Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD)
Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

SCHOOL OF ENGINEERING
B.E Computer Science and Engineering

Programme Specific Outcomes:
The graduates in Computer Science and Engineering will be able to
PSO1: Analyse and develop computer programs in the areas related to algorithms, database, web design, data mining, information security, cloud computing and networking for efficient design of computer based systems of varying complexity.
PSO2: Gain knowledge in diverse areas of Computer Science and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

Corrected Scheme of Instruction & Examination
(For students admitted from **2021-2022** & onwards)

Part	Course Code	Name of Course/component	Hours of Instruction/week		Scheme of Examination				
			Theory	Tutorial/ Practical	Duration of exam	CIA	CE	Total	Credit
First Semester									
I		**Humanities and Social Sciences (HS)**							
	21BEHS01	Professional English	1	0/2	3	50	50	100	2
II		**Basic Sciences (BS)**							
	21BESM01	Algebra and Calculus	3	1/0	3	50	50	100	4
	21BESP01/ 21BESC01	Engineering Physics*/ Engineering Chemistry	3	1/0	3	50	50	100	4
	21BESP02/ 21BESC02	Physics Practicals* / Chemistry Practicals	-	0/3	3	50	50	100	1.5
III		**Core Courses** **Engineering Sciences (ES)**							
	21BEES01/ 21BEES04	Basic Electrical and Electronics Engineering (ECE) /Programming for Problem Solving using C and Python (CSE)*	3	1/0	3	50	50	100	4
	21BEES02	Engineering Graphics(Civil)	1	0/4	3	50	50	100	3
	21BEES03/ 21BEES06	Basic Electrical Engineering Practicals(ECE)/ Programming for Problem Solving using C and Python Practicals(CSE)*	-	0/2	3	50	50	100	1
IV		**Non-Credit Mandatory Courses (NCMC)**							
	21BEMC01	Environmental Science	3	-	2	100	-	100	Remark
	21BENSS1	NSS-I	**-**	**-**	2	100	-	100	Remark
Second Semester									
I		**Humanities and Social Sciences (HS)**							
	21BEHS02	Professional English Practicals	-	0/2	3	50	50	100	1
II		**Basic Sciences (BS)**							
	21BESM02	Laplace Transforms and Complex Variables	3	1/0	3	50	50	100	4
	21BESC01/ 21BESP01	Engineering Chemistry **/ Engineering Physics	3	1/0	3	50	50	100	4
	21BESC02/ 21BESP02	Chemistry Practicals**/ Physics Practicals	-	0/3	3	50	50	100	1.5
III		**Core Courses** **Engineering Sciences (ES)**							
	21BEES04/ 21BEES01	Programming for Problem Solving using C and Python (CSE)/ Basic Electrical and Electronics Engineering (ECE)**	3	1/0	3	50	50	100	4
	21BEES05	Workshop Practicals(Civil, ECE and FPPT)	1	0/4	3	50	50	100	3
	21BEES06/ 21BEES03	Programming for Problem Solving using C and Python Practicals(CSE)/ Basic Electrical Engineering Practicals(ECE)**	-	0/2	3	50	50	100	1
IV		**Non-Credit Mandatory Courses (NCMC)**							
	21BEMC02	Constitution of India	2	-	2	100	-	100	Remark
	21BENSS2	NSS-II	**-**	**-**	2	100	-	100	Remark
	21BAFU01	Fundamentals of Research	2	-	2	100	-	100	Remark

* and **   50% of the I BE students will learn in I and II semester respectively.

Part	Course Code	Name of Course/ component	Hours of Instruction / week		Scheme of Examination				
			Theory	Tutorial/ Practical	Duration of exam	CIA	CE	Total	Credits
Third Semester									
I		**Humanities and Social Sciences (HS)**							
	21BEHS05	Professional and ComputerEthics	3	-	3	50	50	100	3
II		**Basic Sciences (BS)**							
	21BESM07	Probability and Statistics	3	1/0	3	50	50	100	4
III		**Core Courses Engineering Sciences (ES)**							
	21BEOS01	Computer Architecture	3	1/0	3	50	50	100	4
	21BEOS02	Analog and Digital Electronics	3	-	3	50	50	100	3
III		**Core Courses Professional Core (PC)**							
	21BEOC01	Data Structures and Algorithms	3	-	3	50	50	100	3
	21BEOC02	Database Management Systems	3	-	3	50	50	100	3
	21BEOC03	Data Structures and Algorithms Practicals	-	0/3	3	50	50	100	1.5
	21BEOC04	Database Management Systems Practicals	-	0/3	3	50	50	100	1.5
IV		**Non-Credit Mandatory Courses (NCMC)**							
	21BEMC03	Consumer Affairs	3	-	2	100	-	100	Remark
		Value Added Course	2			100	-	100	Remark
	21BENSS3	NSS-III	-	-	2	100	-	100	Remark
Fourth Semester									
II		**Basic Sciences (BS)**							
	21BESM09	Discrete Mathematics and Linear Algebra	3	1/0	3	50	50	100	4
III		**Core Courses Professional Core (PC)**							
	21BEOC05	Software Engineering	4	-	3	50	50	100	4
	21BEOC06	Artificial Intelligence	3	-	3	50	50	100	3
	21BEOC07	Microprocessors and Microcontrollers	3	0/2	3	50	50	100	4
	21BEOC08	Design and Analysis of Algorithms	3	1/0	3	50	50	100	4
	21BEOC09	Operating Systems	3	-	3	50	50	100	3
	21BEOC10	Operating Systems Practicals	-	0/3	3	50	50	100	1.5
	21BEOC11	Artificial Intelligence Practicals	-	0/3	3	50	50	100	1.5
IV		**Non-Credit Mandatory Courses (NCMC)**							
	21BECS01	Communication Skills	3	-	2	100	-	100	Remark
	21BENSS4	NSS-IV	-	-	2	100	-	100	Remark
# 6 to 8 weeks Industrial Internship during summer vacation;									

Part	Course Code	Name of Course/ component	Hours of Instruction / week		Scheme of Examination				
			Theory	Tutorial/ Practical	Duration of exam	CIA	CE	Total	Credits
Fifth Semester									
III		**Core Courses Professional Core (PC)**							
	21BEOC12	Big Data Analytics	3	-	3	50	50	100	3
	21BEOC13	Information Retrieval	3	-	3	50	50	100	3
	21BEOC14	Automata and Compiler Design	3	1/0	3	50	50	100	4
	21BEOC15	Computer Networks	3	-	3	50	50	100	3
	21BEOC16	Data Mining	3	-	3	50	50	100	3
	21BEOC17	Computer Networks Practicals	-	0/3	3	50	50	100	1.5
	21BEOC18	Data Mining and Big Data Analytics Practicals	-	0/3	3	50	50	100	1.5
III		**Professional Elective(PE)**							
		Elective – I (PE1/ PE2)	3	-	3	50	50	100	3
IV		**Non-Credit Mandatory Courses (NCMC)**							
	21BESS01	Soft Skills	3	-	2	100	-	100	Remark
	21BENSS5	NSS- V	-	-	2	100	-	100	Remark
Sixth Semester									
III		**Core Courses Professional Core (PC)**							
	21BEOC19	Software Project Management	3	-	3	50	50	100	3
	21BEOC20	Cloud Computing	3	-	3	50	50	100	3
	21BEOC21	Internet and Web Technology	3	-	3	50	50	100	3
	21BEOC22	Data Privacy and Security	3	-	3	50	50	100	3
	21BEOC23	Internet and Web Technology Practicals	-	0/3	3	50	50	100	1.5
	21BEOC24	Cloud Computing Practicals	-	0/3	3	50	50	100	1.5
	21BEOC25	Mini Project	-	0/4	-	100	-	100	2
		Professional Electives (PE)							
		Elective – II (PE1/ PE2)	3	-	3	50	50	100	3
		Elective – III (PE1/ PE2)	3	-	3	50	50	100	3
IV		**Non-Credit Mandatory Courses (NCMC)**							
		Co-Curricular Course	-	-	-	100	-	100	Remark
	21BENSS6	NSS-VI	-	-	2	100	-	100	Remark
# 6 to 8 weeks Industrial Internship during summer vacation									

