurrence relations. Divide and Conquer – finding max min.
UNIT 2	Dynamic Programming and Greedy Methods – Huffman tree construction, Knapsack problem, 0/1 Knapsack problem, least common subsequence, matrix chain multiplication. Backtrack: 4-queen problem, Branch and Bound: assignment problem
UNIT 3	Graph algorithms–flow problems, String Matching Algorithms: Naive algorithm, automata and KMP matcher algorithms, Boyer-Moore algorithm
UNIT 4	Number Theory Problems – CRT, GCD algorithms, modular arithmetic, Lower Bound Theory; Approximate Algorithms – Set cover, vertex cover, .Randomized Algorithms – Las Vegas and Monte Carlo methods
UNIT 5	NP Completeness: Definitions of P, NP-Hard and NP-Complete Problems. Decision Problems..

OUTCOMES: After study of this subject student will be able to know

CO1: Various methods of calculating complexity

CO 2: Finding out the best method for different algorithms

CO3: About computational geometry, like Lower bound theory, modular arithmetic and CRT

CO4: Various Decision Problems like NP Complete, NP hard

CO5: Knowledge of Graph and its algorithm

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M		M			M				L	H	M	
CO2	H	H			H							L	H	M	M
CO3	M	H	L		M			M				M			M
CO4	H	L	M		M							L	M	H	
CO5	H	M	M		M			L				L	M	M	L

Textbooks:

1. Cormen, Leizerson&Rivest, Introduction to algorithms, Prentice-Hall. 2002
2. Horowitz &Sahni, Fundamentals of Computer Algorithms, Galgotia Publication. 1999

Reference Books:

1. Aho, Hopcroft, Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley. 2001.
2. Introduction to Design and Analysis of Algorithms, Anny Levitin, Person Education Press. 2007.
3. Gilles Brassard & Paul Bratley, Fundamental Algorithms, Prentice-Hall. 1998

BCO 007A	COMPUTER GRAPHICS	3-0-0 [3]
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OBJECTIVE:

- To provide students with a foundation in graphical applications programming
- To introduce students with fundamental concepts and theory of computer graphics
- To give basics of application programming interface (API) implementation based on graphics pipeline approach

UNIT 1	Introduction to Computer Graphics: Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays.
UNIT 2	Scan conversion – lines, circles and Ellipses; Filling polygons and clipping algorithms: Scan Converting Lines, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons, edge data structure, Clipping Lines algorithms Cohen-Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components.
UNIT 3	.Two-Dimensional Transformations: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations.
UNIT 4	Three-Dimensional Transformations: Introduction, Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique Projections, View volumes for projections
UNIT 5	Visible-Surface Determination : Techniques for efficient Visible-Surface Algorithm Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible Surface Ray Tracing, comparison of the methods. Illumination and Shading Illumination and Shading Models for Polygons, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Atmospheric attenuation, Phong's model, Gouraud shading, some examples.

Course Outcome (CO):

At the ends of this course students will have:

CO1: Understand the structure of modern computer graphics system

CO2: Understand the basic principles of implementing computer graphics primitives.

CO3: Familiarity with key algorithms for modeling and rendering graphical data

CO4: Develop design and problem solving skills with application to computer graphics

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M	L								M		
CO2			M	L					L		L			L	
CO3			L		L						M	L	L		M
CO4			H							L					L

H = Highly Related; M = Medium L = Low

Text Books:

1. Donald Hearn and Pauline Baker, Computer Graphics with OpenGL (third edition), Prentice Hall, 2003

Reference Books:

1.F. S. Hill Jr. and S. M. Kelley, Computer Graphics using OpenGL (third edition), Prentice Hall, 2006

2. Peter Shirley and Steve Marschner, Computer Graphics(first edition), A. K. Peters, 2010

3. Edward Angel, Interactive Computer Graphics. A Top-Down Approach Using OpenGL (fifth Edition), PearsonEducation, 2008

BCO 025A	DESIGN& ANALYSIS OF ALGORITHMS LAB	0-0-2
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List of Experiments

1. Write a Program to Explore a Binary Heap
2. Write a Program for Merging of two search trees
3. Write a program to implement Huffman tree construction
4. Write a Program for Computing a spanning tree having smallest value of largest edge
5. Write a Program for Finding the decimal dominant in linear time
6. Write a Program for Problems on Graphs. Etc.
7. Write a program to find Greatest Common Divisor
8. Write a program for fractional Knapsack problem
9. Write a program for 0/1 Knapsack problem
10. Write a program to implement Naive algorithm,
11. Write a program to implement KMP matcher algorithms,
12. Write a program to implement Boyer-Moore algorithm
13. Write a program to implement modular arithmetic
14. Write a program to implement Set cover,
15. Write a program to implement vertex cover

OUTCOMES: After study of this subject student will be able to know

CO1: Various methods of calculating complexity

CO 2: Finding out the best method for different algorithms

CO3: About computational geometry, like Lower bound theory, modular arithmetic and CRT

CO4: Various Decision Problems like NP Complete, NP hard

CO5: Knowledge of Graph and its algorithm

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M		M			M				L	H	M	
CO2	H	H			H							L	H	M	M
CO3	M	H	L		M			M				M			M
CO4	H	L	M		M							L	M	H	
CO5	H	M	M		M			L				L	M	M	L

BCO 015B	COMPUTERGRAPHICS LAB	0-0-2 [1]
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List of Experiments

- 1 Write a Program to Show basic Transformation with OpenGL
- 2 Write a Menu Driven Program with OpenGL
- 3 Write a Program to draw a line using Bresenham's Algorithm with OpenGL
- 4 Write a Program to implement midpoint algorithm to draw circle
- 5 Write a Program to implement midpoint algorithm to draw ellipse
- 6 Program to implement 2d scaling about an arbitrary axis.
- 7 Write a program to implement DDA line Algorithm
- 8 Program to implement 2d rotation about an arbitrary axis.
- 9 Program to implement translation of a line and triangle.
- 10 Program to implement Cohen Sutherland line clipping.
- 11 Program to implement Sutherland Hodgeman polygon clipping.
- 12 Program to draw Bezier curve.
- 13 Program to draw b-spline curve.
- 14 Program to implement a line using slope intercept formula.
- 15 Write a program to implement Bresenham 's Algorithm

Course Outcome (CO):

At the ends of this course students will have:

CO1: Understand the structure of modern computer graphics system

CO2: Understand the basic principles of implementing computer graphics primitives.

CO3: Familiarity with key algorithms for modeling and rendering graphical data

CO4: Develop design and problem solving skills with application to computer graphics

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M	L								M		
CO2			M	L					L		L			L	
CO3			L		L						M	L	L		M
CO4			H							L					L

H = Highly Related; M = Medium L = Low

BCO 028B	COMPILER CONSTRUCTION	3-1-0 [4]
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OBJECTIVE:At the end of the course, the student should be able to:

- Apply the principles in the theory of computation to the various stages in the design of compilers;
- Explain the stages involved in the translation process;
- Analyse problems related to the stages in the translation process;
- Design a compiler for a simple programming language; and
- Implement a compiler based on its design.

UNIT 1	<p>Overview of compilation- The structure of a compiler and applications of compiler technology; Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, hand-written lexical analyzers, LEX, examples of LEX programs.</p> <p>Introduction to syntax analysis -Role of a parser, use of context-free grammars (CFG) in the specification of the syntax of programming languages, techniques for writing grammars for programming languages (removal left recursion, etc.), non-context-free constructs in programming languages, parse trees and ambiguity, examples of programming language grammars.</p>
UNIT 2	<p>Top-down parsing- FIRST & FOLLOW sets, LL(1) conditions, predictive parsing, recursive descent parsing, error recovery. LR-parsing - Handle pruning, shift-reduce parsing, viable prefixes, valid items, LR(0) automaton, LR-parsing algorithm, SLR(1), LR(1), and LALR(1) parsing. YACC, error recovery with YACC and examples of YACC specifications.</p>
UNIT 3	<p>Syntax-directed definitions (attribute grammars)-Synthesized and inherited attributes, examples of SDDs, evaluation orders for attributes of an SDD, Dependency graphs-attributed and L-attributed SDDs and their implementation using LR-parsers and Recursive Descent parsers respectively.</p>
UNIT 4	<p>Semantic analysis- Symbol tables and their data structures. Representation of “scope”. Semantic analysis of expressions, assignment, and control-flow statements, declarations of variables and functions, function calls, etc., using S- and L-attributed SDDs (treatment of arrays and structures included). Semantic error recovery.</p>
UNIT 5	<p>Intermediate code generation - Different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses. Translation of expressions (including array references with subscripts) and assignment statements. Translation of control-flow statements – it- then-else, while-do, and switch. Short-circuit code and control-flow translation of Boolean expressions. Back patching. Examples to illustrate intermediate code generation for all constructs.</p> <p>Run-time environments: - Stack allocation of space and activation records. Access to non-local data on the stack in the case of procedures with and without nesting of procedures.</p>

Course Outcome

At the end of this course students will have:

- CO1 To apply the knowledge of lex tool & yacc tool to develop a scanner & parser.
- CO2 To design parser and Intermediate Code Generation in compiler.
- CO3 To deal with different translators.
- CO4 To learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
- CO5 To use the knowledge of patterns, tokens & regular expressions for solving a problem.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	L		H			L					H	M	
CO2		H				L							H		
CO3		L		H	L										M
CO4		H					H							H	
CO5		H		L		H									L

H = Highly Related; M = Medium L = Low

Text Books:

1. Compilers: Principles, Techniques, and Tools, by A.V. Aho, Monica Lam, Ravi Sethi, and J.D. Ullman, (2nded.), Addison-Wesley, 2007 (main text book, referred to as ALSU in lab assignments).
2. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2004.

Reference Books:

1. K.C. Loudon, Compiler Construction: Principles and Practice, Cengage Learning, 1997.
2. D. Brown, J. Levine, and T. Mason, LEX and YACC, O'Reilly Media, 1992.

BCO 031B	Compiler Design Lab	0:0:2 [1]
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List Of Experiments

- 1 Familiarization with LEX by writing simple specifications for tokens such as identifiers, numbers, comments in C/C++, etc. All LEX specifications must be compiled and executed with appropriate inputs. At least ten such exercises must be completed in two lab classes.
- 2 LEX specification for tokens of the small language in ALSU's book
- 3 Complete the specifications in (2) above to make a complete lexical analyzer. (1 lab class)
- 4 Familiarization with YACC by writing simple specifications for desk calculator, variable declarations in C (only numbers and array). All YACC specifications must be compiled and executed with appropriate inputs. Note that this exercise also requires LEX specifications of the tokens involved. (2 lab classes)
- 5 YACC specifications for the syntax of the small language in ALSU's book (appendix A)(1 lab class)
- 6 Adding error recovery to (5) above to make a complete parser. (1 lab class)
- 7 S-attributed specification of the semantics of the small language in ALSU's book
- 8 Adding semantic error recovery to the semantic analyzer in (7) above to make a complete semantic analyzer. (1 lab class)
- 9 Intermediate code generation for the constructs of the small language in ALSU's book (appendix A) to be incorporated into the semantic analyzer of (8) above. Students doing this last assignment may be awarded bonus marks. (3 lab classes)
- 10 Write a programme to parse using Brute force technique of Top-down parsing.
- 11 Write a program for generating for various intermediate code forms
i) Three address code ii) Polish notation
- 12 Develop an operator precedence parser (Construct parse table also)
- 13 Develop a recursive descent parser
- 14 Develop a lexical analyser to recognize a few patterns.

Competitive Programming Track

Competitive Programming
Department Elective 1

BCO 081A	PROGRAMMING WITH PYTHON	3-0-1 [3]
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OBJECTIVE:

- To study various core programming basics—including data types, control structures, algorithm development,
- To overview the applications of Python.
- To be familiar with program design with functions—via the Python programming language.
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

UNIT 1	Introduction: Features of Python, History of Python, installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages
UNIT 2	Introduction to Operators, Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Strings: subscript operator, indexing, slicing a string, String methods & operations; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers. Text files; manipulating files and directories, os and sys modules; reading/writing text and numbers from/to a file; creating and reading a formatted file
UNIT 3	Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions.
UNIT 4	Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects OOP, continued: inheritance, polymorphism Operator overloading (<code>_eq_</code> , <code>_str_</code> , etc); abstract classes; Exception handling, try block
UNIT 5	Graphical user interfaces; Event-driven programming paradigm; tkintermodule,,turtle module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Multithreading, CSV(Accesing, updating, Creating)

Course Outcome:

- CO1: Able to use various core programming basics—including data types, control structures, algorithm development,
- CO2: Able to understand the applications of Python.
- CO3: Show the program design with functions—via the Python programming language.
- CO4: Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M										H		
CO2		L			M									L	<u>L</u>
CO3			H		M						L		M		L
CO4		M		L					L	L				M	

H = Highly Related; M = Medium L = Low

Text Book:

1. *Fundamentals of Python: First Programs* Author: Kenneth Lambert Publisher: Course Technology, Cengage Learning, 2012 ISBN-13: 978-1-111-82270-5

Reference Books:

1. Python: Real World Machine Learning By Prateek Joshi et al. ISBN 13: 9781787123212 Packt Publishing 941 pages (November 2016)

Competitive Programming
Department Elective 2

BCO 180A	Design Thinking	3-0-0
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Course Objectives

1. Increase ability to communicate with people.
2. Enhance knowledge, imagination and be more assertive on opinions on problems in society.
3. Learn basics of research, data collection, analysis, brainstorming to find solutions to issues.
4. Apply Design Thinking methodologies to problems in field of study and other areas as well.

UNIT 1	WHAT IS DESIGN THINKING? - Designers seek to transform problems into opportunities. Through collaboration, teamwork, and creativity, they investigate user needs and desires on the way to developing human centered products and/or services. This approach is at the very heart of design thinking.
UNIT 2	THE DESIGN THINKING MODEL-A tool that helps guide you along a design thinking path. The model does this by providing a series of activities that that will help you effectively design a product, service or solution to a user’s need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.
UNIT 2I	PHASE 1: DISCOVER- Begin the design thinking process with the Discover phase, where you will identify the specific problem your design is intended to solve, as well as important usability aspects from those who will use your design. Discovery can be performed through a variety of different research methods which you will learn in this module. PHASE 2: DEFINE - In the Define phase, you come to understand the problem. We often refer to this as framing the problem. You can do this by using a variety of tools, including storytelling, storyboarding, customer journey maps, personas, scenarios, and more.
UNIT 4	PHASE 3: DEVELOP - Turn your attention to solving the problem. In this phase you brainstorm custom creative solutions to the problems previously identified and framed. To do this, you conceptualize in any way that helps, putting ideas on paper, on a computer, or anywhere whereby they can be considered and discussed. PHASE 4: DELIVER-This phase is all about testing and building concepts. Here you take all of the ideas that have been discussed to this point and bring them a little closer to reality by building a concept; something that makes it easier for a user to experience a design. This concept is referred to as a prototype.

UNIT 5	<p>PHASE 5: ITERATE - You will test the prototype of your design solution, collecting and acting on feedback received. These actions may mean minor or major revisions to your design, and are repeated as often as necessary until a solution is reached. Tools such as focus groups and questionnaires are used to help you collect feedback that can help with your final design.</p> <p>BEYOND DESIGN THINKING- The Design Thinking Model is a tool that helps guide you along a design thinking path. The model does this by providing a series of activities that that will help you effectively design a product, service or solution to a user’s need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.</p>
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Course Outcomes

- CO1. Examine design thinking concepts and principles
- CO2. Practice the methods, processes, and tools of design thinking
- CO3. Apply the Design Thinking approach and model to real world scenarios
- CO4. Analyze the role of primary and secondary research in the discovery stage of design thinking

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M	M	M	L	L		L	L	L	H			L
CO2			M	M	M	M	L		L		L	H	L		
CO3	L	L	H	M	M	L	H	L	M	M	H	H		M	L
CO4			H	H	H	H	H	L	M	M	M	H	M		L

H = Highly Related; M = Medium L = Low

Reference Books

1. Brown, Tim. “What We Can Learn from Barn Raisers.” Design Thinking: Thoughts by Tim Brown. Design Thinking, 16 January 2015. Web. 9 July 2015.
2. Knapp, Jake. “The 8 Steps to Creating a Great Storyboard.” Co.Design. Fast Company & Inc., 21 Dec. 2013. Web. 9 July 2015.

3. van der Lelie, Corrie. "The Value of Storyboards in the Product Design Process." *Journal of Personal and Ubiquitous Computing* 10.203 (2006): 159–162. Web. 9 July 2015. [PDF].
4. Millenson, Alisson. "Design Research 101: Prototyping Your Service with a Storyboard." *Peer Insight*. Peer Insight, 31 May 2013. Web. 9 July 2015.

Competitive Programming
Department Elective 3

BCO 037 B	ADVANCE PROGRAMMING IN JAVA	3-0-0 [3]
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OBJECTIVES: - Students will be able to know the following

- To learn the Java programming language: its syntax, idioms, patterns, and styles.
- To become comfortable with object oriented programming: Learn to think in objects
- To learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them.
- To introduce event driven Graphical User Interface (GUI) programming

UNIT 1	Revisited of GUI, Database Programming using JDBC Introduction to JDBC ,JDBC Drivers & Architecture CURD operation Using JDBC Connecting to non-conventional Databases. Connectivity with SQL server, Oracle and MS access.
UNIT 2	Networking , Networking Basics ,The Networking Classes and Interfaces InetAddress ,Factory Methods ,Instance Methods ,Inet4Address and Inet6Address, TCP/IP Client Sockets ,URL,URLConnection,Http URL Connection, The URI Class,Cookies, TCP/IP Server Sockets,Datagram, DatagramSocket ,DatagramPacket,
UNIT 3	RMI (Remote Method Invocation) RMI overview RMI architecture, Designing RMI application, Executing RMI application. Example demonstrating RMI
UNIT 4	Servlet: Web Application Basics. Architecture and challenges of Web Application.Introduction to servlet life cycle Developing and Deploying Servlets Exploring Deployment Descriptor (web.xml). Handling Request and Response Initializing a Servlet Accessing Database Servlet Chaining Session Tracking & Management Dealing with cookies Transferring Request Accessing Web Context Passing INIT and CONTEXT Parameter Sharing information using scope object Controlling concurrent access User Authentication Filtering Request and Response Programming Filter Filter Mapping Servlet Listeners .
UNIT 5	Basic JSP Architecture Life Cycle of JSP (Translation, compilation) JSP Tags and Expressions Role of JSP in MVC-2 JSP with Database JSP Implicit Objects Tag Libraries JSP Expression Language (EL) Using Custom Tag JSP Capabilities: Exception Handling Session Management Directives JSP with Java Bean.

OUTCOMES:-

Upon end of this course, students will be able to:

- About the Java programming language: its syntax, idioms, patterns, and styles.
- Become comfortable with object oriented programming: Learn to think in objects
- Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them.
- Introduce event driven Graphical User Interface (GUI) programming

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

Course Outcomes	Program Outcomes												Program specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H	L	H		L			M	H			H	
CO2		L	H		H	L		L					M	H	
CO3			H	M					L	L		M		H	
CO4				M	H			M			L			H	M
CO5		L			H	M			M					H	

Text Books:

1. J2EE: The complete Reference by James Keogh
2. Java 6 And J2Ee 1.5, Black Book by kogent
3. Java Server Programming Java EE6 (J2EE 1.6), Black Book by kogent

Reference books:-

1. Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies
2. Java Programming John P. Flynt Thomson 2nd
3. Java Programming Language Ken Arnold Pearson

BCO 069A	Advance Programming in Java Lab	0-0-2
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Exp.No. Name of the Experiment

- 1 Design a registration page using HTML.
- 2 **Implementing JDBC**
Program 2(A) Write a program by using JDBC to execute insert, select and update query by using PreparedStatement and display the results.
Program 2(B) Write a program by using JDBC to execute an update query by using PreparedStatement and display the results.
Program 2(C) Write a program and execute ResultSetMetaData Interface by using JDBC.
- 3 **Implementing Servlet**
Program 3(A) Write a program and execute a simple servlet demonstrating servlet lifecycle.
Program 3(B) Write a program and execute a servlet program that receives input from html page.
Program 3(C) Write a program and execute ServletRequest and ServletResponse Interfaces with methods.
Program 3(D) Write a program and execute HttpServlet Class doGet() and doPost() Methods.
Program 3(E) Write a program to store the user information into Cookies. Write another program to display the above stored information by retrieving from Cookies.
- 4 **Implementing JSP, JSP Custom Tags and Directives**
Program 4(A) Write a program to connect HTML page, JSP page and mysql database.
Program 4(B) Write a program and implement custom tags in JSP
Program 4(C) Write a program and implement JSP directives.
- 5 **Implementing JavaBean**
Program 5 Write a program and implement Javabeans using JSP page.
- 6 **Implementing JSP Standard ActionElements**
Program 6 Write a program and implement JSP StandardActionElements.
- 7 **Implementing JSP Scripting Elements**
Program 7: Write a program and execute JSP Scriptlets, Declarations and Expressions.
- 8 **Learning session management**
Program 8(A): Write program and execute session management using URL rewriting

Program 8(B) :Write program and execute session management using Hidden Fields.
 Program 8(C) : Write program and execute session management using Cookie
 Program 8(D): Write a program and execute session management using Session Objects.

9 **Remote Method Invocation (RMI)**

Program 9(A):Write a program and execute Remote Method Invocation

10 **Configure web.xml**

Program 10:Write a code to deploy web.xml file

11 **Performing Client-Server Communication and Networking**

Program 11(A): WAP to implement Client-Server Program

Program 11(B): WAP to implement InetAddress.

Program 11(C): WAP for Sending Email in java

12. **Implementing Multithreading**

Program 12: WAP to implement multithreading(three threads using single run method).

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H	L	H		L			M	H			H	
CO2		L	H		H	L		L					M	H	
CO3			H	M					L	L		M		H	
CO4				M	H			M			L			H	M
CO5		L			H	M			M					H	

Competitive Programming
Department Elective 4

BCO 181A	ADVANCED DATA STRUCTURE	3-0-0
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Course Objectives: -

- Understand and apply linear data structures-List, Stack and Queue.
- Understand the graph algorithms.
- Learn different algorithms analysis techniques.
- Apply data structures and algorithms in real time applications

UNIT 1	Unit 1:- Linear Data Structures Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of stack – Evaluating Arithmetic Expressions - Other Applications - Applications of Queue - Linked Lists - Singly Linked List - Circularly Linked List - Doubly Linked lists – Applications of linked list – Polynomial Manipulation.
UNIT 2	Unit 2:- Non- Linear Data Structures Binary Tree, Binary Search Tree, Binary tree traversals, applications of trees, AVL tree, searching, insertion and deletions in AVL trees, Huffman algorithm, B/B+ tree, 2-3 tree operations, Red-Black Trees, Heap operations. Graphs- Graphs terminology, Graph ADT, representations, graph traversals/search methods-dfs and bfs, Applications of Graphs-Minimum cost spanning tree using Kruskal’s algorithm, Dijkstra’s algorithm for Single Source Shortest Path Problem.
UNIT 3	Unit 3:- Heaps: Heaps as priority queues, heap implementation, insertion and deletion operations, binary heaps, binomial and Fibonacci heaps, heapsort, heaps in Huffman coding. Sorting –Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.
UNIT 4	Unit 4:- Hashing and sorting network: Search efficiency in lists and skip lists, hashing as a search structure, hash table, collision resolution, universal hashing, linear open addressing, chains, hash tables in data-compression, LZW algorithm, 2-3-4. Trees and 2-3-4 Heaps. SORTING NETWORK: Comparison network, zero-one principle, bitonic sorting and merging network sorter.
UNIT 5	Unit 5:- NUMBER THEORITIC ALGORITHM: Number theoretic notation, Division theorem, GCD recursion, Modular arithmetic, Solving Linear equation, Chinese remainder theorem, power of an element, RSA public key Crypto system, primality Testing and Integer Factorization. Basic algorithmic techniques:- Greedy algorithms, divide & conquer, dynamic

programming. Search techniques - backtracking,
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COURSE OUTCOMES (COs)

CO1: Describe, explain and use abstract data types including stacks, queues and lists

CO2: Design and Implement Tree data structures and Sets

CO3: Able to understand and implement non linear data structures - graphs

CO4: Able to understand various algorithm design and implementation

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	L	M	M				L		L	L	L	L	
CO2	M	M		L	M						L	L	M		M
CO3	M	M	L	M	M				L			L	M	L	
CO4	M	M	M	M	M		L		L		L	L	H		M
CO5	L	M	L	M	M				L		L	L	L	L	

REFERENCES:

1. Anany Levitin “Introduction to the Design and Analysis of Algorithms” Pearson Education, 2015
2. E. Horowitz, S.Sahni and Dinesh Mehta, “Fundamentals of Data structures in C++”, University Press, 2007
3. E. Horowitz, S. Sahni and S. Rajasekaran, “Computer Algorithms/C++”, Second Edition, University Press, 2007
4. Gilles Brassard, “Fundamentals of Algorithms”, Pearson Education 2015
5. Harsh Bhasin, “Algorithms Design and Analysis”, Oxford University Press 2015

Competitive Programming
Department Elective 5

BCO 182A	Web designing and JavaScript	3-0-1
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Course objectives: -

- To develop the skill & knowledge in JavaScript-enhanced web page.
- Students will understand the knowhow and can function either as an entrepreneur or can take up jobs in the multimedia and Web site development studio and other information technology sectors

UNIT 1	Unit-1 The Nature of JavaScript The Evolution of Scripting Languages, JavaScript - Definition, Programming for Non-Programmers? Comparison between Java, JavaScript & VB Script, Introduction to Objects, Methods, and Events, Events and Program Flow, Jumping Right In, Running Scripts.
UNIT 2	Unit-2 Script Writing Basics Enhancing HTML Documents with JavaScript, The Quintessential Building Blocks, Script Mechanics, Using Names, Objects and Methods Names and References in JavaScript, Built-in Objects, Home-Built Objects, The Hierarchy of Names, Using Methods, Operators and Variables, Keywords, Functions, Object interaction.
UNIT 2I	Unit-3 Adding Interactivity to a Web Page Controlling Script Flow, Storing Tasks within Functions, Using Conditional Statements for Decision Making, if Statements, if-else Conditional Statements, Using the Date Object, for Conditional Statements, while Conditional Statements, break and continue Statements, with Statements, Creating Functions in JavaScript, Declaring a Function, Designing a Simple Function.
UNIT 4	Unit-4 Creating Dynamic Web Page Changing Pages Based on Time and Date, Displaying the Quote of the Day, Using Arrays, Constructing the Quotes Script, Considerations When Accessing External Files, Changing the Background Color through a Random Number, Turning the Color Generator into a Function, Using the Image and Area Objects, Creating an Image Object, Creating an Area Object, Selecting a Guide
UNIT 5	Unit-5 Java Scripting Your Forms Basic Script Construction, Talking to Your Form Objects, Organizing Your Objects and Scripts, Field-Level Validation, Check Required Fields, Validate Zip Code, Automated Formatting, Format Phone, Format Money, Automatic Calculation, Calculate Expiration Date, Calculate

	Amount
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Course Outcomes:

CO1. Able to understand Definition, Evolution and Nature of JavaScript

CO2. Introduction to Jump-Starting JavaScript and Script Writing Basics;

CO3. Design web pages Using Names, Objects, Methods and Method of Adding Interactivity to a Web Page,

CO4. Able to create Dynamic Web Pages; Concept of Java Scripting Your Forms

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L		L	M							L	L	M	
CO2	L		L		M										L
CO3	L	M	H		L								M	H	
CO4		M		L									H	M	H
CO5	M	L		L	M							L	L	M	

Text Books

1. Douglas Crockford JavaScript: The Good Parts,2nd Edition O'Reilly
2. Fritz Schneider,Thomas Powell JavaScript : The Complete Reference 2nd Edition Tata McGraw - Hill Education
3. David Flanagan JavaScript: Pocket Reference 3rd Edition O'Reilly

Reference books

1. Danny Goodman Michael Morrison Paul Novitski Tia GustaffRayl Javascript Bible, 7th Edition Wiley India Pvt Ltd
2. Kogent Learning Solutions Inc Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX Dreamtech Press
3. Ivan Bayross Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML (With CD) and PHP BPB Publication

Competitive Programming
Department Elective 6

BCO 183A	XML Programming	3-0-1
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Course Objectives

1. To help students understand the role of xml in interoperability of applications.
2. To help students to have complete understanding of publishing and applying xml.
3. To help students understand XML in detail w.r.t its fundamentals, syntax
4. Understand the use and role of web services.
5. To help students understand the working of CSS and AJAX in web-based applications.

UNIT 1	Unit-1 Introduction to XML Why XML?, Extending and Adopting Markup Languages, From SGML to XML and XHTML, Benefits and Drawbacks of XML. XML FUNDAMENTALS: Creating an XML Document, Defining Structure, Rules for Well-Formed and Valid XML, Changing XML Documents XML SYNTAX : Tag Attributes and Naming Rules, Empty and Non-Empty Elements, Processing Instructions for XML, Accessing Data from XML Elements.
UNIT 2	Unit-2 XML DOCUMENT TYPE DEFINITION (DTD) XML DTD as an XML Schema, Creating a DTD, Element Conditions and Quantifiers, Referencing DTD Declarations, Validating DTD Compliance
UNIT 3	Unit-3 XML SCHEMA DEFINITION (XSD),Element and Attribute Declarations, Simple, Complex, and Built-in Types, Named and Anonymous Types, Associating XML with a Schema, Validating XSD Compliance
UNIT 4	Unit-4 PUBLISHING XML AND APPLYING XML Stylesheet Languages, Using Style Sheets with XML,Page Layout with Cascading Style Sheets (CSS), CSS Syntax and Classes APPLYING XML: XML and Web Services, HTML with XML, XML and eCommerce, Storing Binary Data in XML Publish and Apply XML : Stylesheet Languages, What is CSS? , Using stylesheet with XML, Layout with cascading style sheet(css), css syntax and classes. Xml and web services, HTML, XML and eCommerce,

	Storing Binary Data in XML.
UNIT 5	Unit-5 CSS AND AJAX 5 CSS: Introduction, CSS and HTML, CSS Essentials, Typography, Colors and Backgrounds AJAX: Security, Performance, Dynamic double combo, The enhanced Ajax web portal, Live search using XSLT, Building stand-alone applications with Ajax.

Course Outcomes

CO1. A complete knowledge of XML and its structure

CO2. Detailed understanding of xml syntax and how to write them.

CO3. Detailed understanding of XML SCHEMA and the uses of DTD and how to write them and integrate with XML data

CO4: To have complete understanding of publishing and applying xml.

CO5: To have complete understanding of the benefits and the implementation of CSS and AJAX in web based applications

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M											L	L		
CO2	L	M	M	L	M									M	
CO3		L	L	M	M								M	M	M
CO4		M	L		L							L			L
CO5	L	H	M	L	H							M	H		H

Text Books

1. XML: The Complete Reference, Heather Williamson, TMH

2. PHP: The Complete Reference, Steven Holzner, TMHH

Reference Books

1. XML How to Program, H. M. Deitel, P. J. Deitel, Pearson

2. Learning XML, Erik T. Ray, O'Reilly

Competitive Programming
Department Elective 7

BCO 184A	Framework of object-oriented Programming (Hibernate)	3-0-0
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Course Objective:

Students will be able to learn the concepts of Hibernate, identifying the drawbacks of JDBS and advantages of using Hibernate for database connectivity

UNIT 1	Introduction to Hibernate, Drawbacks of direct JDBC, Plain Old Java Object (POJO), What is O-R Mapping? Simple Database Application Hibernate Configuration, Required JAR Files, Hibernate configuration File, Hibernate properties File, Hibernate XML File , SQL Dialects Hibernate Concepts, Id and Primary Key, Id Generation Methods, Session Factory, Session, Transaction, Developing CRUD Application
UNIT 2	Hibernate O-R Mapping, Mapping Declarations, Modeling Composition with Relationship, Modeling Composition with Components, One-to-One Association, One-to-Many Association, Many-to-Many Association, Uni and Bidirectional Associations, Hibernate Value Types , Custom Types
UNIT 3	Manipulating and Querying, Persistent Objects , Object Loading, Executing Queries, Iterating Results, Scalar Results, Bind Parameters Pagination , Hibernate Query Language, Select clause, From clause, Where clause, Aggregate functions, Expressions , Sorting , Grouping, Sub queries
UNIT 4	Criteria Queries , Creating Criteria, Narrowing the Result, Ordering the Result, Native SQL, Using SQL Query, Named SQL Query, Using Stored Procedure for Querying, Creating Custom SQL for CRUD
UNIT 5	Transaction and Concurrency, Session and Transaction Scopes, Database Transaction Demarcation, Optimistic Concurrency Control, Pessimistic Concurrency Control, Connection Release Modes, Caching, Connecting with Multiple Databases, Integrating Hibernate with Servlets and Struts, Hibernate Annotations

COURSE OUTCOMES:

- CO1:- understand the drawback of JDBC and benefits of Hibernate
- CO2:- Able to understand mapping concepts of DBMS with its types
- CO3:- Able to understand how to manipulate database using hibernate query language
- CO4:- Understand CRUD operations, developing custom query
- CO5:- Understand the concepts of transaction and concurrency control in Hibernate

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M		L								L	L	M	
CO2	L		M		M									M	
CO3		M	M	L	H							L	L		M
CO4	M	L	M		L								M	H	
CO5	M		H	L	M										L

Reference Book

1. Christian Bauer, Gavin King, "Java Persistence with Hibernate".
2. Thorben Janssen, "Hibernate Tips: More than 70 solutions to common Hibernate problems"
3. Vlad Mihalcea, "High-Performance Java Persistence"

Competitive Programming
Department Elective 8

BCO 185A	Programming in Node JS Struct	3-0-1
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Course Objectives

- Understand the JavaScript and technical concepts behind Node JS
- Structure a Node application in modules
- Understand Buffers, Streams, and Pipes
- Build a Web Server in Node and understand how it really works
- Connect to a SQL or Mongo database in Node

UNIT 1	What is Node JS and advantages of Node JS and How Node JS Works and the difference between the traditional web server and what are the limitations of the traditional web server model, Node.js Process Model Install Node.js on Windows, Installing in mac os , Working in REPL, Node JS Console
UNIT 2	Node JS Module and Node Package manager Functions, Buffer , Module, Module Types, Core Modules , Local Modules , Module.Exports What is NPM, Installing Packages Locally, Adding dependency in package.json, Installing packages globally, Updating packages
UNIT 3	File system and creating web server Fs.readFile, Writing a File, Writing a file asynchronously, Opening a file, Deleting a file, Other IO Operations. creating web server, hadling GET, POST,PUT and Delete requests and listening to certain port numbers and handling routing with basic web server, handling HTTP request, sending request
UNIT 4	Debugging and Events Core Node JS debugger, Debugging with Visual Studio, events in Node JS, and the significance of the events, writing your own events, EventEmitter class, Returning event emitter, Inhering events
UNIT 5	Database connectivity Template engine connect to SQL Server and perform CRUD operations. Connection string, Configuring, Working with select command, Updating records, Deleting records. template engines to perform 2 way databinding and appending dynamic data to the webpage, What is Jade?, What is vash?

Course Outcomes: -

- CO1. Able to understand traditional web server and technical concepts behind Node JS
CO2. Understand how to use modules and packages
CO3. To have complete understanding of using files, events and debuggers.

CO4. Able to understand database connectivity and template engines.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	M		L								M	H	
CO2	L		H	M							L		L	L	
CO3		L	M	M	H								H		L
CO4		M										L	L	L	

Information Security Track

Information Security

Department Elective 1

BCO 081A	PROGRAMMING WITH PYTHON	3-0-0 [3]
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OBJECTIVE:

- To study various core programming basics—including data types, control structures, algorithm development,
- To overview the applications of Python.
- To be familiar with program design with functions—via the Python programming language.
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

UNIT 1	Introduction: Features of Python, History of Python, installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages
UNIT 2	Introduction to Operators, Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Strings: subscript operator, indexing, slicing a string, String methods & operations; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers. Text files; manipulating files and directories, os and sys modules; reading/writing text and numbers from/to a file; creating and reading a formatted file
UNIT 3	Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions.
UNIT 4	Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects OOP, continued: inheritance, polymorphism Operator overloading (<code>_eq_</code> , <code>_str_</code> , etc); abstract classes; Exception handling, try block
UNIT 5	Graphical user interfaces; Event-driven programming paradigm; tkintermodule,,turtle module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Multithreading, CSV(Accesing, updating, Creating)

Course Outcome:

Upon completion of this course, the student will be able to:

- CO1: Understand different core programming basics—including data types, control structures, algorithm development,
- CO2: Understand the applications of Python.
- CO3: Show the program design with functions—via the Python programming language.
- CO4: Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M										H		
CO2		L			M									L	<u>L</u>
CO3			H		M						L		M		L
CO4		M		L					L	L				M	

H = Highly Related; M = Medium L = Low

Text Book:

1. *Fundamentals of Python: First Programs* Author: Kenneth Lambert Publisher: Course Technology, Cengage Learning, 2012 ISBN-13: 978-1-111-82270-5

Reference Books:

2. Python: Real World Machine Learning By Prateek Joshi et al. ISBN 13: 9781787123212 Packt Publishing 941 pages (November 2016)

Information Security

Department Elective 2

BCO 186A	Principle of Cryptography	3-0-0 [3]
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OBJECTIVE:

- To gain knowledge about the mathematics of the cryptographic algorithms.
- To get an insight into the working of different existing cryptographic algorithms.
- To learn how to use cryptographic algorithms in security.

UNIT 1	Algebra: Group, cyclic group, cyclic subgroup, field, probability. Number Theory: Fermat's theorem, Cauchy's theorem, Chinese remainder theorem, primality testing algorithm, Euclid's algorithm for integers, quadratic residues, Legendre symbol, Jacobi symbol etc..
UNIT 2	Cryptography and cryptanalysis, Classical Cryptography, substitution cipher, different type of attack: CMA, CPA, CCA etc, Shannon perfect secrecy, OTP, Pseudo random bit generators, stream ciphers and RC4.
UNIT 3	Block ciphers: Modes of operation, DES and its variants, AES, linear and differential cryptanalysis.
UNIT 4	One-way function, trapdoor one-way function, Public key cryptography, RSA cryptosystem, Diffie-Hellman key exchange algorithm, Elgamal Cryptosystem.
UNIT 5	Cryptographic hash functions, secure hash algorithm, Message authentication, digital signature, RSA digital signature, Elgamal digital signature.