Part	CourseCode	Name of Course/ component	Hours of Instruction / week		Scheme of Examination				
			Theory	Tutorial/ Practical	Duration of exam	CIA	CE	Total	Credits
Seventh Semester									
III		**Core Courses** **Professional Core (PC)**							
	21BEOC26	Machine Learning	3	-	3	50	50	100	3
	21BEOC27	Mobile Application Development	3	-	3	50	50	100	3
	21BEOC28	Machine Learning Practicals	-	0/3	3	50	50	100	1.5
	21BEOC29	Mobile Application Development Practicals	-	0/3	3	50	50	100	1.5
	21BEOC30	Industrial Internship #	-	-	-	100	-	100	1
	21BEOC31	Research Project Phase I	-	0/4	3	100	-	100	2
III		**Professional Electives (PE)**							
		Elective – IV (PE1/PE2)	3	-	3	50	50	100	3
		Elective – V (PE1/PE2) Title of MOOC (SWAYAM-NPTEL) ##	3	-	-	-	-	100	3
		Elective – VI (PE1/PE2) Title of MOOC (SWAYAM-NPTEL) ##	3	-	-	-	-	100	3
		Open Elective (OE)							
	21BEBO01/ 21BEVO01/ 21BELO01/ 21BEFO01/ 21BEPO01	Open Elective –I	3	-	3	50	50	100	3
IV		**Non-Credit Mandatory Courses (NCMC)**							
	21BEMC04	Disaster Management	3	-	2	100	-	100	Remark
	21BEMO01	Computer Science and Engineering- Computer Based Test(CBT)	-	-	2	100	-	100	Remark
## Two MOOCs (12 weeks duration) through SWAYAM - NPTEL with credit transfer of 6 credits, as an alternative to two Professional Elective Courses Elective - V and Elective - VI in VII Semester should be completed between 3rd and 7th semester. Title of the MOOC to be specified after enrollment.									
Eighth Semester									
III		**Core Courses** **Professional Core (PC)**							
	21BEOC32	Research ProjectPhase-II	-	0/20	-	100	100	200	10
							Total Credits		**165**
	21BEOMC1	**MOOC (Core/Non-Core)**	-	-	-	-	-	-	2
One core/non-core MOOC (8 weeks duration) through SWAYAM-NPTEL to be completed with 2 credits between 3rd and 7th semester (without credit transfer).									

Department of Computer Science and Engineering

Conceptual framework applicable for students admitted in 2023-2024 & onwards.
Corrected Part-IV components of B.E. Computer Science and Engineering

Semester	Course Code	Name of the Course/component	Instruction hours/ week/Course	Credit/ Course
Part – IV Non-Credit Mandatory Courses (NCMC)				
A. Ability Enhancement Compulsory Courses (AECC)				
1	23BEMC01	Environmental Science	3	Remark
2	23BEMC02	Constitution of India	2	
2	23BEUR01	Fundamentals of Research	2	
3	23BEMC03	Consumer Affairs	3	
4	23BECS01	Communication Skills	3	
5	23BESS01	Soft Skills	3	
7	23BEMC04	Disaster Management	3	
B. Skill Enhancement Courses (SEC)				
3		Value Added Course (from a basket of choices offered)	40 hrs. duration	Remark
C. Value Based Elective- I				
1-6	23EVBNS 1-6/ 23EVBNC1-6/ 23EVBSP 1-6	NSS/ NCC/ Sports (Representing the Institute)	-	Remark
Value Based Elective- II				
6	23EVBAP1	Principles of Dr.Ambedkar's Philosophy	Varied duration	Remark
	23EVBGP1	Gandhian Philosophy		
	23EVBWS1	Women Empowerment Perspective in the Current Scenario		
	23BSCGA1	General Awareness		
	23BSCQA1	Quantitative Aptitude		
D. Computer Based Test (CBT)				
7	23BEMO01	Computer Science and Engineering	-	Remark

Requirements to earn the B.E. Degree:

1. Total credits to be earned in Part I, II & III components: 165
2. 2 credits MOOC through SWAYAM- NPTEL - 165+2
3. Successful completion of Part IV Non – Credit Mandatory Courses (NCMC).
4. Minimum of two 3 credit (12 weeks duration)MOOCsto be completed through SWAYAM – NPTEL as an alternative to two Professional Electives, Elective V & Elective VI ([#]with credit transfer). Additionally, one core/non-core MOOCthrough SWAYAM -NPTEL to be completed with 2/3 credits (8 weeks/12 weeks) between 3rd and 7[th]Semester ([##]without credit transfer).
5. *6 to 8 weeks Industrial Internship during 4th and/or 6th semester during summer vacation.

LIST OF PROFESSIONAL ELECTIVES (PE1) Systems, Algorithms and Application Domain

Part	Semester	Course Code	Name of the Course
III	Semester V Elective –I	21BEOE01	Software Testing
		21BEOE02	Java Programming
		21BEOE03	Adhoc and Sensor Networks
	Semester VI Elective –II	21BEOE04	Cryptography and Network Security
		21BEOE05	Linux Programming
		21BEOE06	Agile Technologies
	Semester VI Elective –III	21BEOE07	Full Stack Software Development
		21BEOE08	Block Chain
		21BEOE09	Virtual and Augmented Reality
	Semester VII Elective -IV	21BEOE10	Internet of Things and Applications
		21BEOE11	Information Security
		21BEOE12	Artificial Neural Network and Deep Learning
	Semester VII Elective -V	21BEOE13	**MOOC (12 Weeks Course in SWAYAM- NPTEL)**
	Semester VII Elective -VI	21BEOE14	**MOOC (12 Weeks Course in SWAYAM- NPTEL)**