Course Outcome:

CO1: Building a new unbreakable cryptosystem

CO2: Blending the existing cryptographic algorithms with the existing communication protocols

CO3: Analyzing and application of cryptography for secure e Commerce and other secret transactions

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H											M	H	M	
CO2	H	H		L							L		H	M	
CO3	H	M	H		H						M		H		L

H = Highly Related; M = Medium L = Low

Textbook:

1. Stinson. D. Cryptography: Theory and Practice, third edition, Chapman & Hall/CRC, 2010.

Reference Books:

1. W. Stallings, Cryptography and Network Security Principles and practice, 5/e, Pearson Education Asia, 2012.
2. Behrouz A. Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, second edition, Tata McGraw Hill, 2011
3. Thomas Koshy, Elementary Number Theory with applications, Elsevier India, 2005.

Information Security

Department Elective 3

BCO 187A	INFORMATION SECURITY	3-0-1 [4]
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Objective:

- To explain the objectives of information security
- To analyse the trade-offs inherent in security
- To describe the enhancements made to IPv4 by IPSec
- To understand the basic categories of threats to computers and networks
- To discuss issues for creating security policy for a large organization

UNIT 1	Information Security: Introduction, History of Information security, What is Security, CNSS Security Model, Components of Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Security Systems Development Life Cycle.
UNIT 2	Cryptography: Concepts and Techniques, symmetric and asymmetric key cryptography, steganography, Symmetric key Ciphers: DES structure, DES Analysis, Security of DES, variants of DES
UNIT 3	Message Authentication and Hash Functions: Authentication requirements and functions, MAC and Hash Functions, MAC Algorithms: Secure Hash Algorithm, Whirlpool, HMAC, Digital signatures, X.509, Kerberos
UNIT 4	Security at layers(Network, Transport, Application): IPSec, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Electronic Transaction(SET), Pretty Good Privacy(PGP), S/MIME
UNIT 5	Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls

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

CO1: Explain the objectives of information security and analyze the importance of information Security in real world.

CO2: Analyse the trade-offs inherent in security and designing and analysis of different encryption Algorithms.

CO3: Implementation of MAC and Hash functions, security at different layers of a network

CO4: Understand the basic categories of threats to computers and networks and explore different types of intruders and viruses.

CO5: Discuss issues for creating security policy for a large organization

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H					M					M			M
CO2	H	H	H	M								M		M	
CO3	H			L									H		
CO4	L				H						M			L	
CO5	M				H	H	H	M		L	M				M

H = Highly Related; M = Medium L=Low

Text Books –

1. Stalling Williams: Cryptography and Network Security: Principles and Practices, 4th Edition, Pearson Education, 2006.
2. Kaufman Charlie et.al; Network Security: Private Communication in a Public World, 2nd Ed., PHI/Pearson.

Reference Books:

1. Pieprzyk Josef and et.al; Fundamentals of Computer Security, Springer-Verlag, 2008.
2. Trappe & Washington, Introduction to Cryptography, 2nd Ed. Pearson.

Information Security

Department Elective 4

BCO 188A	Cyber Forensic & investigation	3-0-0 (3)
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Objective:

- To study the fundamentals of Computer Forensics
- To learn, analyze and validate Forensics Data
- To study the tools and tactics associated with Cyber Forensics

UNIT 1	File systems, Microsoft file structure, Examining NTFS disks, Microsoft BitLocker, Third Party Disk Encryption Tools, Windows Registry, Start-up Tasks, Virtual Machines, Macintosh file structure and boot process, UNIX and Linux disk structures and boot processes. Other Disk structures (CD, SCSI, IDE and SATA devices)
UNIT 2	Commercial Forensic Tools (Encase, FTK), Advanced Features of forensic tools (search, encryption and decryption, data carving), windows registry, memory analysis, advanced file system analysis (deleted and hidden data, metadata, temporary file, unknown\executable file analysis), applied decryption.
UNIT 3	Graphic files: recognition, lossless and lossy data compression, locating and recovering graphic files, Identifying unknown file formats.
UNIT 4	Virtual Machines, Network Forensics, Network tools, E-mail Investigation, E-mail forensics tools, Mobile Device Forensic.
UNIT 5	Computer Investigation, Evidence acquisition, Processing crime and Incidence scene, Preserving, Analysis, Digital forensic investigation procedures, Report writing, Ethics

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

- CO1: Understand the fundamentals of Computer Forensics
- CO2: Learn the issues of Data Acquisition and Data Recovery
- CO3: Explore networking in cyber forensics
- CO4: Learn to analyze and validate forensics data
- CO5: Be familiar with forensic tools and case studies

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		H									H		
CO2	H	H				M						H	H	L	
CO3	H	H		H									M		
CO4	H	M	H		M	L		M				M		M	H
CO5	M		H		H						L				H

H = Highly Related; M = Medium L=Low

Text Books –

1. Computer Evidence - Collection and Preservation. Brown, C.L.T. Course Technology CENGAGE Learning.
2. Guide to Computer Forensics And Investigations Nelson, Bill ; Phillips, Amelia; Enfinger, Frank; Steuat, Christopher Thomson Course Technology.
3. Scene of the Cybercrime. Shinder, Debra Littlejohn and Tittel, Syngress

Reference Books:

1. Computer Forensics – Computer Crime Scene Investigation. Vacca, John R. Charles River Media
2. Bunting, Steve and William Wei. EnCase Computer Forensics: The Official EnCE: EnCase Certified Examiner Study Guide. Sybex, 2006
3. Prorise, Chris, Kevin Mandia, and Matt Pepe. Incident Response: Computer Forensics. McGraw-Hill,
4. Casey, Eoghan, ed. Handbook of Computer Crime Investigation, Forensic Tools and Technology, Academic press
5. Carrier, Brian. File System Forensic Analysis. Addison-Wesley Professional

Information Security

Department Elective 5

BCO 189A	Web and Android Security	3-0-1 [4]
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OBJECTIVES:

- Introduce the concept of web application security concerns and its related issues.
- To familiarize the students with various types of analysis techniques ,attacks and tools.
- To introduce the various android application architecture and Security concerns.
- To introduce the various types of mobile attacks.

UNIT 1	Web applications: Introduction to web applications, Web application hacking, Overview of browsers, extensions, and platforms. Attacks, detection evasion techniques, and countermeasures for the most popular web platforms, including IIS, Apache, PHP, and ASP.NET Attacks and countermeasures for common web authentication mechanisms, including password-based, multifactor (e.g., CAPTCHA), and online authentication services like Windows Live ID.
UNIT 2	Advanced session analysis, hijacking, and fixation techniques, cross-site scripting, SQL injection, classic categories of malicious input, Overlong input (like buffer overflows), canonicalization attacks (like the infamous dot-dot-slash), and meta characters (including angle brackets, quotes, single quote, double dashes, percent, asterisk, underscore, newline, ampersand, pipe, and semicolon), beginner-to-advanced SQL injection tools and techniques, stealth-encoding techniques and input validation/ output-encoding countermeasures.
UNIT 3	Introduction to Android Applications and Mobile App Security: History of Android, Understanding Android Hardware and Software Architecture, Understanding Android Security Model. Understanding Android Permission Model for Application Security, Sandboxing, Codesigning, Encryption, rooting Devices, Understanding APK Understanding Directories and Files on an APK 9
UNIT 4:	Mobile Application Attacks 1: Setting up Mobile App Pentesting Environment, Interact with the Devices, Starting with Drozer, Understanding AndroidManifest.xml, Configuring, Burp and Traffic Interception, Traffic Interception Bypass, Weak Server Side Controls, Insecure Data Storage, Insufficient Transport Layer Protection, Unintended Data Leakage, Poor Authentication & Authorization 10
UNIT 5	Mobile Application Attacks 2: Broken Cryptography, Client Side Injections, Security Decisions via Untrusted Input, Improper Session Handling, Lack of Binary Protection, Exploiting Debuggable Applications, Developer Backdoor, Location spoofing to download location restricted apps, Configuring Live Device for Penetration Testing, Mitigation Approach for all Vulnerabilities.

OUTCOMES:-

Upon completion of this course, the student will be able to:

- CO1: Learn web application security concerns and its related issues.
- CO2: Develop the Secure web application with help various of analysis techniques and knowledge of different attacks and tools.
- CO3: Understand android application architecture and Security issues.
- CO4: Know about various types of mobile attacks and to deal with these attacks and develop the secure application

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H		M									H		L
CO2	H	H	H		M	L				L		L	H	M	
CO3	H			L	M		L		L				H		M
CO4	H		H			L				M		L		M	

Text Books:

1. Hacking Exposed Web Applications, 3rd edition, JOEL SCAMBRAY, VINCENT LIU, CALEB SIMA
2. The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws By Dafydd Stuttard, Marcus Pinto
3. Mobile device security: A comprehensive guide to securing your information in a moving world. Boca Raton, FL: Auerbach Publications - Fried, S.

Reference Books:

1. Rich Bowen, Ken Coar, "Apache Cookbook", O'Reilly
2. Open Web Application Security Project. A Guide to Building Secure Web Applications and Web Services. http://www.owasp.org/index.php/Category:OWASP_Guide_Project
3. 2 The web application hacker's handbook: Discovering and exploiting security flaws (2nd ed.). Indianapolis, IN: Wiley, John & Sons - Stuttard, D. & Pinto, M.
4. Mobile application security. New York: McGraw-Hill Companies - Dwivedi, H., Clark, C., & Thiel, D.

WAP Lab

- Setting up Mobile App Pentesting Environment,interact with the Devices, Starting with Drozer
- Configuring, Burp and Traffic Interceptionof Mobile Applications between client and server
- Configuring Live Device for Penetration Testing,Mitigation Approach for all Vulnerabilities.
- Performing static Analysis of Mobile Application using MOBSF
- Perform the jailbreak/Root the Android phone and get admin level Privilege by using tools such as Superoneclick, superboot.
- PerformingCross-application scripting error in Android Browser which leads to hacking the devices.
- Detect application communication vulnerabilities and perform exploitation usingComDroid.
- Perform Jailbreaking on iOS Devices.
- Unlock the iPhone using tools such as iphonesimfree and anySIM.
- Perform a method to send Malicious Payload to the victims iPhone and check whether you can take over the control the victim's phone.
- Perform Man-in-the-Middle attack by intercepting the Wireless parameter of iPhone on wireless network.
- Perform social engineering Attack method and send the malicious link and SMS tricks which contains Malicious web page.
- Develop Backdoor,Location spoofing to download location restricted apps.
- Performing dynamic analysis to find API/Web services vulnerabilities.
- Performing reverse engineering on android applications
- Performing network communication attacks in Android and iOS.
- Performing authentication and session management attacks.

Information Security

Department Elective 6

BCO 190A	ETHICAL HACKING	3-0-1 [4]
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OBJECTIVES:

Students undergoing this course are exposed to

- Ethical Hacking ethically penetrates into network systems using various tools to test the strength of a network.
- Ethical Hacking course shows how to test, scan, hack and secure networks and systems.
- Get in-depth theoretical knowledge and rich practical experience in hacking test networks.

UNIT 1	Ethical Hacking: Introduction, Networking & Basics, Foot Printing, Google Hacking, Scanning, Windows Hacking, Linux Hacking, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering,
UNIT 2	Introduction to Computer Systems and Networks , information systems and networks (including wireless networks) and their role in industry business and society, System and Network Vulnerability and Threats to Security , various types of attack and the various types of attackers in the context of the vulnerabilities associated with computer and information systems and networks
UNIT 3	Physical Security, Steganography, Cryptography, Wireless Hacking, Firewall & Honeypots, IDS & IPS, Vulnerability, Penetration Testing, Session Hijacking, Hacking Web Servers, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobile Phone Hacking
UNIT 4:	An introduction to basic ethical hacking tools and usage of these tools in a professional environment in a form of project
UNIT 5	An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking. Ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking.

OUTCOMES:-

Upon completion of this course, the student will be able to:

CO1: Understanding the basics of networking with the introduction on the system attacks

CO2 Describes attacks in terms of industry, society and information systems

CO3 Describes various types of securities and vulnerabilities

CO4 Demonstration of the ethical hacking tools

CO5 Summarizing the legal and professional responsibilities of ethical hacking

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M						L	M		H	H	
CO2	M			M				M		L	M	H	H	H	
CO3	H	M			H			M			M	H	M		M
CO4	M										H				H
CO5	M							H					H		M

Text Books:

- 1 Hands-On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James Corley
2. Official Certified Ethical Hacker Review Guide – By Steven DeFino, Barry Kaufman, Nick Valenteen.

Reference Books:

1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series) [Paperback]
2. Hands-On Ethical Hacking and Network Defense [Print Replica] [Kindle Edition]

Information Security

Department Elective 7

BCO 191A	Application of AI in Cyber Security	3-0-0
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OBJECTIVE:

- To study various AI terminologies in Cyber security
- Understand the various threats and attacks in cyber world
- To be familiar with different types of attacks and AI techniques to detect them
- Study and Compare real-world attacks and AI to solve them
- To understand ethical challenges and enforcements of laws in Cyber attacks

UNIT 1	Introduction of AI in Cyber Security: AI, Machine learning, and Deep learning within cyber security, What AI and machine learning can do for cyber security, How AI is used in cyber security, Examples of machine learning in cyber security, Use of Artificial Intelligence in Cyber Security, The Future of Cyber security, Impact of AI on Cyber security, How They Will Shape the Future. AI systems' support to cyber security, Major techniques in the use of AI for system robustness, resilience, and response,
UNIT 2	Cyber security for AI : Classification of AI Attacks based on attack motivation, Integrity Attack, Availability Attack, Replication Attack, Confidentiality Attack , Classification of AI attacks based on target ,Classification of AI attacks based on attacker capabilities ,Handling AI Attack, Social Media Attacks , Secure AI , Available Software Resources. Case Study of Cybercrime: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, E-mail spoofing instances, The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.
UNIT 3	AI Techniques for Cyber Security : Introduction, Malware Detection and Analysis, Intrusion Detection Systems (IDS) , Generative Adversarial Networks, Attack Detection , Trustworthiness of data, Artificial Intelligence and Hardware Security, Consideration for adoption of AI , Typical use cases.
UNIT 4	Applications from real world: Study of some applications AI-powered threat detection, Detection of sophisticated cyber-attacks, Reducing Threat Response Time , AI-based Antivirus Software, Fighting AI Threats, Email Monitoring ,Using machine learning to analyze mobile endpoints, to enhance human analysis and automate repetitive security tasks.
UNIT 5	Ethics and Laws in Applications of AI in Cyber world :Ethical considerations related to AI in cyber security, Standards on Cyber Security Using AI ,Current and future AI laws: accountability, audit ability, and regulatory enforcement, Existing legal frameworks in

	cyber security and major policy issues, Risk-assessment policies and suitability testing, privacy and data governance , Pitfalls of AI in cyber law.
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Course Outcome:

- CO1. Understand role of AI in Cyber Security
- CO2. Understand various threats and attacks in cyber world
- CO3. Compare and analyze types of attacks and AI techniques to detect them
- CO4. Understand ethical challenges and enforcements of laws for Cyber Security

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M										H			
CO2	M	M										H			
CO3	H	H										H	L	M	
CO4	M	M						M				H			

H = Highly Related; M = Medium; L = Low

Text Book:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018

Information Security

Department Elective 8

BCO 192A	Block chain and Cryptocurrency Technology	3-0-1 [4]
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OBJECTIVES:

- This course is to understand Blockchain and its main application cryptocurrency.
- Students will learn how this system works and how can they utilize and what application can be build.

UNIT 1	Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. ,Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof
UNIT 2	Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.
UNIT 3	Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate
UNIT 4:	Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin Cryptocurrency Regulation: Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market and Global Economy.
UNIT 5	Blockchain Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

OUTCOMES:-

Upon completion of this course, the student will be able to:

- CO1: Learn basic concepts of block-chains
- CO2: Understanding the crypto-currency technology
- CO3: Know the block chain architecture
- CO4: Study the block chain applications
- CO5: Learn the regulatory frameworks

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L		L		M								
CO2	L	L											L		
CO3	M				L		M	M							
CO4	M		1					M					L	M	
CO5							M								L

Reference Books:

- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
- Wattenhofer, The Science of the Blockchain
- Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
- Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
- DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
- Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Tutorial & Practical

- Naive Blockchain construction,
- Memory Hard algorithm –
- Hashcash implementation,
- Direct Acyclic Graph,
- Play with Go-Ethereum,
- Smart Contract Construction,
- Toy application using Blockchain,
- Mining puzzles

AI & ML Track

AI & ML

Department Elective 1

BCO 081A	PROGRAMMING WITH PYTHON	3-0-1 [3]
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OBJECTIVE:

- To study various core programming basics—including data types, control structures, algorithm development,
- To overview the applications of Python.
- To be familiar with program design with functions—via the Python programming language.
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

UNIT 1	Introduction: Features of Python, History of Python, installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages
UNIT 2	Introduction to Operators, Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Strings: subscript operator, indexing, slicing a string, String methods & operations; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers. Text files; manipulating files and directories, os and sys modules; reading/writing text and numbers from/to a file; creating and reading a formatted file
UNIT 3	Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions.
UNIT 4	Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects OOP, continued: inheritance, polymorphism Operator overloading (<code>_eq_</code> , <code>_str_</code> , etc); abstract classes; Exception handling, try block
UNIT 5	Graphical user interfaces; Event-driven programming paradigm; tkintermodule,,turtle module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Multithreading, CSV(Accesing, updating, Creating)

Course Outcome:

Upon completion of this course, the student will be able to:

- CO1: Understand different core programming basics—including data types, control structures, algorithm development,
- CO2: Understand the applications of Python.
- CO3: Show the program design with functions—via the Python programming language.
- CO4: Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M										H		
CO2		L			M									L	<u>L</u>
CO3			H		M						L		M		L
CO4		M		L					L	L				M	

H = Highly Related; M = Medium L = Low

Text Book:

1. *Fundamentals of Python: First Programs* Author: Kenneth Lambert Publisher: Course Technology, Cengage Learning, 2012 ISBN-13: 978-1-111-82270-5

Reference Books:

3. Python: Real World Machine Learning By Prateek Joshi et al. ISBN 13: 9781787123212 Packt Publishing 941 pages (November 2016)

AI & ML

Department Elective 2

BCO 019A	ARTIFICIAL INTELLIGENCE	3:0:0
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Course Objective:

- To explain the basic principles of artificial intelligence
- To apply logic and structured concepts in knowledge representation and discuss the applications of artificial intelligence
- To implement and analyze Uninformed and Informed Search Strategies
- To implement and apply various game playing Algorithms to different problems
- Understand and represent various types of logics and their forms
- To Understand and various Learning techniques and analyze concept of ANN

UNIT 1	Introduction- What is intelligence? Foundations of artificial intelligence (AI), Task of artificial intelligence, Techniques of artificial intelligence, Problem Solving Formulating problems, problem types, states and operators, state space. Knowledge Representation- Role of Knowledge, Declarative Knowledge, Procedural Knowledge, Knowledge representation Techniques; conceptual graphs; structured representations; frames, scripts; issues in knowledge representation
UNIT 2	Uninformed & Informed Search Strategies- Breadth First Search, Depth First Search, Depth Limited Search, Heuristic Functions, Best First Search, Hill Climbing Algorithm, Problems and solutions of Hill Climbing, Iterative Deepening (IDA), A* algorithm, AO* Algorithm
UNIT 3	Game playing- Introduction, Types of games, Minimax game algorithm, Alpha Beta cut-off procedure , Jug problem, Chess problem, Tiles problem
UNIT 4	Logics- Propositional logics, First Order Predicate Logics (FOPL), Syntax of First Order Predicate Logics, Properties of Wff, Clausal Forms, Conversion to clausal forms
UNIT 5	Learning- Overview of different forms of learning, Supervised base learning, Unsupervised based learning, Introduction to Neural networks:- basic, comparison of human brain and machine, biological neuron, general neuron model, Basic Architecture of Neural Networks, Single Computational Layer: The Perception, Choice of Activation functions, Number of Output Nodes and Loss Functions, applications and advantages of neural networks. Brief introduction to single layer and multiplayer networks

Course Outcomes: Upon the end of this course, student will be:

CO1: Familiar with the basic principles of artificial intelligence

CO2: To implement and analyze uninformed and informed Search algorithms

CO3: Able to represent and apply various logics and structured concepts in knowledge representation

CO4: To implement and apply various game playing algorithms to different problems

CO5: To Understand various Learning techniques and concept of ANN

COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	L	M	H	L			M		L	H	L		
CO2	H	H	H	M	H	L			H	M	M	H	M		
CO3	H	M	M	H	H	L	L	L	M	M	M	H	M	M	H
CO4	H	M	M	H	H	L	L	L	H	M	M	H	H	M	H
CO5	H	L		L	M	L			M		L	H	L		M

H = Highly Related; M = Medium L = Low

Text Books:

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson Education Press, 2001.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
3. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.