LIST OF PROFESSIONAL ELECTIVES (PE2) Analytics & Intelligent Systems Domain

Part	Semester	Course Code	Name of the Course
III	Semester V Elective –I	21BEOE21	High Performance Computing
		21BEOE22	Image and Video Processing
		21BEOE23	Edge Computing
	Semester VI Elective –II	21BEOE24	Web Analytics and Development
		21BEOE25	Human Computer Interaction
		21BEOE26	Object Oriented Analysis and Design
	Semester VI Elective –III	21BEOE27	Robotics Technology
		21BEOE28	Computational Intelligence
		21BEOE29	Big Data Security
	Semester VII Elective -IV	21BEOE30	Computer Vision
		21BEOE31	Cognitive Computing
		21BEOE32	Social Media Analytics
	Semester VII Elective -V	21BEOE33	**MOOC (12 Weeks Course in SWAYAM- NPTEL)**
	Semester VII Elective -VI	21BEOE34	**MOOC (12 Weeks Course in SWAYAM- NPTEL)**

PROGRAM OUTCOMES (PO):
Engineering Graduates will be able to:
1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

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

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

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

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

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

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

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

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

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

Program Educational Objectives (PEO)
The graduates in AI & DS will be able to
PEO1: Demonstrate the technical skills to analyse and design suitable solutions for problems using standard practices, tools and techniques
PEO2: Carry out higher education and research in Artificial Intelligence and Data Science areas to address the basic needs of the society
PEO3: Explore technological developments and will be ethically and socially responsible solution providers and entrepreneurs

Professional English-1
(Common to all branches)

Semester I   **Hours of instruction/week: 1T+2P**

21BEHS01   **No. of credits: 2**

Objective:

CLO 1: To familiarize students to corporate communication skills

Unit I   Language through Reading   **9**

Skimming, scanning, predicting the content of a given passage, identifying the lexical and contextual meanings, note making (guided & unguided) cloze reading, drawing inferences, separating facts from opinions.

Unit II   Focus on Language   **9**

Word formation with prefixes and suffixes, synonyms and antonyms, Impersonal passive voice, Tenses, use of prepositions, 'if clauses', use of words as nouns and verbs, subject, verb, agreement, Editing, British and American English.

Unit III   Language through Practice   **9**

Resume writing, writing instructions and recommendations, preparing checklists, classifying the data, analyzing / interpreting the data, Paragraph writing, Formal letters, writing to officials (leave letter, seeking permission for practical training, asking for Certificates, testimonials), unseen comprehension, creative writing, Framing Agendas, Minutes of the meeting.

Unit IV   Oral Practice (Lab Sessions)   **9**

Pronunciation Techniques:

Phonetics, Stress, Primary and Secondary stress, Neutral Accent, Rising and Falling Tone, Voice Modulation.

Public Speaking Skills:
Compeering, introducing a guest to the audience, welcome address, proposing a vote of thanks.

Unit V (Lab Sessions)   **9**

Justifying and Summarizing Skills:

Emphasizing a point, discussing the pros and cons, focusing on reasons, Summarizing briefly and concisely

Designing an Advertisement:
Interpreting advertisements, Slogan/caption writing, creating one's own advertisement for a product.

Total Hours: 45

References:
1. **AyshaViswamohan (2008). English for Technical Communication**. Tata McGraw-Hill Publishing Co Ltd, New Delhi.
2. **Dr. S. Sumant, English for Engineers(2005).** Tata McGraw Hill Publishing Co Ltd, New Delhi.
3. **M. AshrefRizvi (2005). Effective Technical Communication.**Tata McGraw Hill Publishing Co Ltd, New Delhi.
4. **Raymond V Lesikar& Marie E. Flatley(2005). Basic Business Communication**. Tenth Ed. Tata McGraw Hill Publishing Co. Ltd, New Delhi.

Expected Outcomes

On completion of the course students will be able to:

CO 1: Create organized academic and professional writing

CO 2: Develop aural competency and oral fluency of learners

CO 3: Achieve proficiency in the effective use of language in various authentic career,

related situations.

CO PO Matrix

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

Algebra and Calculus
(Common to all branches)

Semester I   **Hours of Instruction/ week: 3T+1Tu**
21BESM01   **No. of Credits: 4**

Objectives:
CLO1 Develop skills in processing matrices and applications of differential calculus
CLO2 Enrich knowledge in solving problems in multiple integrals and ordinary
differential equation
CLO3 Gain practice in implementing algorithms and to use software tools

UNIT I   EIGENVALUES AND EIGENVECTORS   12
Characteristic equation of matrix - Eigenvalues and Eigenvectors of a real matrix- Properties of
Eigenvalues and Eigenvectors -Cayley Hamilton theorem- Reduction of quadratic form to canonical
form by orthogonal transformation.

UNIT II   GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS   12
Curvature- Cartesian and polar co-ordinates - Centre and radius of curvature - Circle of curvature-
Involutes and Evolutes - Envelopes of family of curves- Maxima and minima- Constrained maxima and
minima -Jacobians.

UNIT III MULTIPLE INTEGRALS   12
Double integration - Cartesian and polar coordinates - Change of order of integration - Area as a double
integral - Triple integration in cartesian coordinates and spherical polar coordinates - Volume as a triple
integral.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS   12
Linear equations of second order with constant coefficients and variable coefficients - Homogeneous
equations of Euler type - Method of variation of parameters -Simultaneous first order linear equations
with constant coefficients.

UNIT V MATHEMATICAL SOLUTIONS USING SOFTWARE TOOLS   12
Arithmetic Operations Commands - Elementary Math Built-in functions – Arrays -Ordinary
differential equations - Multiple Integrals(Unit V is only for gaining knowledge in software
applications and not included in theory exams)

Total hours –60

Text Books:
1. *T.Veerarajan* (**2016**)**,** *Engineering Mathematics* (*for semester I and II),* updated 2nd Edition, Tata
   McGraw Hill Publishing Co.Ltd, New Delhi.
2. *P.Kandaswamy, K.Thilagavathy and K.Gunavathy (2014), Engineering Mathematics, Volume I*,
   10th Revised Edition, S. Chand & Co, New Delhi.

References:
1. *E.Kreyszig (2014), Advanced Engineering Mathematics*, 8th Edition, John Wiley and Sons (Asia)
   Ltd, Singapore.
2. *Dennis G. Zill and Michael R.Cullen(2012),Advanced Engineering Mathematics,*2nd edition, CBS
   Publishers.
3. *Srimanta Pal and Subhodh C Bhunia(2012), Engineering Mathematics,* 9th Edition,John Wiley
   and Sons.
4. *Dr. B. S. Grewal (2014), Higher Engineering Mathematics*, 43rd Edition, Khanna Publishers, New
   Delhi.
5. *Jain R.K. and Iyengar S.R.K. (2007), Advanced Engineering Mathematics,* 3rd Edition,Narosa
   Publications, New Delhi.
6. Open Source Software tools.

Course Outcomes:

On completion of course the students will be able to

CO1: Apply the concepts of Algebra and calculus in engineering fields like computer science, communication, food technology etc.