AI & ML

Department Elective 3

BCO 086B	MACHINE LEARNING	3-0-1 [4]
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Course Objectives

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms
- To understand the Bayesian techniques
- To understand the instant based learning
- To understand the analytical learning and reinforced learning

UNIT 1	INTRODUCTION, CONCEPT LEARNING AND SUPERVISED LEARNING ALGORITHMS: Introduction, Types of learning, Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm , Linear Regression Model, Naïve Bayes Classifier, Decision Tree, K Nearest Neighbor, Logistic Regression, Support Vector Machine, Random Forest Algorithm.
UNIT 2	UNSUPERVISED LEARNING ALGORITHM: Clustering- K-means Clustering, Hierarchical Clustering, Probabilistic Clustering, Apriori Algorithm, Association Rule Mining, Gaussian Mixture Model, Expectation Maximization. ENSEMBLE LEARNING-Bagging, Boosting and Stacking
UNIT 3	REGULARIZATION- Overfitting, Underfitting, Bias-Variance trade off, Cost Function, Regularized Linear Regression and Regularized Logistic Regression, Model Selection and train/Validation/Test Sets, VC Dimension. STATISTICAL LEARNING- Feature Extraction, Principal Component Analysis, Singular Value Decomposition, Feature Selection and subset selection.
UNIT 4	NEURAL NETWORKS AND GENETIC ALGORITHMS Neural Network Representation – Problems – Perceptron – Multilayer Networks and Back Propagation Algorithms – Gradient Descent.
UNIT 5	ANALYTICAL LEARNING AND REINFORCED LEARNING Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning- Markov Decision Processes (MDP), Introduction to Natural Language Processing and Recommended System- Collaborative and Content based Filtering.

Course Outcome:

- CO1. Choose the learning techniques with this basic knowledge.
- CO2. Apply effectively neural networks and genetic algorithms for appropriate applications
- CO3. Apply Bayesian techniques and derive effectively learning rules.
- CO4. Choose and differentiate reinforcement and analytical learning techniques

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M											M	M	
CO2	H	H	H	H	H								M	M	
CO3	H	H			M									M	
CO4	H	H	H	H	M									M	

H = Highly Related; M = Medium ;L = Low

Required Texts:

1. Machine Learning, Tom Mitchell, McGraw Hill, 1997, ISBN 0-07-042807-:
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCES:

1. EthemAlpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.

AI & ML

Department Elective 3

BCO 089 B	MACHINE LEARNING LAB	0-0-2 [2]
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Course Outcomes

- CO1. To implement regression and various learning algorithms
- CO2. Implement various classifiers and analyze those classifiers base on confusion matrix
- CO3. pattern recognition and machine learning theories
- CO4. To design neural network and test network for different dataset
- CO5. To apply the ML theories to different applications like face

List of Experiments

- Lab 1. Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples.
- Lab 2. Write a program to implement Linear Regression and Logistic Regression
- Lab 3. Implement the ID3 algorithm for learning Boolean-valued functions for classifying the training examples by searching through the space of a Decision Tree.
- Lab 4. Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.
- Lab 5. Implement K-Nearest Neighbor algorithm to classify the iris data set. Calculate the score also.
- Lab 6. Write a program to implement Support Vector Machine. Also discuss the confusion matrix and score of model.
- Lab 7. Apply EM algorithm to cluster a set of data and also apply K-Means algorithm on the same data set to compare two algorithms.
- Lab 8. Build an Artificial Neural Network by implementing Back-Propagation algorithm and test the same using appropriate data set.
- Lab 9. Implement the Non-Parametric Locally Weighted Regression Algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph.
- Lab 10. Build a Face detection system to recognize faces in a frame or image. You can use OpenCV for this task.

AI & ML**Department Elective 4**

BCO 193A	DATA MINING AND PREDICTIVE MODELLING	3-0-0
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Course objectives

- Understand the process of Data mining and predictive analytics
- Compare and contrast the underlying predictive modelling techniques.
- Apply predictive modelling approaches using a suitable packages
- Identify the basic concepts and the importance of model development and evaluation techniques.
- Develop data analysis and modelling through tools like SPSS/MINITAB/R

UNIT1	Introduction and Overview of the Data Mining & Predictive Analytics : Introduction, The Cross-Industry Standard Process for Data Mining, analysis and methodologies , Fallacies of Data Mining, data mining tasks, Dimension reduction methods,
UNIT2	Data Understanding and Preparation: Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.
UNIT3	Predictive Modelling Techniques : Simple Linear Regression, Multiple Linear Regression and model building, Logistic Regression and diagnostics Classification Algorithms and Ensemble Methods, Discriminant Analysis, Logistic regression for classification, Decision trees, Ensemble methods: Bagging and Boosting, Naïve Bayes.
UNIT4	Model development : Model selection, Model Development Techniques, Model Evaluation Techniques ,Neural networks, Decision trees, Support vector machine, Bayesian Networks, , Association rules, Sequence Detection, Which Technique to use when and in which application
UNIT 5	Model Evaluation: Model Evaluation Techniques for Prediction and classification Tasks ,Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Meta Level Modelling, Deploying Model, Assessing Model Performance, Updating a Model.

COURSE OUTCOMES

- CO1. Understand and recognize the process of Data mining & predictive analytics
- CO2. Compare and contrast the underlying predictive modelling techniques.
- CO3. Identify and select appropriate predictive modelling techniques for particular application
- CO4. Develop and evaluate predictive data model using different modelling tools

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H										H	M	M	
CO2	H	H		H	H							H	M	M	
CO3	H	H	H		M							H		M	
CO4	H	H	H	H	M									M	

H = Highly Related; M = Medium ;L = Low

Text Books

1. Larose, D.T. and Larose, C. D., Data Mining and Predictive Analytics, Wiley.
2. Shumeli, G., Bruce, P.C., Yahav, I., Patel, N.R. and Lichtendahl, K.C. Jr., Data Mining for Business Analytics, Wiley.
3. Kumar, D. U., Business Analytics-The Science of Data-Driven Decision Making, Wiley.
4. Kabacoff, R. I., R in Action: Data Analysis and Graphics with R, Dreamtech Press.
Crawley, M. J., The R-Book, Wile
5. Data Mining & Predictive Modeling (IBM ICE Publications).

AI & ML

Department Elective 5

BCO 194A	NEURAL NETWORKS	3-0-1
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Course Objectives

- The main objective of this course is to provide the student with the basic understanding of neural networks fundamentals,
- Program the related algorithms and Design the required and related systems
- To evaluate the performance of neural architectures in comparison to other machine learning method

UNIT1	Introduction to Artificial Neural Network : Introduction and ANN Structure, Biological neurons and artificial neurons, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear separability, Type of network architecture, Activation functions, Basic Learning rules, Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures.
UNIT2	Mathematical Foundations and Learning Mechanisms. Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning. Memorybased learning, Hebbian learning. Competitive learning
UNIT3	Single Layer Perceptrons: Structure and learning of perceptrons, Pattern classifier, introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence. Limitations of a perceptrons.
UNIT4	Feed forward Networks: Multilayer Neural Network, Gradient Descent learning, Back propagation, Empirical Risk Minimization, regularization, Radial Basis Neural Network bias-variance trade off, regularization - over fitting - inductive bias regularization - drop out - generalization
UNIT 5	Radial Basis Function Networks: Pattern separability and interpolation, Regularization Theory Regularization and RBF networks, RBF network design and training. Approximation properties of RBF.

Text Books

1. Simon Haykin, “Neural Networks, A Comprehensive Foundation”, 2nd Edition, Addison Wesley Longman, 2001.
2. Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006
3. Charu C. Aggarwal “Neural Networks and Deep learning” Springer International Publishing, 2018
4. Satish Kumar, “Neural Networks, A Classroom Approach”, Tata McGraw -Hill, 2007.

Course Outcomes

- CO1. Explain & Demonstrate the basic concepts in Neural Networks and applications
- CO2. Define foundations and learning mechanisms and state-space concepts
- CO3. Identify structure and learning of perceptions
- CO4. Explain Feed forward, multi-layer feed forward networks and Back propagation algorithms
- CO5. Analyze Radial Basis Function Networks, Theory Regularization and RBF network

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L			M							M			
CO2	M	L										M	M	M	
CO3	H	M	M		M							H			
CO4	H	M	M	M	M							H			
CO5	H	M	M	M	M							H	M	M	

Course Objectives:

At the end of the course

- The students should be able to design and implement machine learning solutions
- Understand classification, regression, and clustering problems;
- Able to evaluate and interpret the results of the algorithms.

Course Outcomes:

CO1. Create a custom feed-forward Artificial Neural Networks.

CO2. Design Constructing Layers and Setting Transfer Functions

CO3. Implement Discriminative Learning models: Logistic Regression, Perceptrons,

List of Experiments

Lab 1. Create a custom feed-forward network .It consists of the following sections:

Constructing Layers , Connecting Layers , Setting Transfer Functions, Weights and Biases , Training Functions & Parameters , Performance Functions , Train Parameters

Lab 2. Write a program to plot various membership functions.

Lab 3. Generate AND, NOT function using McCulloch-Pitts neural net program.

Lab 4. Generate XOR function using McCulloch-Pitts neural net.

Lab 5. Write a program for Perceptron net for an AND function with bipolar inputs and targets

Lab 6. Write a program of Perceptron Training Algorithm

Lab 7. Write a program of Back Propagation Algorithm.

Lab 8. Implement ANN and compare , regularization, overfitting, underfitting and drop out

Lab 9. Write a for Hebb Net to classify two dimensional input patterns in bipolar with their given targets

Lab 10. Write a program to implement Hebb's rule

AI & ML

Department Elective 6

BCO 195A	PATTERN RECOGNITION	3-0-1
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Course Objective

- Understand how to generate pattern and explain how to analyze pattern features
- Understand how to build classifiers using non parametric methods.
- Learn and compare principles of parametric and non parametric classification
- To implement pattern recognition and machine learning theories
- To apply the pattern recognition theories to applications of interest

Module 1:	<p>PATTERN RECOGNITION OVERVIEW Overview of Pattern Recognition- Relations of PR with other Systems, PR Applications, Different Approaches to Pattern Recognition, Classification and Description—Patterns and feature extraction with Examples—Training and Learning in PR systems—Pattern recognition Approaches.</p>
Module 2:	<p>STATISTICAL PATTERN RECOGNITION Introduction to statistical Pattern Recognition, Gaussian Case and Class Dependency, Discriminate Function, Examples, Classifier Performance</p>
Module 3:	<p>LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING Introduction—Discrete and binary Classification problems—Techniques to directly obtain linear Classifiers, Formulation of Unsupervised Learning Problems—Clustering for unsupervised learning and classification.</p>
Module 4:	<p>SYNTACTIC PATTERN RECOGNITION Overview of Syntactic Pattern Recognition—Syntactic recognition via parsing and other grammars, Graphical Approaches to syntactic pattern recognition, Learning via grammatical inference.</p>
Module 5:	<p>RECOGNITION OF SYNTACTIC DESCRIPTION Recognition by Matching, Recognition by Parsing, CYK Parsing Algorithm, Augmented Transition Nets in Parsing, Graph Based structure representation, Structured Strategy to Compare Attributed Graphs</p>

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

References:

1. Robert Schalkoff, "Pattern Recognition: Statistical Structural and Neural Approaches", John Wiley & Sons, Inc, 1992.
2. Earl Gose, Richard Johnsonbaugh, Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India, Pvt Ltd, New Delhi, 1996.
3. Duda R.O., P.E. Hart & D.G. Stork, "Pattern Classification", 2nd Edition, J. Wiley Inc 2001.
4. Duda R.O. & Hart P.E., "Pattern Classification and Scene Analysis", J. Wiley Inc, 1973.

	PATTERN RECOGNITION LAB	0-0-2
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Course Objectives:

- To introduce the most important concepts, techniques, and algorithms • Assess and understand the challenges behind the design of machine vision systems.
- Understand the general processes of image acquisition, storage, enhancement, segmentation, representation, and description.
- Implement filtering and enhancement algorithms for monochrome as well as color images.

Course Outcomes:

- CO1. To implement efficient algorithms for nearest neighbour classification, Linear Discriminate Function
- CO2. Able to identify the strengths and weaknesses of different types of classifiers & implement them on simple applications.
- CO3. Validate and assess and implement different clustering techniques
- CO4. Be able to combine various classifiers using fixed rules or trained combiners and boost their performance
- CO5. Understand the possibilities and limitations in implementation of pattern recognition techniques to different applications

Course Contents: Exercises that must be done in this course are listed below:

- Lab 1. Implement a function for extracting the colour histogram of an image.
- Lab 2. Read all the images from the training set. For each image compute the colour histogram with general bin size m and save it as a row in the feature matrix X . Save the corresponding class label in the label vector y .
- Lab 3. Implement the k -NN classifier for an unknown image and for a general K value. Evaluate the classifier on the test set by calculating the confusion matrix and the overall accuracy.
- Lab 4. Try out different values for the number of bins for the histogram and the parameter K to see which feature attains the best performance. Convert the input image into Luv or HSV color-space before histogram calculation.
- Lab 5. Data visualization, central limit theorem, multivariate normal distribution, data whitening, non-parametric
- Lab 6. Implement Hierarchical clustering, k -means, fuzzy c -means
- Lab 7. Implementation of Bayesian classifier, k -NN classifier
- Lab 8. Linear regression, MMSE, MAP, MLE, quality measures
- Lab 9. Apply various dimensionality reduction methods whether through feature selection or feature extraction. Assess classifier complexity and regularization parameters

Lab 10. Combine various classifiers using fixed rules or trained combiners and boost their performance using some test data set from real world

AI & ML
Department Elective 7

BCO 196A	DEEP LEARNING -PRINCIPLE & PRACTICE	3-0-0
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Course Objectives

- To understand the concepts of deep Learning neural networks
- Familiar with the fundamental principles, theory and approaches for learning with deep neural networks
- Discuss Convolution Neural Network models to Applications
- Analyse performance of deep networks.
- Understanding Deep Learning applications and tools in different fields

UNIT1	Deep Learning Fundamentals and Strategies: Introduction to deep learning-History of Deep Learning- Perspectives and issues in deep learning – Deep Neural Networks - Unsupervised deep learning - Deep reinforcement learning - Deep learning strategies. Comparisons between architecture of different types of deep learning models,
UNIT2	Introduction to Convolution Neural Networks: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications. Case studies: Alex net, VGGNet, GoogLeNet
UNIT3	Introduction to Recurrent Neural Networks: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, Optimization in deep learning: Gradient Descent (GD), Momentum Based GD, RNN application
UNIT4	Autoencoders: Under complete auto encoders, regularized auto encoders, sparse auto encoders, denoising auto encoders, representational power, layer, size, and depth of auto encoders, stochastic encoders and decoders
UNIT 5	Deep Learning Applications and Tools: deep learning in Image Processing, Natural Language Processing, Speech Recognition, Video Analytics Tools like NVIDIA , Tensor Flow, Caffe, Theano, Torch.

Text Books

1. Charu C.Aggarwal “Neural Networks and Deep learning” Springer International Publishing, 2018
2. Ian Goodfellow, Deep Learning, MIT Press, 2016.
3. Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc, 2015.
4. Mindy L Hall, Deep Learning, VDM Verlag, 2011
5. Li Deng (Author), Dong Yu, Deep Learning: Methods and Applications (Foundations and Trends in Signal Processing), Now Publishers Inc, 2009.

Course Outcomes

- CO1. Describe the Feed forward and Deep networks.
- CO2. Discuss & Apply Convolution Neural Network models to applications
- CO3. Analyse various deep networks and analyze their performances
- CO4. Understanding Deep Learning applications and tools in various areas

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L										M			
CO2	M	L			H							M			
CO3	H	M	M	M	H							H	M	H	
CO4	H	M	M	M	M							H	M	M	

AI & ML

Department Elective 8

BCO 197A	APPLICATION OF AI IN INDUSTRY	3-0-0
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Course Objectives

- Able to apply the concept of Artificial intelligence in various sectors
- Familiarize with applications of Artificial intelligence in banking Applications .
- Appreciate the various applications in Communication and Education Industry.
- Identify the applications in Health care and Government sectors.
- Recognize the applications in Manufacturing industry and Transportations.

Module 1:	AI in Banking : Use of AI in banking and finance, Fraud detection, , Risk modeling and investment banks, Customer data management, Decreased customer experience and loyalty, Personalized marketing, Role of machine learning: Challenges of banking sector and securities, Widely used machine learning algorithms in banking and security, Fraud prevention and detection systems, Rule based and machine learning based approach in fraud detection, Anomaly detection: Ways to expose suspicious transactions in banks, Advanced fraud detection systems, Risk management systems, Current challenges and opportunities: Banking and security domain.
Module 2:	AI in Communication, Media & Healthcare: Usage of AI in media and entertainment industry, Machine learning techniques for customer sentiment analysis, Real-time analytics in communication, Real time analytics and social media, Recommendations engines. The most important applications of machine learning in healthcare, Role of machine learning in drug discovery, Medical image analysis, Why deep learning for medical image analysis and Predictive medicine: Prognosis and diagnostics accuracy, Predictive medicine
Module 3:	AI in Education & Manufacturing: Advantages of AI in education, learning analytics, Academic analytics, Action research, Educational data mining, Personalized adaptive learning, Learning analytics process, Case study: Application of ML in predicting students' performance. Applications in manufacturing industry, Deep learning for smart manufacturing, Machine learning for quality control in manufacturing, Case study, Construction of CNN, Experimental results, Efficiency of CNN for defect detection, Comparative experiments, Machine learning for fault assessment, Machinery failure prevention technology.

Module 4:	AI in Government Administration: Type of government problems appropriate for AI applications, AI for citizen services use cases, Answering questions, Routing requests, Translation, Drafting documents, Chat bots for communication between citizen and government, Media richness theory, Chatbots in the public sector, Case study, Data management services, Knowledge processing services, Application services.
Module 5:	AI in Transportation & Energy Sector: Applications of ML and artificial intelligence in transportation, Incident detection, Predictive models, Application of AI in aviation and public transportation, Aviation, Shared mobility, Buses, Intelligent urban mobility, Autonomous vehicles, Autonomous transportation, Artificial intelligence use cases in logistics, Back office AI, Cognitive customs, Predictive logistics, Predictive risk management, Seeing thinking and speaking logistics operations, ML powered customer experience, Limitations of AI techniques in transportation, AI in Smart grid technologies, Key characteristics of smart grid, Machine learning applications in smart grid, Machine learning techniques for renewable energy generation, Forecasting etc Case studies

TEXT BOOK

1. David Beyer, Artificial Intelligence and Machine Learning in Industry, : O'Reilly Media, Inc., ISBN: 9781491959336
2. Doug Hudgeon, Richard Nichol, Machine Learning for Business , December 2019 , ISBN 9781617295836
3. Application of machine learning in industries (IBM ICE Publications).
4. Andreas François Vermeulen, “Industrial Machine Learning”, Apress, Berkeley, CA, 2020

Course Outcomes

- CO1. Familiarize, compare and analyze the role of AI in banking applications
- CO2. Analyze the applications in Media and Health care Industry
- CO3. Appreciate the various applications in manufacturing industry and Education sectors.
- CO4. Identify the problems in public sectors and role of AI in the solutions
- CO5. Recognize the applications and challenges in Transportation and Energy Sectors

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M			H							H	M	M	
CO2	H	H			H	M						H	M	M	
CO3	H	H			H	M						H	M	M	
CO4	H	H			H							H	M	M	
CO5	H	H			H							H	M	M	

RPA Track

RPA

Department Elective 1

BCO 204A	Programming in C# with .NET	3-0-1
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OBJECTIVES:

- To learn basic programming in C# and the object-oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
- To implement mobile applications using .Net compact framework
- To understand the working of base class libraries, their operations and manipulation of data using XML.

UNIT-I	C# LANGUAGE BASICS: .Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and Types- Classes and Structs – Inheritance- Generics – Arrays and Tuples – Operators and Casts – Indexers
UNIT-II	ADVANCED FEATURES: Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection
UNIT-III	BASE CLASS LIBRARIES AND DATA MANIPULATION: Diagnostics -Tasks, Threads and Synchronization – .Net Security – Localization – Manipulating XML- SAX and DOM – Manipulating files and the Registry- Transactions – ADO.NET- Peer-to-Peer Networking – PNRP – Building P2P Applications – Windows Presentation Foundation (WPF).
UNIT-IV	WINDOW BASED APPLICATIONS, WCF AND WWF9: Window based applications – Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services – .Net Remoting – Windows Service – Windows Workflow Foundation (WWF) – Activities – Workflows
UNIT-V	.NET FRAMEWORK AND COMPACT FRAMEWORK: Assemblies – Shared assemblies – Custom Hosting with CLR Objects – Appdomains – Core XAML – Bubbling and Tunnelling Events- Reading and Writing XAML – .Net Compact Framework – Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

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

CO1: Write various applications using C# Language in the .NET Framework.

CO2: Develop distributed applications using .NET Framework.

CO3: Create mobile applications using .NET compact Framework

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H	L	H		L			M	H			H	
CO2		L	H		H	L							M	H	
CO3			H	M					H	L		M		H	M

TEXT BOOKS:

- Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner . —Professional C# 2012 and .NET 4.5, Wiley, 2012
- Harsh Bhasin, —Programming in C#, Oxford University Press, 2014.

REFERENCES Books:

- Ian Gariffiths, Mathew Adams, Jesse Liberty, —Programming C# 4.0, OReilly, Fourth Edition, 2010.
- Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication, 2012.
- Andy Wigley, Daniel Moth, Peter Foot, —Mobile Development Handbook, Microsoft Press, 2011.

RPA

Department Elective 2

BCO 019A	ARTIFICIAL INTELLIGENCE	3:0:0
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Course Objective:

- To explain the basic principles of artificial intelligence
- To apply logic and structured concepts in knowledge representation and discuss the applications of artificial intelligence
- To implement and analyze Uninformed and Informed Search Strategies
- To implement and apply various game playing Algorithms to different problems
- Understand and represent various types of logics and their forms
- To Understand and various Learning techniques and analyze concept of ANN

UNIT 1	Introduction- What is intelligence? Foundations of artificial intelligence (AI), Task of artificial intelligence, Techniques of artificial intelligence, Problem Solving Formulating problems, problem types, states and operators, state space. Knowledge Representation- Role of Knowledge, Declarative Knowledge, Procedural Knowledge, Knowledge representation Techniques; conceptual graphs; structured representations; frames, scripts; issues in knowledge representation
UNIT 2	Uninformed & Informed Search Strategies- Breadth First Search, Depth First Search, Depth Limited Search, Heuristic Functions, Best First Search, Hill Climbing Algorithm, Problems and solutions of Hill Climbing, Iterative Deepening (IDA), A* algorithm, AO* Algorithm
UNIT 3	Game playing- Introduction, Types of games, Minimax game algorithm, Alpha Beta cut-off procedure , Jug problem, Chess problem, Tiles problem
UNIT 4	Logics- Propositional logics, First Order Predicate Logics (FOPL), Syntax of First Order Predicate Logics, Properties of Wff, Clausal Forms, Conversion to clausal forms
UNIT 5	Learning- Overview of different forms of learning, Supervised base learning, Unsupervised based learning, Introduction to Neural networks:- basic, comparison of human brain and machine, biological neuron, general neuron model, Basic Architecture of Neural Networks, Single Computational Layer: The Perception, Choice of Activation functions, Number of Output Nodes and Loss Functions, applications and advantages of neural networks. Brief introduction to single layer and multiplayer networks

Course Outcomes: Upon the end of this course, student will be:

CO1: Familiar with the basic principles of artificial intelligence

CO2: To implement and analyze uninformed and informed Search algorithms

CO3: Able to represent and apply various logics and structured concepts in knowledge representation

CO4: To implement and apply various game playing algorithms to different problems

CO5: To Understand various Learning techniques and concept of ANN

COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	L	M	H	L			M		L	H	L		
CO2	H	H	H	M	H	L			H	M	M	H	M		
CO3	H	M	M	H	H	L	L	L	M	M	M	H	M	M	H
CO4	H	M	M	H	H	L	L	L	H	M	M	H	H	M	H
CO5	H	L		L	M	L			M		L	H	L		M

H = Highly Related; M = Medium L = Low

Text Books:

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson Education Press, 2001.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
3. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.

RPA

Department Elective 3

BCO 205A	Foundation of Machine learning	3-0-1
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Course Objectives

1. To understand various key paradigms for machine learning approaches
2. To familiarize with the mathematical and statistical techniques used in machine learning.
3. To understand and differentiate among various machine learning techniques.

UNIT-I	Basics of Machine Learning and Python: Review of Linear Algebra, Definition of learning systems; Designing a learning system, Goals and applications of machine learning; Classification of learning system, Basic concepts in Machine Learning.
UNIT-II	Supervised Learning: Linear regression with one variable, Linear regression with multiple variables, Logistic regression; Linear Methods for Classification; Linear Methods for Regression; Decision trees, overfitting.
UNIT-III	Support Vector Machines: Introduction, Maximum Margin Classification, Mathematics behind Maximum Margin Classification, Maximum Margin linear separators, non-linear SVM, Kernels for learning non-linear functions
UNIT-IV	Unsupervised Learning: Learning from unclassified data, Clustering - Hierarchical Agglomerative Clustering, K-means partitional clustering, Expectation maximization (EM) for soft clustering; Dimensionality reduction – Principal Component Analysis, factor Analysis, Multidimensional scaling, Linear Discriminant Analysis.
UNIT-V	Applications of Machine Learning: Strategies, guidelines for good design, performance measurement, Reading Data, PreProcessing Data, handwriting recognition, object detection, face detection.

Course Outcomes:

- CO1: Explain Machine Learning concepts, classifications of Machine Learning and write simple programs using python
- CO2: Describe Supervised Learning concepts
- CO3: Explain Support Vector Machine concepts
- CO4: Describe unsupervised learning concepts and dimensionality reduction techniques.
- CO5: Discuss simple Machine Learning applications in a range of real-world applications using Python programming

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H	M	H				M		H		M	H	
CO2	L		M		H		L			M	M			H	M
CO3		M		H	M	L				M	H		M	H	
CO4			H	M			L		M		H		M	H	
CO5			H	M		L						M	H	H	

Text Books:

- Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.
- Hastie, Tibshirani, Friedman the elements of Statistical Learning Springer Verlag
- Dive into Deep Learning Aston Zhang and Zachary C. Lipton and Mu Li and Alexander J. Smola, 2019

References Book:

- Probability, Random Variables and Stochastic processes by Papoulis and Pillai, 4th Edition, Tata McGraw Hill Edition.
- Boyd and Vandenberghe *Convex optimization*
- Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press, 2016.
- Linear Algebra and Its Applications by Gilbert Strand. Thompson Books.

RPA

Department Elective 4

BCO 092A	Robotic Process Automation	3-0-1
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Course Objectives:

- To create and maintain automated marketing campaigns
- How to track the customer behaviour using analytics

Unit 1	<p>Programming Basics & Recap: Programming Concepts Basics – 1: Understanding the application, Basic Web Concepts, Protocols, Email Clients, Data Structures, Data Tables, Algorithms, Software</p> <p>Processes, Software Design, SDLC.: Programming Concepts Basics – 2 : Scripting,.Net Framework,.Net ,Fundamentals, XML, Control structures and functions, XML, HTML, CSS, Variables& Arguments</p> <p>RPA Basics : History of Automation, What is RPA,RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated</p>
Unit 2	<p>RPA Advanced Concepts :Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture ,RPA business case, RPA Team ,Process Design Document/Solution Design Document, Industries best suited for RPA, Risks& Challenges with RPA,RPA and emerging ecosystem</p> <p>Installation :Installing Studio community edition, The User Interface, Keyboard Shortcuts, About Updating, About Automation Projects, Introduction to Automation Debugging, Managing Activation Packages, Reusing Automations Library, Installing the Chrome Extension, Installing the Firefox Extension, Connecting your project to a source control system, Activities Guide</p> <p>Variables: Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel,UsingArguments,About Imported Namespaces,Importing New Namespaces</p>
Unit 3	<p>Control Flow :Control Flow Introduction,If Else Statements,Loops,Advanced Control Flow,Sequences,Flowcharts,About Control Flow,Control Flow Activities,The Assign Activity,The Delay Activity,The Do While Activity,The If Activity,The Switch Activity,The While Activity,The For Each Activity,The Break Activity</p> <p>Data Manipulation :Data Manipulation Introduction,Scalar variables, collections and Tables,TextManipulation,DataManipulation,Gathering and Assembling Data.</p> <p>Recording and Advanced UI Interaction :Recording Introduction,Basic andDesktop Recording,WebRecording,Input/Output Methods,Screen Scraping,DataScraping,</p>

	<p>Scraping advanced techniques. Selectors :Selectors,Defining and Assessing Selectors,Customization, Debugging, Dynamic Selectors,Partial Selectors,RPA Challenge.</p>
Unit 4	<p>Advanced Automation concepts and techniques: Image, Text & Advanced Citrix Automation :Introduction to Image & Text ,Automation,Image based automation,Keyboard based automation,InformationRetrieval,Advanced Citrix Automation challenges,BestPractices,Using tab for Images,Starting Apps. Excel Data Tables & PDF :Data Tables in RPA,Excel and Data Table basics,Data Manipulation in excel,Extracting Data from PDF,Extracting a single piece of data,Anchors,Using anchors in PDF Email Automation :Email Automation,Incoming Email automation,Sending Email automation Exceptional Handling & Best Practice:Debugging and Exception Handling :Debugging Tools,Strategies for solving issues,Catching errors Project Organization:What is project organization ,Bestpractices ,Avoidingpit falls,Invoke Activity</p>
Unit 5	<p>Introduction to Orchestrator Orchestrator:Tenants,Authentication,Users,Roles, Robots,Environments,Queues &Transactions,Schedules Emerging and Future Trends in IT:Emerging and Future Trends in IT:Artificial Intelligence,MachineLearning,Agentawareness,Natural Language Processing, Computer Vision Capstone Project Real life case studies which can be used to apply the concepts learnt during the course. The projects shall test student’s skills right from process transformation and documentation to the design and development of the actual robot.</p>

Course Outcomes:

- Understand Robotic Process Automation (RPA) and its value proposition
- Learn RPA tool UiPath and how to use different component to automate the process
- Learn UiPath Installation, Selectors and data manipulation.
- Learn Web, Windows, Email, Excel, PDF, Database, API and Image Automation
- Learn Invoice automation using IQ Bots

Text Books

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition
2. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition

RPA

Department Elective 5

BCO 206A	UiPath Studio	3-0-1
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Course Objectives:

- To create and maintain automated marketing campaigns
- How to track the customer behaviour using analytics
- Finally gain the practical knowledge of each and every module in the automation anywhere training

UNIT-1	Recording and Advanced UI Interaction: Recording Introduction, Basic and Desktop Recording, Web Recording, Input/Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques. Selectors: Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge.
UNIT-2	Advanced Automation concepts and techniques: Image, Text & Advanced Citrix Automation: Introduction to Image & Text, Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, using tab for Images, Starting Apps. Excel Data Tables & PDF: Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, extracting a single piece of data, Anchors, Using anchors in PDF
UNIT-3	Email Automation: Email Automation, Incoming Email automation, Sending Email automation Exceptional Handling & Best Practices Debugging and Exception Handling: Debugging Tools, Strategies for solving issues, Catching errors Project Organization: What is project organization, Best practices, Avoiding pitfalls, Invoke Activity
UNIT-4	Introduction to SAP Automation: Use case of SAP Automation, Custom Component and Code Stage: Custom Component Development, Component Deployment, Accessing Robots using WCF Web Services, - Database: Connecting with Database, Executing Query with Database
UNIT-5	Introduction to Orchestrator: Orchestrator: Tenants, Authentication, Users, Roles, Robots, Environments, Queues & Transactions, Schedules Emerging and Future Trends in IT Emerging and Future Trends in IT: Artificial Intelligence, Machine Learning, Agent awareness, Natural Language Processing, Computer Vision

	Capstone Project: Real life case studies which can be used to apply the concepts learnt during the course. The projects shall test student's skills right from process transformation and documentation to the design and development of the actual robot.
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Course Outcomes:

- CO1: Provide an overview of UiPath Studio and UiPath Robot
- CO2: Demonstrate how to create automation scripts using UiPath Studio
- CO3: Explain in detail the features and functionalities of the UiPath platform
- CO4: Guide learners to be able to solve basic change requests of running automation projects in UiPath
- CO5: Provide the knowledge to independently develop automation using UiPath Studio

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H											L		
CO2				H				L		M					M
CO3			M	H	M	H				M		H		M	H
CO4	L	L		M		H		L			M	M			H
CO5			M		H	M	L		L		M	H		M	H

Text Books

3. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition
4. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition

RPA

Department Elective 6

BCO 209A	RPA Case Study (BOT Create)	3-0-1
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Course Objectives

The objectives of this course are to:

- To make them understand the concepts of Project Management for planning to execution of projects.
- To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
- To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.
- Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

In this course students will create and deploy real time project by using UiPath / Automation Anywhere platform.

Sample Project:

Use Case

We need to help Ron generate a region wise aggregate subtotal report for a Table in a website.

Input Files / Source

<https://www.contextures.com/xlSampleData01.html>

Requirement

Loop over the web Table given in the link above and generate a Region wise subtotal report Region wise.

Sample Screenshot of Web Table

Order Date	Region	Rep	Item	Units	Unit Cost	Total
1/6/2018	East	Jones	Pencil	95	1.99	189.05

1/23/2018	Central	Kivell	Binder	50	19.99	999.50
2/9/2018	Central	Jardine	Pencil	36	4.99	179.64
2/26/2018	Central	Gill	Pen	27	19.99	539.73

Output

Region	Total Cost
East	1000
West	2000
Central	2200

Note: Actual Figures in Total Cost may vary.

Course Outcome:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilising a systems approach.
4. Conduct an engineering project.
5. Communicate with engineers and the community at large in written and oral forms.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.

RPA

Department Elective 7

BCO 208A	Automation Anywhere	3-0-1
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Course Objectives:

- To create and maintain automated marketing campaigns
- How to track the customer behaviour using analytics
- Finally gain the practical knowledge of each and every module in the automation anywhere training

UNIT-1	Introduction to Robotic Process Automation & Bot Creation (6 Hours) Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots – Conclusion.
UNIT-2	Web Control Room and Client: Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials) - Devices (View Development and Runtime Clients and Device Pools) -
UNIT-3	Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.
UNIT-4	Bot Creator (9 Hours) Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command - Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer - Best Practices - Summary
UNIT-5	Meta Bot and Bot Insight (6 Hours) Introduction - MetaBot Designer - MetaBot with AI Sense - Bot Insight - Transactional Analytics - Operational Analytics - Course Key Points.