CO2: Develop mathematical models to interpret and solve engineering problems

CO3: Appreciate the need of software tools to solve higher order linear ordinary integral and differential equations used in real world problems

CO/PO Matrix

POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO1	H	H	M	-	-	-	-	-	-	-	-	M
CO2	H	H	M	-	-	-	-	-	-	-	-	M
CO3	H	H	M	-	L	-	-	-	-	-	-	M

Engineering Physics
(Common to all branches)

Semester I/ II   **Hours of instruction/week: 3T+1Tu**
21BESP01   **No. of credits: 4**

Objectives:

CLO1 To impart knowledge in basic concepts of physics relevant to engineering and technology

CLO2: To understand and apply the concepts of physics for various engineering applications

Unit I   Ultrasonics& Acoustics   **12**

Introduction, Magnetostriction effect, Production of ultrasonic waves: Magnetostriction generator, Inverse piezoelectric effect, Piezoelectric generator, Detection of ultrasonic waves, Properties, Cavitation soldering and cleaning, Ultrasonic Doppler Blood flow meter

Classification of sound, characteristics of musical sound, Weber- Fechner law, Absorption coefficient and its determination, Factors affecting acoustics of building and their remedies.

Unit II Lasers & Fiber optics   **12**

Principle of spontaneous and stimulated emission, Einstein theory of stimulated emission, Population inversion, Pumping mechanism, Types of Lasers, CO_2, Nd-YAG and Semiconductor laser, Applications: welding, heat treatment, cutting and holography.

Principle of fiber optics, Preparation, Crucible-crucible technique, Classification based on materials, refractive index profile, Applications: Fiber optic communication, Temperature sensor and Endoscope.

Unit III Crystal physics   **12**

Single crystalline, polycrystalline and amorphous materials – single crystals, unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distance - coordination number and packing factor for SC, BCC, FCC and HCP structures- crystal imperfections: point defects, line defect ,growth of single crystals: Czochralski growth technique.

Unit IV Quantum physics   **12**

Introduction to Quantum theory, Dual nature of matter and radiation, de Broglie wave length, Uncertainty principle, Schrödinger wave equation, Particle in one dimensional box, Electron microscope, Scanning electron microscope (SEM), Scanning Transmission Electron Microscope (STEM).

Unit V Vacuum & Nano science   **12**

Importance of vacuum in industries, Pumping speed and throughput, Types of pumps, Working principle and construction of Rotary pump, Diffusion pump, Measurement of vacuum using Pirani and Penning Gauges.

Dimensionality and size dependence, Fabrication methods: Top down process (Lithographic process) and Bottom up process (Physical vapour deposition) Carbon Nanotubes (CNT), Types and Properties, Fabrication of CNT -Laser ablation method, Applications: CNT field effect transistor, Fuel cells, Organic light emitting diode (OLED).

                                                                    Total Hours : 60

References

1.BhattacharyaD.K&T.Poonam(2015). Engineering Physics, Oxford University Press,

2. *M.N Avadhanulu , P G Kshirsagar & TVS Arun Murthy (2018) A Textbook of Engineering Physics,*S. Chand Publishing.

*3.V Rajendran*Engineering Physics, Tata Mcgraw Hill Publishing Co Ltd

4. S.O. Pillai (2011).Solid State Physics New Age International (P) Limited, Publishers

5. S. Jaya Kumar (**2009).** *Materials Science*. R.K. Publishers, *Coimbatore*

6. G. SenthilKumar(2011). Engineering Physics. Chennai Revised Edition. VRP Publisher

7. **S. Jayakumar (2007).***Engineering PhysicsFirst Edition, RK Publishers, Coimbatore*

Outcomes

On completion of the course students will able to

CO1: Identify the basic concepts of Physics applied in Engineering.
CO2: Discuss the theory and demonstrate the methods involved in Engineering Physics.
CO3:Apply the theoretical ideas of various processes and techniques of physics in Engineering and Technology.

CO/PO Matrix

POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	H	M	M	-	-	M	L	-	M	-	-	L
CO2	H	M	-	-	-	M	L	-	M	-	-	L
CO3	H	M	M	-	-	M	L	-	M	-	-	L

Physics Practicals

(Common to all branches)

Semester I/ II   **Hours of Instruction/week:3P**

21BESP02   **No. of credits: 1.5**

Objective

CLO1: To impart experimental skills on potentially important experiments needed for Engineering.

List of Experiments (Any 10)

1. LASER- Wavelength & Particle size determination

2. Ultrasonic interferometer-Determination of compressibility of a liquidS

3. Melde's apparatus- Frequency of the vibrator

4. Spectrometer- wavelength determination –Grating (Simulation Experiment).

5. Torsional Pendulum-Rigidity modulus of wire and moment of inertia of disc.

6. Non Uniform bending – Determination of Young's Modulus .

7. LCR Bridge –Dielectric constant of solids

8. Four Probe Apparatus-Bandgap of a semiconductor

9. Hysteresis curve tracer - Coercivity and Retentivity

10. Solar cell-V-I characteristics

11. Spectrometer- Determination of dispersive power of the prism.

12. Fiber optics – Numerical aperture

Outcomes

On completion of the course students will be able to

CO1:Conduct experiments and interpret the results.

CO2: Verify the knowledge gained in theory with practical results.

CO/PO Matrix

POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	H	H	-	M		M	-	-	M	-	-	M
CO2	H	H	-	M	-	M	-	-	M	-	-	M

Basic Electrical and Electronics Engineering

Semester I   **Hours of Instruction/week:3L+1Tu**
21BEES01   No.ofcredits:4

Objective:

CLO1:   To provide a comprehensive idea for engineering students about AC and DC circuit analysis, working principles of basic machines in electrical engineering and their applications in various fields.
CLO2:   To understand the working principle of electronic devices and circuits.

Unit I   Basics ofCircuit Analysis   12
Ohm's Law- Kirchoff's Laws- DC circuits-AC Circuits (in series and parallel)-MeshandNodalanalysisusingMatrixmethod,Thevenin'sandNorton'stheorems-Superpositiontheorem-Reciprocitytheorem – Maximum power transfer theorem.

Unit II   Introduction to Singleand threephases   12

Single phase and three phase with applications, three phase balanced /unbalanced loads – current and voltage relationship in star/delta connection – phasor diagrams of voltage and current – power and power factor measurements in three phase circuits - Transient response of RL, RC and RLC circuits to DC excitation - Three phase power- measurement by two wattmeter methods.

Unit III   Transformers   12
Principle of operation, Mutual coupling, construction, EMF equation,powerlosses,efficiency, Transformers and their functions, OC and SC equivalent
Circuits,Idealandpracticaltransformer,lossesintransformers,Introductiontoautotransformers,applications.

UnitIV   Basics of Electronics   12

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier Circuits - Working principle and characteristics – Wave shaping examples- Introduction to BJT, JFET and MOSFET (Construction, working and characteristics).

UnitV   Electrical Machines   12
Protection and Devices: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, Types of Batteries DCMachine & Induction Motor: DC Generator, DC Motor - Construction, working principle, EMF equation and its types (qualitative treatment only). Single Phase Induction Motor- Construction and working (qualitative treatment only).

Total Hours: 60

ReferenceBooks:

1. *R.K.Mehta&A.K.Mal"ProblemsandSolutionsofElectricalCircuitAnalysis"* CBS Publishers, 2015
2. *D.P.KothariandI.J.Nagrath,"BasicElectricalEngineering",*TataMcGrawHill,2010.
3. *E.Hughes, "Electrical and Electronics Technology",* Pearson,2010.
4. *JosephEdministerandMahmoodNahri,"ElectricCircuits",*fifthEdition,TataMcGraw Hill New Delhi,2008.
5. *V.K.Mehta,RohitMehta,"PrinciplesofElectricalMachines",*S.Chand&companyLtd.,Rep rint 2006.
6. *John Bird, "Electrical Circuit theory and technology",* Routledge; 5th edition, 2013
7. *Thomas L. Floyd, "Electronic Devices",* 10th Edition, Pearson Education, 2018.