Course Outcomes:

CO1: Understand Robotic Process Automation (RPA) and its value proposition

CO2: Learn RPA tool Automation Anywhere and how to use different component to automate the process

CO3: Learn Automation Anywhere Installation, Bots runner and Bots Controller, Control room, Queues, Bots Insights, and Citrix automation

CO4: Learn Web, Windows, Email, Excel, PDF, Database, API and Image Automation

CO5: Learn Invoice automation using IQ Bots

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H											L	M	
CO2				H						M					M
CO3	L		M		H		L			M	M			L	M
CO4		M		H	M	L				M	L		M		
CO5			H	M			L		M		M		M	L	

Text Books

5. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition
6. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition

Data Analytics Track

Data Analytics

Department Elective 1

BCO 081A	PROGRAMMING WITH PYTHON	3-0-1 [3]
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OBJECTIVE:

- To study various core programming basics—including data types, control structures, algorithm development,
- To overview the applications of Python.
- To be familiar with program design with functions—via the Python programming language.
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

UNIT 1	Introduction: Features of Python, History of Python, installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages
UNIT 2	Introduction to Operators, Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Strings: subscript operator, indexing, slicing a string, String methods & operations; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers. Text files; manipulating files and directories, os and sys modules; reading/writing text and numbers from/to a file; creating and reading a formatted file
UNIT 3	Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions.
UNIT 4	Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects OOP, continued: inheritance, polymorphism Operator overloading (<code>_eq_</code> , <code>_str_</code> , etc); abstract classes; Exception handling, try block
UNIT 5	Graphical user interfaces; Event-driven programming paradigm; tkintermodule,,turtle module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Multithreading, CSV(Accesing, updating, Creating)

Course Outcome:

Upon completion of this course, the student will be able to:

- CO1: Understand different core programming basics—including data types, control structures, algorithm development,
 CO2: Understand the applications of Python.
 CO3: Show the program design with functions—via the Python programming language.
 CO4: Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M										H		
CO2		L			M									L	<u>L</u>
CO3			H		M						L		M		L
CO4		M		L					L	L				M	

H = Highly Related; M = Medium L = Low

Text Book:

1. *Fundamentals of Python: First Programs* Author: Kenneth Lambert Publisher: Course Technology, Cengage Learning, 2012 ISBN-13: 978-1-111-82270-5

Reference Books:

4. Python: Real World Machine Learning By Prateek Joshi et al. ISBN 13: 9781787123212 Packt Publishing 941 pages (November 2016)

Data Analytics

Department Elective 2

BCO 019A	ARTIFICIAL INTELLIGENCE	3:0:0
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Course Objective:

- To explain the basic principles of artificial intelligence
- To apply logic and structured concepts in knowledge representation and discuss the applications of artificial intelligence
- To implement and analyze Uninformed and Informed Search Strategies
- To implement and apply various game playing Algorithms to different problems
- Understand and represent various types of logics and their forms
- To Understand and various Learning techniques and analyze concept of ANN

UNIT 1	Introduction- What is intelligence? Foundations of artificial intelligence (AI), Task of artificial intelligence, Techniques of artificial intelligence, Problem Solving Formulating problems, problem types, states and operators, state space. Knowledge Representation- Role of Knowledge, Declarative Knowledge, Procedural Knowledge, Knowledge representation Techniques; conceptual graphs; structured representations; frames, scripts; issues in knowledge representation
UNIT 2	Uninformed & Informed Search Strategies- Breath First Search, Depth First Search, Depth Limited Search, Heuristic Functions, Best First Search, Hill Climbing Algorithm, Problems and solutions of Hill Climbing, Iterative Deepening (IDA), A* algorithm, AO* Algorithm
UNIT 3	Game playing- Introduction, Types of games, Minimax game algorithm, Alpha Beta cut-off procedure , Jug problem, Chess problem, Tiles problem
UNIT 4	Logics- Propositional logics, First Order Predicate Logics (FOPL), Syntax of First Order Predicate Logics, Properties of Wff, Clausal Forms, Conversion to clausal forms
UNIT 5	Learning- Overview of different forms of learning, Supervised base learning, Unsupervised based learning, Introduction to Neural networks:- basic, comparison of human brain and machine, biological neuron, general neuron model, Basic Architecture of Neural Networks, Single Computational Layer: The Perception, Choice of Activation functions, Number of Output Nodes and Loss Functions, applications and advantages of neural networks. Brief introduction to single layer and multiplayer networks

Course Outcomes: Upon the end of this course, student will be:

CO1: Familiar with the basic principles of artificial intelligence

CO2: To implement and analyze uninformed and informed Search algorithms

CO3: Able to represent and apply various logics and structured concepts in knowledge representation

CO4: To implement and apply various game playing algorithms to different problems

CO5: To Understand various Learning techniques and concept of ANN

COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	L	L	M	H	L			M		L	H	L		
CO2	H	H	H	M	H	L			H	M	M	H	M		
CO3	H	M	M	H	H	L	L	L	M	M	M	H	M	M	H
CO4	H	M	M	H	H	L	L	L	H	M	M	H	H	M	H
CO5	H	L		L	M	L			M		L	H	L		M

H = Highly Related; M = Medium L = Low

Text Books:

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson Education Press, 2001.

2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.

3. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. George F. Luger, Artificial Intelligence, Pearson Education, 2001.

2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.

Data Analytics

Department Elective 3

BCO 210A	Foundation of data Science & Machine learning	3-0-1
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Prerequisite : Students are expected to have some background in mathematics and to have the rudiments of programming in Python.

Course Objective : This course introduces the methods for you the mathematical intuition behind a number of core/common machine learning algorithms. There is a significant practical aspect too, in which student will learn to use the methods and evaluate their performance on real world data. However, the UNIT is not purely about learning to use machine learning libraries. It is about learning how and why they work too.

Syllabus

UNIT 1	Introduction: 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 2	Data preprocessing: 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 3	Basic Machine Learning Algorithms: 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 4	Clustering: 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 5 | Data Visualization: Basic principles, ideas and tools for data visualization.

Course Outcomes: By the end of the course, students will have :

CO1. Basic understanding of supervised learning (regression and classification)

CO2. Basic understanding of unsupervised learning (clustering and dimensionality reduction).

CO3. Able to apply methodologies in each of these problem domains; to assess the suitability of approaches to a constrained set of tasks;

CO4. Employ common techniques to evaluate a methodology's performance.

CO5. Make use of Data sets in implementing the machine learning algorithms and Implement the machine learning concepts and algorithms in any suitable language

of choice.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		L										L		L
CO2		L				L					L			L	
CO3	L		M										L		
CO4		L			M						L			L	
CO5	M		L		H								M		

H = Highly Related; M = Medium L = Low

TEXTBOOKS

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.

Data Science & Machine learning Lab

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the builtin classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories

Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course outcomes: The students should be able to:

1. Understand the implementation procedures for the machine learning algorithms.
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems.

Data Analytics

Department Elective 4

BCO 211A	Data Analytics	3-0-0
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Prerequisite : Nil

Course Objectives:

- 1.This course introduces the methods for data preparation and data understanding.
- 2.It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.
- 3.Supports to Summarize the insurers use of predictive analytics, data science and Data Visualization

UNIT:1	Introduction To Exploratory Data Analysis: Data Analytics lifecycle,Exploratory Data Analysis(EDA) Definition, Motivation, Stepsindataexploration, The basic data types Data Type Portability.
UNIT:2	Preprocessing-Traditional Methods And Maximum Likelihood Estimation : Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, Improving the accuracy of analysis Preprocessing Bayesian Estimation : Introduction to Bayesian Estimation ,Multiple Imputation-Imputation Phase, Analysis and Pooling Phase, Practical Issues in Multiple Imputation, Models for Missing Notation Random Data
UNIT: 3	Data Summarization & Visualization Statistical data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, ND Statistical data analysis
UNIT: 4	Outlier Analysis Introduction, Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data
UNIT:5	Feature Subset Selection : Feature selection algorithms: filter methods, wrapper methods and embedded methods, Forward selection backward elimination, Relief, greedy selection, genetic algorithms for features election Dimensionality Reduction : Introduction, Principal Component Analysis(PCA), Kernel PCA, Canonical Correlation Analysis, Factor Analysis, Multi dimensional scaling, Correspondence Analysis

Course Outcome:

CO1.Handle missing data in the real-world data sets by choosing appropriate methods.

CO2.Summarize the data using basic statistics. Visualize the data using basic graphs and plots.

CO3.Identify the outliers if any in the data set.

CO4.Choose appropriate feature selection and dimensionality reduction

CO5.Techniques for handling multi-dimensional data

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L											L			L
CO2		L			M							L		L	
CO3	L					L						M			
CO4		L			M							L		L	
CO5						L						L			

*H = Highly Related; M = Medium L = Low

Text Book(s)

1. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction, 2nd Edn, Springer, 2014
2. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly. 2014.
3. Jiawei Han, MichelineKamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.
4. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.

Reference Books

1. Charu C. Aggarwal ,“Data Mining The Text book”, Springer, 2015.
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Inge Koch, “Analysis of Multivariate and High dimensional data”, Cambridge University Press, 2014.
4. Michael Jambu, “Exploratory and multivariate data analysis”, Academic Press Inc. , 1990.
5. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC press, 2015

Data Analytics

Department Elective 5

BCO 230 A	Big Data Analytics using R	3-0-2
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Pre-requisites : Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

COURSE OBJECTIVES :

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System
6. Apply analytics on Structured, Unstructured Data.
7. Exposure to Data Analytics with R.

UNIT 1	INTRODUCTION TO BIG DATA AND HADOOP : Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.
UNIT 2	HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.
UNIT 2I	Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.
UNIT 4	Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction
UNIT 5	Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

COURSE OUTCOMES:

The students will be able to:

CO1 Identify Big Data and its Business Implications.

CO2 List the components of Hadoop and Hadoop Eco-System

CO3 Access and Process Data on Distributed File System

CO4 Manage Job Execution in Hadoop Environment and Develop Big Data Solutions using Hadoop Eco System

CO5 Analyze Infosphere BigInsights Big Data Recommendations and Apply Machine Learning Techniques using R.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L										L	M		L
CO2	L				M								L	L	
CO3		L				L						L	M		
CO4	L				M							L	M	L	
CO5		L				L							M		

*H = Highly Related; M = Medium L = Low

Text Books

1. Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily 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. 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.
4. Anand Rajaraman and Jeffrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
7. Pete Warden, "Big Data Glossary", O'Reily, 2011.
8. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012
10. Paul Zikopoulos, Dirk DeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.

Big Data Analytics Lab

List of Experiments

1. Implement the following Data structures in Java

i) Linked Lists ii) Stacks iii) Queues iv) Set v) Map

2. Perform setting up and Installing Hadoop in its three operating modes:

a) Standalone, Pseudo distributed, Fully distributed.

3. Implement the following file management tasks in Hadoop:

- Adding files and directories

- Retrieving files

- Deleting files

(Hint: A typical Hadoop workflow creates data files (such as log files)

elsewhere and copies them into HDFS using one of the above command line utilities.)

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

6. Implement Matrix Multiplication with Hadoop Map Reduce.

7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

8. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

9. Solve some real life big data problems.

Data Analytics

Department Elective 6

BCO 212A	Data mining and Predictive Modelling	3-0-2
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Course Objectives:

1. To provide comprehensive knowledge on developing and applying machine learning algorithms for massive real-world datasets in distributed frameworks.
2. To demonstrate the use of big data analytics tools like Spark and Mahout for mining massive datasets.
3. To impart in depth knowledge on Deep Learning and Extreme Learning concepts.

UNIT:1	MapReduce Based Machine Learning K-Means, PLANET, Parallel SVM, Association Rule Mining in MapReduce, Inverted Index, Page Ranking, Expectation Maximization, Bayesian Networks Classification and Regression models with Spark and Mahout Linear support vector machines - Naive Bayes model- Decision Trees - Least square regression- Decision trees for regression.
UNIT:2	Clustering in Spark and Mahout : Hierarchical Clustering in a Euclidean and Non-Euclidean Space - The Algorithm of Bradley, Fayyad, and Reina - A variant of K-means algorithm - Processing Data in BFR Algorithm CURE algorithm - Clustering models with Spark - Spectral clustering using Mahout
UNIT:3	Mining Social-Network Graphs : Clustering of Social-Network Graphs - Direct Discovery of CommUNITies - Partitioning of Graphs Finding Overlapping CommUNITies - Counting Triangles using MapReduce Neighborhood Properties of Graphs
UNIT:4	Semi-Supervised Learning : Introduction to Semi-Supervised Learning, Semi-Supervised Clustering, Transductive Support Vector Machines
UNIT:5	Deep Learning : Introduction, Deep Neural Networks, Deep Belief Networks, Auto Encoders, Recurrent Networks Extreme Learning : Extreme Learning Machines (ELM), ELM auto encoder, Extreme Support Vector Regression

Course Outcome:

CO1. Identify right machine learning / mining algorithm for handling massive data

CO2. Apply classification and regression models with Spark and Mahout

CO3. Implement clustering models using Spark and Mahout

CO4. Mine social Network graphs using MapReduce

CO5. Apply semi supervised learning for clustering and classification and deep learning to solve real-life problem

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L				M								M		L
CO2		L			H						L			L	
CO3	L				M	L							M		
CO4		L			M						L			L	
CO5					H	L									

H = Highly Related; M = Medium L = Low

Text Book(s)

1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", Stanford Press, 2011.
2. Nick Pentreath, "Machine Learning with Spark", Packt Publishing,
3. Olivier Chapelle, Bernhard Scholkopf, Alexander Zien "Semi-Supervised Learning", The MIT Press, 2006.

Reference Books

1. Ron Bekkerman, Mikhail Bilenko, John Langford "Scaling Up Machine Learning: Parallel and Distributed Approaches", Cambridge University Press, 2012.
2. Jimmy Lin, Chris Dyer, "Data-Intensive Text Processing with MapReduce", Morgan Claypool Publishers, 2010.
3. Hennessy, J.L. and Patterson, D.A., 2011. Computer architecture: a quantitative approach. Elsevier.
4. ChandramaniTiwary "Learning Apache Mahout", Packt Publishing, 2015.
5. Fuchen Sun, Kar-Ann Toh, Manuel Grana Romay, KezhiMao,"Extreme Learning Machines2013: Algorithms and Applications", Springer, 2014.

	Data mining and Predictive Modelling LAB	0-0-2
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1. K-means implementation in MapReduce
2. Association Rule Mining with Map Reduc
3. Decision trees in Spark
4. Nave bayes classification using Spark
5. Advanced text processing with Spark
6. Clustering models with Spark
7. Building a recommendation engine with Spark
8. Representing social-network data using Graphs
9. Implementing Semi-supervised Clustering
10. Deep Learning using H2O
11. Predictive analysis using H2O tool
12. SVM Classification using Mahout
13. Spectral clustering using Mahout
14. Building a recommendation engine with Sparkling water

Data Analytics

Department Elective 7

BCO 213A	Data Privacy and Security	3-0-0
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Course objectives:

The objective of this course is to create architectural, algorithmic and technological foundations for the maintenance of the privacy of individuals, the confidentiality of organizations, and the protection of sensitive information, despite the requirement that information be released publicly or semi-publicly.

Syllabus:

UNIT 1	Introduction- Fundamental Concepts, Definitions, Statistics, Data Privacy Attacks, Data linking and profiling, access control models, role based access control, privacy policies, their specifications, languages and implementation, privacy policy languages, privacy in different domains- medical, financial, etc.
UNIT 2	Data explosion- Statistics and Lack of barriers in Collection and Distribution of Person-specific information, Mathematical model for characterizing and comparing real-world data sharing practices and policies and for computing privacy and risk measurements, Demographics and Uniqueness.
UNIT 3	Protection Models- Null-map, k-map, Wrong map Survey of techniques- Protection models (null-map, k-map, wrong map), Disclosure control, Inferring entity identities, Strength and weaknesses of techniques, entry specific databases.
UNIT 4	Computation systems for protecting delimited data- MinGen, Datafly, Mu-Argus, k-Similar, Protecting textual documents: Scrub.
UNIT 5	Technology, Policy, Privacy and Freedom- Medical privacy legislation, policies and best practices, Examination of privacy matters specific to the World Wide Web, Protections provided by the Freedom of Information Act or the requirement for search warrants.

Course Outcomes:

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

CO1 Understand the concepts of privacy in today’s environment.

CO2 Obtain the understanding of how automation is changing the concepts and expectations concerning privacy and the increasingly interconnected issue of security.

CO3 Obtain the knowledge of the role of private regulatory and self-help efforts.

CO4 Have an understanding of how emerging issues are affecting society and business, with a concentration on how information security must shape corporate practices

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L			L		L							L		L
CO2		L				M					L			L	
CO3	L			L		L							M		
CO4		L				M					L			L	

H = Highly Related; M = Medium L = Low

Text books and References:

1. B. Raghunathan, The Complete Book of Data Anonymization: From Planning to Implementation, Auerbach Pub, 2013.

2. L. Sweeney, Computational Disclosure Control: A Primer on Data Privacy Protection, MIT Computer Science, 2002.

Data Analytics

Department Elective 8

MCO 214A	Streaming Data Analytics	3-0-2
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Pre-requisite : Nil

Course Objectives:

It introduces theoretical foundations, algorithms, methodologies, and Applications of streaming data and also provide practical knowledge for handling and analyzing streaming data.

UNIT:1	Introduction : Characteristics of the data streams, Challenges in mining data streams Requirements and principles for real time processing, Concept drift Incremental learning.
UNIT:2	Data Streams : Basic Streaming Methods, Counting the Number of Occurrence of the Elements in a Stream, Counting the Number of Distinct Values in a Stream, Bounds of Random Variables, Poisson Processes, Maintaining Simple Statistics from Data Streams, Sliding Windows, Data Synopsis, Change Detection: Tracking Drifting Concepts, Monitoring the Learning Process
UNIT:3	Decision Trees : The Very Fast Decision Tree Algorithm (VFDT), The Base Algorithm, Analysis of the VFDT Algorithm, Extensions to the Basic Algorithm: Processing Continuous Attributes, Functional Tree Leaves, Concept Drift. Clustering from Data Streams :Clustering Examples: Basic Concepts, Partitioning Clustering - The Leader Algorithm, Single Pass k-Means, Micro Clustering, Clustering Variables: A Hierarchical Approach
UNIT:4	Frequent Pattern Mining : Mining Frequent Itemsets from Data Streams- Landmark Windows, Mining Recent Frequent Itemsets, Frequent Itemsets at Multiple Time Granularities Sequence Pattern Mining- Reservoir Sampling for Sequential Pattern Mining over data streams
UNIT:5	Evaluating Streaming Algorithms : Evaluation Issues, Design of Evaluation Experiments, Evaluation Metrics, Error Estimators using a Single Algorithm and a Single Dataset, Comparative Assessment, The 0-1 loss function, Evaluation Methodology in Non-Stationary Environments, The Page-Hinkley Algorithm.

Course Outcome:

CO1. Recognize the characteristics of data streams that make it useful to solve real-world problems.

CO2. Identify and apply appropriate algorithms for analyzing the data streams for variety of problems.

CO3. Implement different algorithms for analyzing the data streams

CO4. Identify the metrics and procedures to evaluate a model

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				L										L	
CO2	L					L						M	M		
CO3		L			L	L									L
CO4	L			L								M		L	

H = Highly Related; M = Medium L = Low

Text Book(s) & Reference Books

1. Joao Gama, “Knowledge Discovery from Data Streams”, CRC Press, 2010.

2. David Luckham, “The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems”, Addison Wesley, 2002.

3. Charu C. Aggarwal, “Data Streams: Models And Algorithms”, Kluwer Academic Publishers, 2007

	Streaming Data Analytics LAB	0-0-2
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List of Experiments

1. Exploring one stream processing engine like storm or STREAM etc (2 classes)
2. Implementation of algorithms for example : VFDT, CVFDT(2 classes)
3. Implementation of Clustering
4. Implementation of Frequent pattern mining
5. Exploring one CEP engine like ESPER or DROOLS(2 classes)
6. Exercise with continuous queries Logical operations on single stream
7. Exercise with continuous queries Logical operations on multiple streams
8. Exercise with continuous queries temporal operators on single stream
9. Exercise with continuous queries temporal operators on multiple streams
using DL4J

Web and App Development Track

**Web and App Development
Department Elective 1**

BCO 215A	Web development using WordPress	3-0-1 [3]
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Web development using WordPress

Course objective:- Student will be able to design and develop websites using WordPress tool.