CourseOutcomes:
Attheend of the course,thestudentwillbeableto:

CO1: Comprehend the basic concepts of electric and magnetic circuits

CO2: Differentiate properties and Analyse AC as well as DC circuits and various machines,

CO3: Understand the working principle of electronic devices such as diode, Zener

diode, characteristics and working of current controlled and voltage-controlled

devices

CO/PO Matrix

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	L									L
CO2	H	H	L									L
CO3	H	L	L			M	M					L

Programming for Problem Solving using C and Python

Semester I/ II   **Hours of instruction/week: 3T+1Tu**

21BEES04   **No. of Credits: 4**

Objectives:

CLO1: Understand the basic knowledge in programming concepts and problem solving using

C.

CLO2: Learn core Python scripting elements such as variables and flow control structures

and develop simple applications.

Unit- I   C Programming Fundamentals   12

Introduction to C programming – Fundamentals – Structure of a C program – Character set-Keywords- Data types and sizes - Constants- Variables – Expressions - Operators –Control statements - if - else statement- nested if statement- switch case – Looping Statements - while- do-while- for - nested control structures - break- continue- goto statement – Implementation of simple C programs on Control Structures.

Unit- II   Arrays and Strings   12

Arrays: Introduction - Initialization – Declaration – One Dimensional and Two Dimensional Arrays. Strings: String Operations – String Arrays - Variable length arrays- Implementation of Concepts on Arrays and String handling.

Unit -III   Functions and Pointers   12

Functions: Prototypes and Functions–Declaring- defining and accessing functions–Parameter passing methods –Recursion–Storage classes–auto- extern- static and register–Library functions. Pointers: Pointer concept–Declaration–Accessing variable through pointer–Initializing pointer variable–Pointers and Functions–Pointers and Arrays - Implementation of Concepts on Functions and Pointers- Structures and Union.

Unit-IV   Fundamentals of Python Programming   12

Introduction : History - Features - Setting up path - Working with Python - Basic syntax - Variables and Data types - Operators - Conditional- Looping –Control statements. String Manipulation: Accessing Strings - Operations and String slices. Functions: Definition - Calling a Function - Types - Arguments - Global and Local variable.

Unit-V   Core Python Programming   12

Lists: Introduction - Accessing list - Operations and Methods. Tuples: Accessing Tuples - Operations - Working - Functions and Methods. Dictionaries: Accessing values in Dictionaries - Properties - Functions. Modules: Importing Module - Packages - Compositions. Exception Handling: Exception and Exception handling.

Total hours: 60

References:

1. *PradipDey- ManasGhosh (2013). Computer Fundamentals and Programming in C*.Second Edition*. Oxford University Press*.
2. *Yashavant P. Kanetkar (2011).Let Us C.* BPB Publications*.
3. *Allen B. Downey (2016).Think Python: How to Think Like a Computer Scientist*. 2nd edition.O'Reilly Publishers.
4. *Guido van Rossum and Fred L. Drake Jr (2011). An Introduction to Python – Revised and updated for Python 3.2.* Network Theory Ltd.
5. *Ashok N. Kamthane (2007). Computer Programming.Pearson Education.*
6. *Kernighan,B.W and Ritchie,D.M (2006). The C Programming language.*SecondEdition.Pearson Education*.
7. *Byron S Gottfried and Jitendar Kumar Chhabra (2011).Programming with C.*ThirdEdition.Tata McGraw Hill Publishing Company.

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

> **CO1:**Describe and use the data types, expressions, functions, control statements, strings in C and Python programming.
> **CO2:**Write user defined functions and implement different Operations on arrays, strings, pointers and classes in python.
> **CO3:**Identify and use suitable C and python programs to solve real life problems.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	L	L	M	L	M	_	_	_	L	_	_	_
CO2	L	L	M	L	M	_	_	_	L	_	_	_
CO3	L	M	M	L	M	_	_	_	L	_	_	_

Engineering Graphics
(Common to all branches)

Semester I   **Hours of Instruction /week: 1T+4P**
21BEES02   **No. of Credits: 3**

Course Learning Objective:
CLO1: The objective of this course is to develop the students in graphic skill for communication of concepts and ideas in Engineering.

Unit I   **Projection of Points, Lines and Surfaces**   **17**

Introduction to letter practice, the principles, orthographic projection of points, Projection of straight lines located in the first quadrant only, determination of true length and true inclination, Projections of plane surfaces like polygonal lamina and circular lamina, located in first quadrant only.

Unit II   **Projection of Simple Solids**   **17**

Projection of simple solids like prism, pyramid, and cylinder, Drawing views when the axis of the solid is inclined to one reference plane.

Unit III   **Sectioning of Solids**   **17**

Sectioning of simple solids like prisms, pyramids, cylinder, cone and sphere. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.

Unit IV   **Isometric, Perspective Projection and freehand sketching**   **17**

Isometric projections, Isometric scale, Isometric views of simple solids, Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including freehand dimensioning. Sketching pictorial views from given orthographic views. Perspective projections of solids.

Unit V   **Auto CAD**   **7**

Introduction to drafting software, creation of simple geometric bodies using basic primitives (line, arc, circle) and editing the drawings. Practice in drawing orthographic projection

                                                             Total Hours: 75

References:
1. Venugopal.K (2008). Engineering Graphics. New Age International (P) Limited.
2. Natarajan K.V (2008).Engineering drawing and graphics. 17thEdition.Private Publisher, Chennai.
3. Bhatt.N.D (2011)"Engineering Drawing" Charotar Publishing House.
4. Kumar M.S (2007). Engineering Graphics. Ninth edition. D.D. Publications, Chennai.
5. Warren J, Luzadder and John.M.Duff (2007). Fundamentals of Engineering Drawing. Eleventh edition. PrenticeHall of India Pvt., Ltd.,
6. Gopalakrishnan K.R (2007). Engineering Drawing (Vol.I& II).Subhass Publications.

7. Bertoline and Wiebe (2007). Fundamentals of graphics Communication. Third edition.
8. DhananjayA.Jolhe (2008). Engineering Drawing with an introduction to AutoCAD. Tata McGraw Hill Publishing Company Limited.

Course Outcomes:
CO1: To draw orthographic projection of one dimensional, two dimensional and 3 dimensional objects.
CO2: To prepare isometric and perspective sections of simple solids
CO3: To demonstrate basic skills in computer aided drafting.

CO- PO Mapping

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

Basic Electrical Engineering Practicals

SemesterI   **Hoursof Instruction/week:2P**
21BEES03   **No.ofcredits:1**

Objective:
CLO1:To make the students learn and use the basic electrical concepts in various practicalapplications and machines.

ListofExperiments:

Introductionanduseofmeasuringinstruments–voltmeter,ammeter,multi-meter,oscilloscope,resistors, capacitors and inductors.