Unit-1	Introduction to CMS: Introduction to Content Management Systems, Main Features of CMS: Web Content Management System, Component Content Management System, Enterprise Content Management System, Introduction of Blogs, Installing WordPress with a Web Host's "1-Click Install", Manually Installing WordPress
Unit-2	Introduction to WordPress: Introduction to WordPress, Setting up WordPress, Setting Up Database, Overview of Working of WordPress, Dashboard, Exporting and Importing of Site Content, Backup of Site data and files, Upgrading WordPress, Settings: General, Writing, Reading, Discussion, Media, Privacy, Permalinks, Configuring and Managing Accounts, Adding Content: Post, Pages, Setup and use of Categories, Tags, Internal Linking
Unit-3	Advance Features for WordPress: Working with media : using Media Library, Audio and Video Files, Managing Comments, Fighting Spam with Akismet, Syndication : Setup and Display of RSS Feed, Setup of Subscriptions, use of Google FeedBurner with WordPress, Widgets and Plug-ins : Use of Widgets and Plug - ins, Differences, Upgrade of Plug – ins Adding an Image Gallery, Editing an Existing Image Gallery , Adding Video Embedding Responsive Videos, Uploading a Video File
Unit-4	Customization with WordPress: Introduction to WordPress Themes, Customized WordPress Theme : Default Theme, New Theme, Theme Editor, Set up of Menus, Post Frames, Getting Fancy with Themes : Customization of Themes with CSS, addition of Favicon, Editing Function file, Advanced Theme Development : Anatomy of WordPress theme, Building new Theme, Template Files, Template Tags, Use of Loop, Custom Post Types and Custom Taxonomies, One Installation and Multiple blogs: Setup and Administration of Blog Network, Customization of WordPress : Integration of Third Party Services, Third Party Comment System, AD Integration, Web Fonts , Tools and Tricks
Unit-5	About Menus & Locations, Adding & Removing Links in Menus, Creating Submenus, Opening Menu Links in a New Tab, Creating Links (Hyperlinks), Linking to Another Website, Opening a Link in a New Tab, Linking to a Page Within Your Site, Editing & Removing Links

Course Outcomes

CO1:- To be able to understand concepts of content management system, its benefits.

CO2:- Understand installation and configuring word press for web development

CO3:- To be able to work with video and audio files with their plug-ins in websites

CO4:- To be able to create websites more attractive by using themes and CSS, increasing usability by adding hyperlinks.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	M	L	M							L	L		
CO2	L		M		M									L	M
CO3		L		M	H				M		M		M	M	M
CO4		M	L	M	H				M		M	M	M	H	H

H = Highly Related; M = Medium L = Low

References:

1. Building Web Apps with WordPress: WordPress as an Application Framework 2nd Edition by Brian Messenlehner, Jason Coleman
2. WordPress for Beginners 2020: A Visual Step-by-Step Guide to Mastering WordPress (Webmaster Series) by Dr. Andy Williams
3. WordPress 5 Complete - Seventh Edition by Karol Krol

Web and App Development
Department Elective 2

BCO 216A	Software Reliability and testing	3-0-0 [3]
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Course Objectives: This course makes students understand the concepts and theory related to software reliability and testing. Understand different reliability models and testing techniques used in designing test plans, developing test suites, and evaluating test suite coverage. Understand how software developers can integrate a testing framework into code development in order to incrementally develop and test code

Unit-1	<p>Basic Ideas of Software Reliability, Hardware reliability vs. Software reliability, Reliability metrics, Failure and Faults – Prevention, Removal, Tolerance, Forecast, Dependability Concept – Failure Behaviour, Characteristics, Maintenance Policy, Reliability and Availability Modeling, Reliability Evaluation Testing methods, Limits, Starvation, Coverage, Filtering, Microscopic Model of Software Risk</p> <p>Reliability Engineering Measures: Reliability Definitions, System Mean Time to Failure, Failure Rate Function, Reliability Function for Common Distributions, Maintainability and Availability.</p>
Unit-2	<p>Computation of software reliability, Functional and Operational Profile, Operational Profiles – Difficulties, Customer Type, User Type, System Mode, Test Selection - Selecting Operations, Regression Test.</p> <p>Software Reliability Modelling: Introduction, Halstead’s Software Metric, McCabe’s Cyclomatic Complexity Metric, Error Seeding Models, Failure Rate Models, Curve Fitting Models, Markov Structure Models.</p>
Unit-3	<p>Software Cost Models: Introduction, A Software Cost Model With Risk Factor, A Generalized Software Cost Model, A Cost Model With Multiple Failure Errors, Applications.</p> <p>Fault- Tolerant Software: Introduction, Basic Fault- Tolerant Software Techniques, Self- Checking Duplex Scheme, Reliability Modeling, Reduction Of Common- Cause Failures.</p>
Unit-4	<p>The purpose of Testing : What we Do, Productivity and Quality in Software, Goals for Testing, Phases in a tester’s Mental life, Test Design, Testing Isn’t Everything, The Pesticide Paradox and the complexity Barrier.</p> <p>Some Dichotomies : Testing Versus Debugging , Function Versus Structure, The designer Versus the Tester, Modularity Versus Efficiency, Small Versus Large, The builder Versus the Buyer.</p>
Unit-5	<p>A Model for Testing : The Project, Overview, The Environmental, The Program, Bugs, Tests, Testing and Levels, The Role of Models.</p> <p>Flowgraphs and Path Testing: Path Testing Basics, Predicates, Path Predicates, and Achievable Paths, Path Sensitizing , Path Instrumentation, Complement and Application of Path Testing, Generalizations.</p> <p>Transaction- Flow Testing: Transactions Flows, Transactions – Flows Testing Techniques, Implementation Comments</p>

COURSE OUTCOME: -

- CO1 Understanding the fundamental concepts of Software Reliability
- CO2 Able to understand the basics of Software Reliability Modeling.
- CO3 Learning the concepts of Comparison Criteria
- CO4 Understanding the concepts of Measurements in Software Engineering.
- CO5 Understanding the importance of testing and its methods

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Cours e Outco me</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	M	L								L	L		
CO2	L	M	M											L	L
CO3		L		M									M	M	M
CO4		M	L	M									L	M	
CO5	M	H	M	M	M							M		M	H

H = Highly Related; M = Medium L = Low

REFERENCES:

1. John D. Musa, Anthony Iannino and Kazuhira Okumoto, “Software Reliability, Measurement, Prediction, Application, Series in Software Engineering and Technology”, McGraw Hill, 1987.
2. Norman E, Fenton and Share Lawrence Pfleeger, “Software metrics”, Second Edition, Thomson, 2002.
3. John D. Musa, “Software Reliability Engineering”, Tata McGraw Hill, 1999.
4. Roger S.Pressman, Software engineering- A practitioner’s Approach, McGraw-Hill International Editions
5. Ian Sommerville, Software engineering, Pearson education Asia
6. Software Testing Techniques, 2nd edition, Boris Beizer, 1990
7. Software Testing: Principles and Practices by Srinivasan Desikan

Web and App Development
Department Elective 3

BCO 217A	Multi-Platform Mobile Development	3-0-1 [3]
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Course Objective:- Students would be able To develop cross platform applications.

Unit-1	Xamarin platform: Introduction to Mobile Development:Differences between Starter vs. Indie vs. Business licenses, types of mobile apps that can be created with Xamarin Studio vs. Visual Studio on both Windows and OS X, Requirements for creating a Xamarin.iOS application
Unit-2	Cross-Platform: Best practices for developing mobile applications with Xamarin: Introduction to Portable Class Libraries, Differences and approaches to sharing source code files (File Linking vs. SAPs vs. PCLs), Techniques used to switch to the UI thread (platform-specific and cross-platform), Basic knowledge of Xamarin.Social component (what it supports), Basic knowledge of the Xamarin.Mobile component (what it supports), Differences between common design patterns used in mobile development (MVVM, IoC/DI, Singleton, etc.), Using the Nuget and Xamarin Component Store, Basic knowledge of .NET libraries you can use in Xamarin.iOS and Xamarin.Android. Using the async / await keywords
Unit-3	Memory Management, Techniques for Building Efficient Xamarin Applications: SGen vs. Bohm garbage collection (differences, why choose one over the other), which collector is used by default on each platform and how do you change it, Strong vs. Weak references in GC, Techniques to avoid circular references. Navigation, Fragments in Android: Navigation patterns used in Android, Navigation patterns used in iOS, How to add items to the Android, Options menu
Unit-4	Data in Mobile: Working with the File System: Advantages and restrictions to SQLite, ORM libraries used in the mobile world, How to abstract paths in Xamarin.Android and Xamarin.iOS, Isolated storage on Xamarin.Android, Xamarin.iOS and Windows Phone Web Services: Web Services in Xamarin: Common architecture and data formats used in Web Services, Approaches you can use to access a web service from a Xamarin application, Available bindings in WCF/SOAP for Xamarin
Unit-5	Backgrounding: Backgrounding: Starting and communicating with Android Services, Running a background task while suspended in iOS Xamarin.Forms: Introduction to Xamarin.Forms: Xamarin.Forms core types - Page types, Layout containers, etc, What is XAML, Basic binding features.

Course Outcomes: -

CO1: Get hands on with Xamarin Studio and Visual Studio.

CO2: Building apps for cross platform and basic knowledge of Xamarin. Social and Xamarin. Mobile components.

CO3: Students would be able to able to manage application memory using Garbage collection & Navigation libraries.

CO4: Demonstrate database of an app in Xamarin. Android &Xamarin. iOS and create web services in Xamarin.

CO5: Student will be able to implement background services in iOS& Xamarin .Forms.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L			M	H							M	L	M	
CO2		M	M	H	M								M		H
CO3	M	L	M	M										M	
CO4	L	M		M									L		M
CO5	M	M	H	H										L	

H = Highly Related; M = Medium L = Low

Text Books:

1. Professional Cross-Platform Mobile Development in C# By Scott Olson, John Hunter, Ben Horgen, Kenny Goers, Wiley

2. Xamarin Cross-platform Application Development By Jonathan Peppers, Packt Publishing Ltd.

Reference Book:

3. Mobile Design and Development: Practical concepts and techniques for creating mobile sites and web apps By Brian Fling, O'Reilly

**Web and App Development
Department Elective 4**

BCO 218 A	Mobile Analytics	3-0-1 [3]
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Course Objectives

1. Having the knowledge on the Data Analysis.
2. Able to analyse mobile data using Analytics Software.
3. Able to develop a complete Platform for predicting the facts from structured data.

Unit-1	Overview, Web Analytics Vs Mobile Analytics, Social media Analytics Vs Mobile analytics, Need of mobile analytics, Basics of mobile computing - Smart phones, mobile browsers, Mobile applications, Bandwidth. transactions, sessions, handset types & operating systems, mobile operators & their services, WAP gateway or GGSN support, APNs or regional POPs support, Architecture components, mobile webservices, overview of mobile cloud.
Unit-2	Mobile as next customer experience frontier, Customers expectations, business impact & criticality, Core metrics for deeper behavior analysis, Integration of different channels - SMS, Instant messaging, chatting, apps, HTML5 enabled sites on browsers for unique experience, Multi-channel campaning optimization, considerations for best mobile services, Location based media & support.
Unit-3	Mobile Handset Analysis, Mobile Handset Screen Resolution - supported screen resolutions of mobile handsets browsing site in terms of page views, visits and visitors, Mobile Operator Analysis -operator names and countries of subscribers browsing your site in terms of page views, visits and visitors. The types of statistics & reports: • Bandwidth (total, average per visit, total per file type) • Transactions (average per visit, number of downloads, page view breakdown) • Sessions (entry page, average duration, click paths, referring search engine) • Subscribers (browser type, user agent, operating system) • Operating system (iOS, Android, Blackberry, etc) • Mobile applications (YouTube, Facebook, Twitter, etc) • Content categorization (Adult, Video, Social, Ad Networks, etc) • Handsets (make, model, screen resolution) • Mobile Operator (country of origin, operator name) • Geo Location (Visitor location tracking, country of origin, RDNS lookup) • Referrer tracking, Search term performance, Specific visitor behaviour, Page views per visit by referrer/advert, Time spent on site by referrer/advert
Unit-4	MAIL MARKETING- Logs users email address, Cold callers report.
Unit-5	DATA FUNCTIONALITIES- Page views per annum, Data recording timeframe, Data archiving timeframe, Historic comparison , Integration to client platforms through API, HTTPS Support.

Course Outcomes

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

CO1. Describe the need of Mobile Analytics

CO2. Describe effectively the area where mobile analytics is solely useful

CO3. Construct mobile analytics tools in apps and analyze the results

CO4. Design and use advance tools for Email Marketing

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	L	L						L			M		M
CO2	L	L								L			M		L
CO3	L	L		M	M	L		L					L	M	M
CO4	L		M		H	L		L				L	M	M	H

Reference Books:

IBM Mobile Enterprise Redbooks, Available at

[<https://www.redbooks.ibm.com/Redbooks.nsf/portals/mobile?Open&page=featured>]

Web and App Development
Department Elective 5

BCO 219 A	Mobile App development Using Android	3-0-0 [3]
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Course Objectives

1. To enable students with the basic concepts of Mobile Application development.
2. To enable students to provide innovative business solutions with help of Mobile Application techniques and supporting technologies
3. To enable students acquire skills to Mobile application development using Android

Unit-1	Introduction to Android and Setup History & Background of Android, Environment Setup – Installation & Setup of SDK tools on Windows; Installing platforms and samples; Creating an Android Virtual Device (emulator) ; Installing Eclipse on a Windows machine; Installing the Android Development Tools; Preparing an Android device for development. Android Fundamentals , Overview of Android development; Understanding project creation and structure; Working with the AndroidManifest.xml file; Creating and managing activities; Using explicit intents; Using implicit intents; Creating and using resources; Understanding security and permissions; Debugging an app.
Unit-2	User Interface and Controls, Understanding units and layout; Using layout managers; Working with text controls; Building button controls; Building list controls; Building custom list layouts; Other interesting controls. Graphics and Styling, Creating and using styles; Creating and using themes; Creating icons; Creating Nine Patch drawable.
Unit-3	Supporting Multiple Screens, Understanding screen size and density; Providing alternate layouts. Animation And Graphics, Setting up frame-by-frame animation; Showing tween animation; Working in 2D graphics. Menus And Dialogs Setting up options menus; Building context menus; Building alert dialogs; Setting up progress dialogs; Creating custom dialogs.
Unit-4	Notifications And Toast, Displaying status bar notifications; Displaying toast notifications. Working With Media, Setting up audio playback; Establishing video playback; Accessing the camera and camera roll. Preferences And Data Storage Using shared preferences; Creating a preferences activity; Using the SQLite database; Setting up network access; Using Content Providers. Locations And Maps, Incorporating Google Maps; Using GPS to find the current location.
Unit-5	Creating A Home Screen Widget, Creating a simple home-screen widget; Creating a widget configuration activity. Publishing Android App, Preparing for publishing; Signing and building; Preparing the graphics; Publishing to the Android Market.

Course Outcomes

CO1. Understand the Mobile application development fundamentals

CO2. Understand various components and interfaces available to develop Mobile Application Using Android.

CO3. Understanding the importance of effectively developing the interactive UI in mobile platform to maximize the app usage.

CO4. Apply Mobile application development in the domain of Games and Graphics.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L				M							M	L	L	L
CO2			L		M	L			L		L	M	L	L	M
CO3		M			M		M		M			M	L	L	M
CO4					M						H	M	L	L	M

Text Books

1. Professional Android 4 Application Development 3rd Edition – Reto Meier

2. Programming Android O’ Rielly

Reference Books

<https://developer.android.com/training/index.html>

Web and App Development
Department Elective 6

BCO 220 A	Mobile App development Using IOS	3-0-1 [3]
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Course Objectives

- Develop iOS mobile app using Swift
- Design UI for iPhones and iPad screens
- Evaluate and integrate third-party APIs and libraries into mobile app
- Apply principles of effective UI design
- Understand the hardware and software constraints of developing for mobile platforms

Unit-1	Unit 1: Fundamentals: Overview of iOS and X-CODE: Installation, Create and manage project using XCode, Introduction to iPhone Architecture, Introduction to SWIFT, Developer Technology Overview: The Apple Developer Tool, Swift, Cocoa Touch, Model-View-Controller, Interface Builder, Overview of latest iOS features.
Unit-2	Swift Basics: Object oriented programming with swift, File structure in Swift, Swift Programming Basics: Data types, Constants, Variables, Operators, Decision making and Branching, Arrays, Functions, Enumerations. Introduction to iOS Playground.
Unit-3	iPhone Application Development: Exploring the iOS Framework with XCode, Cocoa Fundamentals, Tracking the iOS Application Life cycle, Understanding Interface Builder, Creating User Interface, Customizing the Interface Appearance using Layout, Views, Outlets and Actions, View Controllers and UI Controllers like Labels, Buttons, Sliders, Different Views, Gestures, etc. Connecting the code with Accelerometer, Location service, 3D touch, Push notifications
Unit-4	Understand the MVC Design pattern, MVC in XCode, Using Application Templates, User Input and Output: Handling Keyboard Input, Implementing Alert, Sounds and Vibrations, Using XCode debugger. Database Management and Web Services: Parsing JSON data, Parsing XML data, SQLite databases, Web Service APIs calls.
Unit-5	Submit App to Apple Store: Create Apple developer account, Submit App to Apple Store

Course Outcomes:

- CO1. To be able to design iOS application.
- CO2. To be able to develop an application using Swift Programming language
- CO3. To be able to develop multi-screen application using XCode
- CO4. To understand the need and be able to use Different UI Controllers.
- CO5. To be able to upload iOS application on Apple's App Store.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M		M						M	M	L	H	L
CO2		L	H		M						L			M	L
CO3		L	H		H				M		H		M	L	L
CO4				M	H				L	L	M			M	
CO5					H	M			L		L	M		M	

References:

1. iOS 10 Programming Fundamentals with Swift by Matt Neuburg - O'Reilly Media Pub
2. Building iPhone and iPad Electronic Projects - Mike Westerfield - O'Reilly Media Pub.
3. Head First iPhone and iPad Development, 2nd Edition - Dan Pilone, Tracey Pilone - O'Reilly Media
4. Beginning iPhone and iPad Web Apps - Chris Apers, Daniel Paterson - Apress Pub

Web and App Development
Department Elective 7

BCO 221 A	Security in Mobile App Development	3-0-0 [3]
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Course Objective:- Students will learn concepts of security parameters in mobile applications and meet the following security parameters like authentication, data integrity, confidentiality, authorization, and non-repudiation.

Unit-1	Software Development Life Cycle (SDLC)- Introduction, Software Engineering Paradigms, Software Process, Software Characteristics, Verification and Validation of Software, Software Development Lifecycle - Waterfall Model, Spiral Model, System Engineering, Business Process Engineering, Product Engineering, Agile Methodology
Unit-2	Information Security Concepts - Definition of Information Security, Evolution of Information Security; Basics Principles of Information Security; Critical Concepts of Information Security; Components of the Information System; Balancing Information Security and Access; Implementing IT Security, The system Development Life cycle, Security professional in the organization.
Unit-3	Building Security into Software Life Cycle - Understanding security requirements, building security into design of application, approach for secure coding and security testing
Unit-4	Web Application Security - Understanding web security vulnerabilities, attack types, controls and overview of OWASP
Unit-5	Secure SDLC in Mobile Application Development - Understanding mobile app SDLC challenges, security issues in mobile apps, security design aspects in mobile apps, approach to secure SDLC in mobile app development

Course Outcomes

CO1:- Understand software development life cycle and its models

CO2:- To be able to understand information security concepts

CO3:- To be able to implement security in SDLC

CO4:- Understand concepts of web application security and role of secure SDLC in mobile application development

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	M	L								M	L		L
CO2	M	L	L								L	M		L	M
CO3		M		L								M	L	M	
CO4	L	M	M								H	M		L	H

References:

1. Information Security Risk Analysis - Thomas R. Peltier, Third Edition, Pub: Auerbach, 2012
2. Information security: Principles and Practice - Mark Stamp, 2nd Edition, Pub: John Wiley & Sons, Inc., 2011
3. Ian Sommerville, "Software engineering", Seventh Edition, Pearson Education Asia, 2007
4. Roger S. Pressman, "Software Engineering – A practitioner’s Approach", Sixth Edition, McGraw-Hill International Edition, 2005

Web and App Development
Department Elective 8

BCO 221 A	Advance Android Development	3-0-1 [3]
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Course objective: - Students would be able to develop advance android application.

Unit-1	Fragment: Creating a fragment and its layout, adding a fragment to an activity, Fragment lifecycle, Communication between a Fragment and an Activity. App widgets: creating widget to an app, updating the widget provider-info. Sensors: Discovering sensors and sensor capabilities, sensor configuration. Device orientation and rotation. Motion and position sensor.
Unit-2	Performance: Good performance, performance test, frame rate, minimize overdraw, Garbage collection, Memory leak and memory churn, memory profiler tool, Network and battery best practices, Optimizing images and serializing data. Localization: Understanding language and locale settings, using the Translation Editor, Formatting date and time, numbers, currencies.
Unit-3	Location: Requesting location permissions and last known location, Geocoding, creating a Location. Request object, working with the user's location settings. Places: Using the place-picker UI, Getting the device's current place, using the place-autocomplete service. Mapping: GoogleMap objects, Map types, Configuring the initial map state, Lite mode, Map style.
Unit-4	Custom views: Creating and drawing the custom view, using custom view in a layout, using property accessories and modifiers. Canvas: Canvas object, creating and drawing canvas object, drawing shapes and text, Transformations, Clipping, saving and restoring a canvas.
Unit-5	Animation: View animation, Property animation, Drawable animation, Physicsbased animation.

Course outcomes

- CO1 Will be able to create Fragment and App widgets
- CO2 Will be able to handle sensor of Mobile, and handle sensor data in app
- CO3 Will be able to create mobile app with language selection as localization
- CO4 Will be able to handle mobile location (GPS), Places, Mapping
- CO5 Will be able to create Canvas and handle animation and media files

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L	M	L	M							M	L	H	L
CO2		L			M						L			M	
CO3		L	H	L									M		L
CO4				M	H						M			M	
CO5					H	M					L	M		M	M

Text Books:

1. Advanced Android Application Development by Joseph Annuzzi (Jr.), Lauren Darcey, Shane Conder, Addison Wesley.
2. <https://developers.google.com/training/courses/android-advanced>
3. Android Developer Advance – Concepts by Developed by Google Developer Training

Reference Book:

1. Professional Android 2 Application Development by Reto Meier, Wiley

Internet of things (IOT) Track

Internet of things (IOT)

Department Elective 1

BCO 223A	Open-Source Programming for IOT (Programming in SWIFT/RUST)	3-0-1 [2]
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Course Objective:

UNIT-I	Introduction: Rust Programming Language: The Complete Course
UNIT-II	Basic Programming Concept: variables, datatypes, Function in rust, control flow
UNIT-III	Rust ownership Principle: Rust Ownership Model, Rust Ownership Model 2 - Memory Allocation, Rust Programming Language: The Complete Course, Rust Ownership Model 4 - References and Borrowing, Rust Ownership Model 5 - Data Races and Mutable References Rust Ownership Model 6 - Slices
UNIT-IV	Structuring Data: Using Structs, Initializing Structs - Field Init Shorthand, Tuple Structs, Examples of Struct - Area of Rectangle, Enum and Pattern Matching:Enums, Option Enum, Match statement and Enum
UNIT-V	Error handling in Rust, Unrecoverable errors with panic! Recoverable errors with Result enum, Shortcuts to Panic with Error: unwrap and expect Smart Pointers: Smart Pointers in Rust, Box<T> Smart Pointer, Deref trait, Drop trait, Rc<T> Smart Pointer, RefCell<T>

Course Outcome (CO)

At the end of this course students will have:

- CO1: Create a Rust project, including proper Cargo configuration.
- CO2: Translate a design into a working Rust program.
- CO3: Explain and remedy type and lifetime errors encountered during Rust programming.
- CO4: Construct reasonable types within programs, including parametric and lifetime-bounded types.
- CO5: Use structs, enums and traits as intended in the construction of Rust programs.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H	M	H				M		H		M	H	
CO2	L		M		H		L			M	M			H	M
CO3		M		H	M	L		L		M	H		M	H	
CO4			H	M			L		M		H		M	H	
CO5			H	M		L						M	H	H	

Textbook:

- *Programming Rust: Fast, Safe Systems Development* Jim Blandy and Jason Orendorff O'Reilly 2018

Internet of things (IOT)

Department Elective 2

BCO 090B	INTERNET OF THINGS	3-0-0 [3]
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Course Objectives:

The objective of the course is to:

1. Introduction to IoT concepts.
2. Understand IoT Market perspective.
3. Data and Knowledge Management and use of Devices in IoT Technology.
4. Understand State of the Art – IoT Architecture.
5. Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

UNIT 1	M2M to IoT -The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.
UNIT 2	M2M to IoT – A Market Perspective – Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview – Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.Sensor modules, nodes and systems.
UNIT 3	M2M and IoT Technology Fundamentals - Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management
UNIT 4	IoT Architecture-State of the Art – Introduction, State of the art, Architecture Reference Model - Introduction, Reference Model and architecture, IoT reference Model
UNIT 5	IoT Reference Architecture - Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints - Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation - Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation - Introduction, Case study: phase one-commercial building automation today, Case study: phase two-commercial building automation in the future..

Course Outcome (CO) of Internet of Things

At the end of this course students will have:

CO1: To provide the basic understanding of IoT concepts

CO2: To equip our students with the market perspective of IoT and have the knowledge of architectural overview of IoT.

CO3: To be familiar with contemporary issues in IoT and Data and Knowledge Management and use of Devices in IoT Technology.

CO4: To be familiar with IoT tools and to enhance analytical skills to develop innovative solutions, automation.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H											L		
CO2				H				L		M					M
CO3			M			M								L	M
CO4				H	M				M				M		

Textbook:

- 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”**, 1st Edition, Academic Press, 2014.

Reference Books:

- Vijay Madiseti and Arshdeep Bahga, **“Internet of Things (A Hands-on-Approach)”**, 1st Edition, VPT, 2014.
- Francis daCosta, **“Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”**, 1st Edition, Apress Publications, 2013

Internet of things (IOT)

Department Elective 3

BCO 224A	Sensors and Actuator Devices	3-0-0
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Course Objectives:

- Understand Internet of Things (IoT) sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules
- Market forecast for IoT devices with a focus on sensors
- Learn the Sensors and Actuators used in Automotive Industry and Security

UNIT-1	Introduction to sensors for IoT: Internet of Things Promises–Definition– Scope– Sensors for IoT Applications–Structure of IoT– IoT Map Device
UNIT-2	Sensors and actuator: Introduction to Sensors and Actuator- Sensor and Actuator Characteristics- Primary factors driving the deployment of sensor technology
UNIT-3	Seven generations of IoT sensors: Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap
UNIT-4	Energy Harvesting Technologies: Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module– Sensing Module
UNIT-5	Sensors for Automotive Vehicle and Security applications: Tyre pressure monitoring systems - Two wheeler and Four wheeler security systems - Parking guide systems - Anti-lock braking system - Future safety technologies- Vehicle diagnostics and health monitoring, Sensor and Actuators in smart cities: Sensors in Home activity monitoring, human activity recognition, road traffic management,

Course Outcome:

- CO1: Identify the IoT networking components with respect to sensors.
- CO2: Build schematic for IoT solutions with sensors.
- CO3: Design and develop IoT based sensor systems.
- CO4: Select the appropriate sensors for various industrial applications
- CO5: Evaluate the wireless sensor technologies for IoT.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM
OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L										L		
CO2		M	H						M		H		M	M	
CO3			H	M	M				M		H			L	
CO4							M					H			L
CO5	H		L	M									L	M	

Text Book(s)

1. Timothy Chou,. Precision: Principles, Practices and Solutions for the Internet of Things, Cloudbook Inc., USA. April-13 2020
2. Maggie Lin and Qiang Lin., Internet of Things Ecosystem: 2nd Edition,. January 19, 2021., independently published

Reference Books:

1. Patranabis, Sensors and Actuators, 2 nd edition, PHI, 2013
2. D. Patranabis, Sensors and Transducers, 1st edition, PHI Learning Private Limited,2013
3. Monk, Simon. Programming the Raspberry Pi: getting started with Python, 1st edition, McGraw-Hill Education, 2016.

Internet of things (IOT)

Department Elective 4

BCO 225A	Real Time Operating System	3-0-0
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COURSE OBJECTIVES

- To introduce the characteristics of real-time systems & their different types and to discuss the characteristics and constraints of some commercial real-time operating systems.
- To discuss and analyze different task scheduling algorithms in uniprocessor and multi processor environments.
- To discuss the features and algorithms for real-time communications to take place in different network structures.
- To explain the characteristics of real-time databases and their applications in real world.

UNIT-1	REAL TIME SYSTEMS: Introduction- Issues in real time computing- Structure of a real time system- Task classes- Performance measures for real time systems- Task assignment and scheduling algorithms - Mode changes- Fault tolerant scheduling - Real Time Models.
UNIT-2	μC/OS- II RTOS CONCEPTS: Foreground/Background process- Resources - Tasks - Multitasking -Priorities - Schedulers -Kernel - Exclusion - Inter task communication-Interrupts - Clock ticks - μC/OS- II Kernel structure - μC/OS- II Initialisation - Starting μC/OS- II
UNIT-3	μC/OS- II RTOS FUNCTIONS: Task Management - Time management - Semaphore management - Mutual exclusion semaphore - Event Management –Message management - Memory management - Porting μC/OS- II – Comparison and Study of Various RTOS like QNX- VX Works-PSOS
UNIT-4	EMBEDDED LINUX: - Features - Embedded Linux Distributions - Architecture of Embedded Linux - Linux Kernel Architecture – User Space -Root File System - Linux Start-Up Sequence - GNU Cross Platform Tool chain - Porting Traditional RTOS Applications to Linux.
UNIT-5	REAL-TIME LINUX: Linux and Real-Time - Real-Time Programming in Linux - Hard Real-Time Linux - Building and Debugging - Building the Kernel- Integrated Development Environment - Kernel Debuggers - Embedded Drivers - Board support packages - Introduction to C linux.

COURSE OUTCOMES

After reading this subject, students will be able to:

CO1: Understand and develop real-time applications.

CO2: Develop efficient algorithms for real-time task scheduling in uniprocessor and multi process or environments.

CO3: Get an exposure to the different types of commercial real-time operating systems.

CO4: Identify the limitations of a non real-time operating system in running a real-time application.

CO5: Identify and address the important issues in real-time communications and will be able to use real-time databases.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M			L				L		H		L
CO2		M	L						M		H			M	
CO3			M		M									M	M
CO4	M		L									L			
CO5	M			L					L				M	L	

TEXT BOOKS:

1. Krishna C.M., Kang G. Shin, "Real Time Systems", Tata McGraw-Hill Edition, 2010.
2. Philip A.Laplante, "Real Time Systems Design and Analysis-An Engineers Handbook", II Edition-IEEE Press, IEEE ComputerSociety Press, 2001
3. Jean J Labrosse, "MicroC/OS-II The Real Time Kernel" II Edition,CMP Books, 2002.
4. P. Raghavan,Amol Lad, SriramNeelakandan, "Embedded LinuxSystem Design and Development", Auerbach Publications, Taylor& Francis Group, 2006.
5. Christopher Hallinan, "Embedded Linux Primer, A Practical, Real-World Approach", II Edition Pearson Education, Inc., 2011.

Internet of things (IOT)

Department Elective 5

BCO 226A	Wireless Ad-hoc and Sensor Networks	3-0-0
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Course Objectives:

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.
- Familiar with different types of adhoc routing protocols.
- Expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks

UNIT-1	INTRODUCTION: Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel MANET and WSN: Mobile Ad hoc Networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks
UNIT-2	MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11
UNIT-3	ROUTING PROTOCOLS IN WIRELESS AD-HOC NETWORKS: Issues in designing a routing protocol for Ad hoc networks- proactive routing, reactive routing (ondemand), hybrid routing TRANSPORT LAYER IN AD-HOC NETWORKS: Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.
UNIT-4	WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS: Issues in Designing in MAC protocol for WSN, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, T-MAC, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, BLUETOOTH, ZIGBEE, RFID
UNIT-5	WSN ROUTING, LOCALIZATION: Issues in Ad- Hoc and WSN routing protocols - Secure Ad hoc routing protocols – LEACH, PEGASIS, Direct Diffusion, Energy Efficient WSN Routing protocols, QoS WSN Routing Protocols - Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation

Course Outcome:

CO1: Understanding the concepts, network architectures and applications of ad hoc and wireless sensor networks

CO2: Understanding challenges in the layered architecture of Ad hoc wireless networks

CO3: Understanding the working of MAC and Routing Protocols for ad hoc and sensor networks

CO4: Analyze the protocol design issues of ad hoc and sensor networks

CO5: Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues

CO6: Evaluate the QoS related performance measurements of ad hoc and sensor networks

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H											L		
CO2		H		H		L		M			L		H		
CO3	H			M			L			H				M	
CO4			M		H				M			L	L		H
CO5	H	M		L								L	M	L	
CO6	M			H		L				M				H	

Text Book(s)

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference, 2008.
2. Dargie, Walteneagus, and Christian Poellabauer. Fundamentals of wireless sensor networks: theory and practice. John Wiley & Sons, 2010.

Reference Books

1. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley, 2007. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003

Internet of things (IOT)

Department Elective 6

BCO 227A	IOT for Industry	3-0-1
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Course Objectives:

- To develop knowledge in Industrial Internet of Things (IIoT) fundamentals.
- To gain conceptual understanding of networking and wireless communication protocols used in IIoT deployments
- To Understand the various Internet of Things (IoT) Protocols like COAP, MQTT.etc

UNIT-1	Industrial IOT Introduction: Introduction to IOT, What is IIOT? IOT Vs. IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining & Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT
UNIT-2	IoT Architecture: IOT components; Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT
UNIT-3	Sensors and Protocols: Introduction to sensors, Roles of sensors in IIOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Bacnet, BLE, Modbus, SPI , I2C, IIOT protocols –COAP, MQTT, 6lowpan, lwm2m, AMPQ. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet
UNIT-4	Privacy and Security: Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, non-repudiation and availability
UNIT-5	Application Design & Case Study: Application Design & Case Study: Wireless Patient Monitor system, Wearable Fitness & Activity Monitor Application Design: Design of IOT based pulse oximeter, Reliability of IoT-Aware BPNM Healthcare process

Course Outcomes:

- CO1. Develop conceptual design of Medical and Industrial IoT architecture.
 CO2. Apply sensors and various protocols for industry standard solutions
 CO3. Articulate privacy and security measures for industry standard solutions.
 CO4. Study about Internet of Medical Things (IoMT) and its applications in Healthcare industry.
 CO5. Design various applications using IoT in Healthcare Technologies.
 CO6. Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L										L		
CO2		M	H						M		H		M	M	
CO3			H	M	M				M		H			L	
CO4							M					H			L
CO5	H		L	M									L	M	
CO6	H		L										L	H	

Text Book(s)

1. Veneri, Giacomo, and Antonio Capasso. Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1st edition, Packt Publishing Ltd, 2018.
2. Reis, Catarina I., and Marisa da Silva Maximiano, eds. Internet of Things and advanced application in healthcare, 1st edition, IGI Global, 2016.

Reference Books

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017
2. Aboul Ella Hassanien, Nilanjan Dey and SureakaBoara, Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications, 1st edition, CRC Press, 2019.

Internet of things (IOT)

Department Elective 7

BCO 228A	Analytics for IOT	3-0-0
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Course Objectives:

- Apply the fundamentals of machine learning and statistics to extract value from IoT data
- Understand different business use-cases for IoT data
- Understand different types of IoT data

UNIT-1	Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges
UNIT-2	IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics
UNIT-3	IoT Analytics for the Cloud: Introduction to elastic analytics, decouple key components, Cloud security and analytics, designing data processing for analytics, Applying big data technology to storage
UNIT-4	Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis
UNIT-5	Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data Strategies to Organize Data for Analytics: Linked Analytical Datasets, Managing data lakes, data retention strategy

Course Outcomes:

- CO1: Implement the architectural components and protocols for application development
- CO2: Identify data analytics and data visualization tools as per the problem characteristics collect, store and analyse IoT data
- CO3: Engineers who would like to understand the methods used to analyze IoT data in large scale
- CO4: Executives who would like to understand how to utilize IoT data to create business value

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			L								H	L	
CO2				H				L		M			L		M
CO3			M			M								L	M
CO4				H	M				M				M		

Text Books:

1. Minter, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. Kai Hwang,
2. Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley HwaiyuGeng,
3. Internet of Things and Data Analytics Handbook, Wiley John Soldatos, Building Blocks for IoT

Reference Books:

1. Analytics Internet-of-Things Analytics, RiverPublishers Gerardus Blokdyk, IoT Analytics A Complete Guide, 5starcooks

Internet of things (IOT)

Department Elective 8

BCO 229A	Smart City Deployment using IOT	3-0-1
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Course Objectives:

- To acquire specific scripting knowledge to develop interactive applications.
- To understand the basics of android application development.
- To apply the programming skills in developing application pertaining to Industrial, medical, agricultural, etc.

UNIT-1	Smart City – Introduction: Introduction, Smart City, Complexities of Smart Cities, Urban Network, Sensor Network, Role of Urban Networks, Trends in Urban Development, Community Resource Sensing.
UNIT-2	Urban Planning: Urban Planning, Databases, Principles of Urban Planning, Data Organization, Role of Planning in Smart Cities, Case Studies.
UNIT-3	Energy Sustainability in Smart Cities: Energy, Decision Making, Energy as a catalyst for Sustainable Transformation, Cohesion and efficiency of smart cities. Security, Privacy and Ethics in Smart Cities: Security challenges in Internet of Things, Security threats in IoT, IoT related safety measures for a safer smart city.
UNIT-4	Smart Cities Planning and Development: City Planning, Understanding Smart Cities, Dimensions of Smart Cities, Global standards and performance benchmark of smart cities, Financing smart cities development, Governance of smart cities.
UNIT-5	Project Management in Smart Cities: Philosophy and project management, Phases and Stages of Project, Work Breakdown Structure, Project Organization Structure, Planning, Scheduling, Case studies on project management of smart cities – web application and mobile based implementation

Course Outcome:

1. Design dynamic systems to process user & sensor data
2. On a profound level to implement hardware & software for wireless sensor networks in day-to-day life
3. Implement secured application using android Software Development Kit
4. Solve the need for smart systems in a distributed environment
5. Understand the Internet of Things (IoT) architecture and building blocks for various domains
6. Devise multidisciplinary case to case modelling and execute wide range of application

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H									L		L		
CO2				H					L	M					M
CO3	L		M			M								L	M
CO4				H	M		H		M				M		
CO5		M					L						M		
CO6				L				M							

Text Book(s)

1. Fadi Al-Turjman, Intelligence in IoT-enabled Smart Cities, 1st edition, CRC Press ,2019.
2. Giacomo Veneri, and Antonio Capasso , Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0 , 1 st edition, Packt Publishing,2018

Reference Books

1. John Dean, Web Programming with HTML5, CSS and JavaScript, 1 st edition, Jones and Bartlett Publishers Inc.,. 2018
2. Subhas Chandra Mukhopadhyay, Smart Sensing Technology for Agriculture and Environmental Monitoring, 1 st edition, Springer, 2012
3. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2003.