1. Design a resistive circuit to derive the specified load voltage and load current from aDCpower source.
2. VerificationofKirchhoff'slaws.
3. Build andtestthevoltageacrossandthecurrentthroughanyelementusingappropriate circuit analysistechniques.
4. Verifyacircuit topologyhavingstar/deltaconnected network.
5. Design an RL/RC circuit for a given time constant, determine its current/voltageresponse and analyze the step response and the source free response of your circuitwith initialconditions.
6. Designahome wiringcircuit with R, RLloadandtwo-wayswitch.
7. Powermeasurements in threephasesystem bytwo wattmeter method.
8. Determinationofefficiencyof single-phasetransformerbyload test.
9. Determinationofefficiencyofsingle-phaseinduction motorbyLoad test.
10. Loadtest and No-loadtest on DC motor.
11. Speedcontrol of DC shunt motor.

                                                       TotalHours: 30

CourseOutcomes:

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

CO1: Analyze AC and DC circuits and verify networks theorem
CO2: Design and demonstratewiringforvarious loads.
CO3: Test transformers and electrical machines

CO/POMatrix

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	L					L			L
CO2	H	H	L	L					L			L
CO3	H	H	L	H		L			L	L		L

Programming for Problem Solving using C and Python Practicals

Semester I/II   **Hours of instruction/week: 2P**
21BEES06   **No. of Credits: 1**

Objective:

    CLO: To understand and gain knowledge on the basic concepts in C and Python
        Programminglanguages.

List of Experiments:

C Programs

1. Programs using conditional operator and if statement
2. Programs using Switch Case Statements
3. Programs using for- while and do while loops
4. Programs using Arrays
5. Programs using Functions and Recursive Functions
6. Programs using Structures
7. Programs using Pointers
8. Programs using Files

Python Programs

1. Basic Python programs for reading input from console.
2. Programs using built-in data types – Numeric, Sequences (String, List, Tuple), Set and DictionaryOperations and type conversions
3. Programs using Looping statements.
4. Programs using the Decision statements
5. Programs for math operations and random number generation
6. Programs using user-defined functions with different types of function arguments
7. Programs for Class declaration and Object creation
8. Programs for File manipulations.

                                                   Total Hours: 30

References:

1. *PradipDey- ManasGhosh (2013). Computer Fundamentals and Programming in C*.Second Edition. Oxford University Press.
2. *Yashavant P. Kanetkar (2011).Let Us C.* BPB Publications.
3. *Allen B. Downey (2016).Think Python: How to Think Like a Computer Scientist*. 2nd edition.O'Reilly Publishers.
4. *Guido van Rossum and Fred L. Drake Jr (2011). An Introduction to Python – Revised and updated for Python 3.2.* Network Theory Ltd.
5. *Ashok N. Kamthane (2007). Computer Programming.Pearson Education.*
6. *Kernighan,B.W and Ritchie,D.M (2006). The C Programming language.*SecondEdition.Pearson Education.
7. *Byron S Gottfried and Jitendar Kumar Chhabra (2011).Programming with C.*ThirdEdition.Tata McGraw Hill Publishing Company.

Course Outcomes:

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

CO1: Experiment the fundamental concepts, control statements and functions in C and Python programming.

CO2: Apply Structures, Union and File concepts in C Programming to provide solutions to solve real world applications.

CO3: Analyze a problem and use appropriate language in C and python programs to solve it.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	M	H	M	L	L	-	-	-	-	M	M	M
CO2	L	M	H	M	L	-	-	-	-	M	M	M
CO3	M	M	M	L	L	-	-	-	-	M	M	M

<div align="center">**Environmental Science**
(Common to all branches)</div>

Semester I   Hours of Instruction /week: 3T
21BEMC01

Objective:

CLO 1: To study the interrelationship between living organisms and environment and to help students understand the various environment problems that we face and develop possible solutions to them.

UNIT I   ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY   11

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity- definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds.
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II   NATURAL RESOURCES   10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT III   ENVIRONMENTAL POLLUTION   9
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards– solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies–disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act– Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health –Case studies.

TOTAL HOURS: 45

References:

1. *Raman Sivakumar,"Introduction to Environmental science and Engineering",* McGraw Hill Education,**ISBN 13: 9780070672802,**2009.
2. *Gilbert M.Masters, 'Introduction to Environmental Engineering and Science'*, 3rd edition, Pearson Education, ISBN-13: 9780131481930,2008.
3. *Benny Joseph, 'Environmental Science and Engineering'*, Tata McGraw-Hill, New Delhi,**ISBN-13 9789387432352,**2006.
4. *R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards'*,Vol. I and II, Enviro Media.ISBN:8186421017
5. *Dharmendra S. Sengar, 'Environmental law'*, Prentice Hall of India Pvt. Ltd., New Delhi, **ISBN-13:** 978-8120330597, 2007.
6. *Rajagopalan, R, 'Environmental Studies-From Crisis to Cure'*, Oxford University Press,***ISBN:***9780199459759,2005 .

Outcomes:

On completion of the course students will be able to:
CO1: Correlate the complex relationship between natural environment and human activities.

CO2: Predict the consequences of human actions on the web of life, global economy and

qualityof life.

CO3: Identify suitable measures to solve environmental problems.

CO/PO Matrix

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	-	-	-	M	H	M	L	-	-	M
CO2	L	M	-	-	-	H	H	M	L	-	-	M
CO3	L	M	-	-	-	H	H	M	L	-	-	M

Professional English Practicals
(Common to all branches)

Semester II **Hours of instruction/week:0T+ 2P**
21BEHS02 **No.of credit: 1**

Objective:

CLO 1: To provide hands-on aural, oral, reading and writing practices to students

Exercises:

I Group Discussion **4**
GD strategies, initiating a discussion, persuasion skills, body language, ways of interrupting (non–offending), summarizing and concluding.

II Interview Skills **4**
Introducing oneself, listing one's aspirations and goals, systematically expressing one's achievement (academic as well as professional), listening keenly and gently manipulating the interviewer, e mail etiquette.

III Presentation Skills **5**
Business and technical presentation, technical articles (for journals and conferences), business etiquette.

IV Active Listening Practices **4**
Speech decoding, comprehending, types of conversation, formal and informal, listening to academic, business and technical speeches.

V Online Grammar Exercises **4**
Editing the passage, cloze exercises, jumbled sentences, tag question, usage of tenses, phrasal verbs, sentence patterns.

VI Vocabulary Enrichment **4**
Word formation, technical jargon, words often confused and misused, homophones.

VII Book Review **5**
Reading inspiring articles, inferring meanings, reading between the lines and beyond the lines, understanding implicit and explicit ideas.

Total Hours : 30

References :

1.*Aysha Viswamohan*(**2008**)*. English for Technical Communication*. Tata McGraw Hill Publishing Co. Ltd, New Delhi.
2.*M. AshrefRizvi (2005). Effective Technical Communication.* Tata McGraw Hill Publishing Co. Ltd, New Delhi.
3.*Dr.K.Devadoss and P.Malathi(2008).Customize Yourself to Corporate Life.* InderPublications,Coimbatore.

Outcomes

On completion of the course students will be able to:

CO 1: Analyze and acquire listening and speaking skills in both formal and informal contexts.
CO 2: Acquire English language skills at their own pace by using language lab components.
CO 3: Communicate their thoughts, opinions and ideas freely and naturally**.**

CO PO Matrix

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

Laplace Transforms and Complex variables
(Common to all branches)

Semester II　　　　　　　　　　　　　**Hours of Instruction/ week: 3T+1Tu**
21BESM02　　　　　　　　　　　　　　**No. of Credits: 4**

Objectives:
CLO1: To enhance knowledge in Laplace transforms, vector calculus and its applications.
CLO2: To understand the concepts of complex integration and contour integration.
CLO3: To gain knowledge in creating and working with arrays and to explore the built – in functions for vector, matrix operations and integration.

UNIT I LAPLACE TRANSFORM　　　　　　　　　　　　　　　　12
Laplace Transform, Definition and Sufficient conditions, Transforms of functions, properties of Laplace Transforms,Inverse transforms, Derivatives and integrals of transforms, Transforms of derivatives and integrals, Convolution theorem, Transform of periodic functions, Application to solution of linear ordinary differential equations up to second order with constant coefficients.

UNIT II ANALYTIC FUNCTIONS　　　　　　　　　　　　　　　12
Function of a complex variable, Analytic function, Necessary conditions, Cauchy – Riemann equations in Cartesian coordinates, Sufficient conditions (Proof not included), Properties of analytic function, Determination of harmonic conjugate by Milne – Thomson method, Conformal mapping, $w = z + a, az, \dfrac{1}{z}$

UNIT III COMPLEX INTEGRATION　　　　　　　　　　　　　　12
Statement and application of Cauchy's theorem and Cauchy's integral formula, Laurent's expansion, Singularities, Classification, Residues, Cauchy's residue theorem, Contour integration, Unit circle and semi-circular contours (excluding poles on real axis).

UNIT IV VECTOR CALCULUS　　　　　　　　　　　　　　　　12
Gradient, divergence and curl, Green's, Gauss divergence and   Stoke's theorems (without proof), Verification of the above theorems and evaluation of integrals using them.

UNIT V MATHEMATICAL SOLUTIONS USING SOFTWARE TOOLS　　　12
Scripts and Functions, Software tools applied to operation with Vectors, Arrays and Complex Integrations.(Unit V is only for gaining knowledge in software applications and not included in theory exams)

Total hours –60

Text Books:
1. *T.Veerarajan (2016), Engineering Mathematics (for semester I and II),* updated 2ndEdition, Tata McGraw Hill Publishing Co.Ltd, New Delhi.
2. *P.Kandaswamy,　K.Thilagavathy　and　K.Gunavathy　(2014),　Engineering Mathematics,*10thRevised Edition, S. Chand & Co, New Delhi.

References:

1. *E.Kreyszig (2014), Advanced Engineering Mathematics*, 8[th]Edition, John Wiley and Sons (Asia) Ltd, Singapore.
2. *Dennis G. Zill and Michael R.Cullen (2012), Advanced Engineering Mathematics,*2nd Edition, CBS Publishers.
3. *Srimanta Pal and Subhodh C Bhunia (2012), Engineering Mathematics,*9[th]Edition,John Wiley and Sons.
4. *Dr. B. S. Grewal (2014), Higher Engineering Mathematics*, 43[rd]Edition, Khanna Publishers, New Delhi.
5. *Jain R.K. and Iyengar S.R.K. (2007), Advanced Engineering Mathematics,*3[rd]Edition, Narosa Publications, New Delhi.
6. *Sastry, S.S (2014), Engineering Mathematics", Vol. I & II,*4th Edition, PHI Learning Pvt. Ltd, New Delhi,.
7. Open Source Software tools.

Course Outcomes:
On completion of course the students will be able to
CO1:Recognise the need of Laplace transform techniques, Complex integrals and Vector calculus in engineering fields like computer science, biomedical, communication etc.
CO2:Apply the knowledge of Laplace transforms and Complex variables in solving complex engineering problems
CO3:Assess complex variables and evaluate complex integrals that arise in engineering fields

CO/PO Matrix

POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO1	H	H	M	-	-	-	-	-	-	-	-	M
CO2	H	H	M	-	-	-	-	-	-	-	-	M
CO3	H	H	M	-	L	-	-	-	-	-	-	M

Engineering Chemistry
(Common to all branches)

Semester I/ II   **Hours ofInstruction/week:3T+1Tu**
21BESC01   **No. of credits: 4**

Objective:
CLO 1:To provide students with a background in important concepts and principles of Chemistry and use the knowledge gained to describe and solve real technological problems.

Unit I   Water Technology   12
Characteristics: Alkalinity, types of alkalinity and determination. Hardness: Types and estimation by EDTA method (problems). Boiler feed water, requirements, and disadvantages of using hard water in boilers. Internal conditioning: Phosphate, calgon and carbonate conditioning. External conditioning: Demineralization process. Domestic water treatment: Disinfection methods (Chlorination, ozonation, UV treatment). Desalination: Reverse osmosis.

Unit II   Electrochemistry and corrosion   12
Electrochemical cells: Electrode potential, Nernst equation (problems). Reference electrodes: Calomel electrode, glass electrode and measurement of pH, EMF, electrochemical series and its significance. Chemical and electrochemical corrosion: principle, mechanism, galvanic corrosion, differential aeration corrosion. Factors influencing corrosion .Corrosion control: Selection of materials and proper designing, sacrificial anode and impressed current cathodic protection methods, corrosion inhibitors.

Unit III Engineering Materials12
Refractory, classification, acidic, basic, and neutral refractory, Properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling), manufacture of alumina, magnesite and zirconia bricks, Adhesives – adhesive action – development of adhesive strength – physical and chemical factors influencing adhesive action – bonding process of adhesives –phenol formaldehyde resins, polyurethane, epoxy resins and urea formaldehyde.Lubricants,properties, viscosity index, flash and fire points, cloud and pour points, oilyness, aniline point, solid lubricants, graphite and molybdenum sulphide, semisolid lubricants,greases.

Unit IV   Polymer Chemistry   12
Introduction: Functionality-degree of polymerization. Classification of polymers- Natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic), condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution andsuspension.Conducting polymers, types, mechanism of conductionand Applications.

Unit V Photochemistry and Spectroscopy   12
Photochemistry: Laws of photochemistry-Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes - fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines.Estimation of concentration of a coloured solution by colorimetry, UV-Visible and IR spectroscopy- principles, instrumentation (Block diagram only) and applications.

Total Hours: 60

REFERENCES:

1.Jain P. C. & Monika Jain., "Engineering Chemistry", DhanpatRai Publishing Company
(P) Ltd, New Delhi, ISBN 13: 9788187433170, 2015.

2. *Vairam S., Suba Ramesh., "Engineering Chemistry*", Wiley India Pvt Ltd., New
   Delhi.,ISBN 13: 9788126544752, 2013.

3. **ShashiChawla.,"A Text Book of Engineering Chemistry"**, DhanpatRai& Co Pvt. Ltd.
   3rd Edition, 10thReprint 2013

4. *Dara S.S.,Umare S.S., 'Engineering Chemistry' , 12th edition,* S.Chand & Company
   Pvt.Ltd, NewDelhi., ISBN : 81-219-0359-9, 2010

5. *PalannaO.G,"Engineering Chemistry*", 2nd Edition, McGraw-Hill Education (India) Pvt.
   Ltd.,Chennai,**ISBN:9789352605774,** 2017

6. *Kannan P., Ravikrishnan A., "Engineering Chemistry*", Sri Krishna Hitech Publishing
   Company Pvt. Ltd. Chennai, 2014.

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

CO1: Identify chemistry principles related to engineering concepts.

CO2: Analyse scientifically various chemistry related problems in engineering field based on
theoretical concepts, experimental procedures and mechanism.

CO3: Predict potential applications of chemical principles and knowledge acquired inorder
to become good engineers and innovators

CO/PO Matrix

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	-	-	-	M	L	-	-	-	-	-
CO2	L	H	-	M	-	L	L	-	-	-	-	-
CO3	L	-	H	-	-	M	M	-	-	-	-	-

Chemistry Practicals
(Common to all branches)

Semester I/II   **Hours of Instruction/week:3P**
21BESC02   **No. of credits: 1.5**

Objective
CLO 1:To impart experimental skills and hands on experience in the use of analytical equipment needed for engineering applications.

List of Experiments
1. Determination of total hardness of water by EDTA method.
2. Determination of DO content by Winkler's method.
3. Determination of alkalinity in a water sample.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of concentration of a coloured solution using colorimeter
6**. pHmetry**
To find out the strength of given hydrochloric acid by sodium hydroxide.
7**. Conductometry**
a. Estimation of strength of acids in a mixture of acids.
 b. Estimation of Barium Chloride using Sodium Sulphate.
 8**. Potentiometry**
Estimation of ferrous ionin the given solution.
 9**. Viscometry**
Determination of molecular weight of a polymer
10**. Corrosion Experiment**
Weight Loss method.
11**. Spectrophotometry**
Estimation of iron content of water sample

(Any ten experiments)

Outcomes:

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

CO1 : Acquire skills in measuring, recording and analysing the results.
CO2 : Assess the quality of water through different tests.
CO3 : Develop skills in handling analytical instruments.

CO/PO Matrix

Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	-	H	-	L	-	L	-	-	-	-
CO2	H	H	-	H	-	H	M	-	-	-	-	L
CO3	H	H	-	H	-	M	-	-	-	-	-	-

Workshop Practicals

Semester II   **Hours of Instruction/Week: 1T + 4P**
21BEES05   **No. of Credits: 3**

Course Learning Objectives:

CLO1: The course caters the needs of the practical application and to help in basiclearning skills inCivilEngineering,MechanicalEngineeringandElectronicsEngineering.

PART A (CE)
PLUMBING WORK:
1. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
2. Preparing plumbing line sketches for household.
3. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:
1.Sawing, 2. Planning and 3. Making joints like Lap Joint and T-Joint

WOOD WORK STUDY:
1.Studying joints in door panels and wooden furniture

PART B (ME)
1. Simple turning and facing operations using Lathe
2. Knurling and Grooving operations using Lathe
3. Preparation of square butt joint in Arc welding
4. Preparation of T-Joint using Arc Welding
5. Preparation of Lap Joint using Arc Welding

PART C (ECE)
1. Soldering simple electronic circuits
2. V-I Characteristics of PNJunction Diode
3. V-I Characteristics of Zener Diode
4. Design and verify the characteristics of Half and Full Wave Rectifier
5. Householdwiring–seriesandparallelconnections withtwo switches
6. Staircaselightwiring

Total Hours: 45

Examination Pattern:
The Examination is to be conducted for both parts AB **(OR)** parts AC **(OR)** parts BC allotting 1.5 hours for each part.

Course Outcomes:

At the end of the course, the students will able to

CO1: Identifypipe fitting, prepare plumbing line sketch connect pipes of different materials in plumbing works and identify various joints and components in wooden doors and furniture's.

CO2: Operate lathe for various operations and prepare butt, T, Lap joints in Arc welding

CO3: Understand basic connections of wiring and verify the characteristics of PN junction, ZenerDiode and rectifiers.

CO – PO Mapping:

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

Constitution of India
(Common to all branches)

Objective:

CLO 1:To know about making of Indian constitution,Rights&Duties, Organs of Governance, Local Administration, and Election Commission

Unit I: History of Making of the Indian Constitution   **6**

History, Drafting Committee, (Composition & Working), Philosophy of the Indian constitution-Preamble Salient Features

Unit II Contours of Constitutional Rights & Duties   **6**

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit III Organs of Governance   **6**

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit IV Local Administration   **6**

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayat raj: Introduction, PRI: ZilaPachayat.Elected officials and their roles, CEO ZilaPanchayat: Position and role Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit V Election Commission   **6**

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

                                         Total Hours: 45

References:

1. *The Constitution of India, 1950 (Bare Act),* Government Publication.
2. *Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution,* 1st Edition, 2015.
3. *M. P. Jain, Indian Constitution Law,* 7th Edn., Lexis Nexis, 2014.
4. *D.D. Basu, Introduction to the Constitution of India*, Lexis Nexis, 2015.

Outcomes

On completion of the course studentswill be able to:
CO1: Comprehend the history of Indian Constitution and the various schedules under it.
CO2: Appreciate and discuss the basic components of Indian constitution, Constitutional rightsand duties and various Organs of Governance
CO3: Participate in democratic processes

CO PO Matrix

Program outcome												
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	L	L	-	-	-	-
CO2	-	-	-	-	-	-	M	M	-	-	-	-
CO3	-	-	-	-	-	-	L	H	-	-	-	-

Fundamentals of Research

Semester II   **Hours of instruction/week:2**

21BAFU01   **No.ofcredits:2**

Objectives

Tointroducetheimportanceofresearch.

Toimpartknowledgeonthemethods ofdatacollectionand analysis

Togivebasicfoundationofstatistics.

Tointroducetheskillof report writing

UNITI Introduction to Research   5

Definition – Significance of Research – Types of Research – Scope of Research – Definingthe research problem – Steps in Research – importance of research problem – ResearchObjectives – Research Protocol – outcomes of research – Understanding concepts, constructs,variables.

UNITII   Tools forCollection of Data   6

Methods of data collection – Primary and Secondary data collection methods, qualitativemethods of data collection and survey methods of data collection-Most popular methods:Directobservation,ExperimentsandSurvey-Populationand sampling–Typesofsampling.

UNITIII   Statistical Methods   5

Basics of data analysis - Measurement Scales, Sources of error in measurement. Measures ofcentral tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation,StandardDeviation)-DiagrammaticandGraphical representationof Data.

UNITIV   Inferentialstatistics   5

Types of hypothesis- Testing of Hypothesis - Type I and Type II error- Testing the differencebetweenmeans (Z &t-test), ANOVA and Chi squaretest (basicsonly)

UNIT5   Report Writing   6

Reportgeneration–Reportwriting-Bibliography–ImportanceofResearchEthicsandIntegrity-Misconduct inresearchandconsequences ofmisconduct

Practicalsession   3

Identifyingaproblemandusingappropriatestatisticaltools

TextBook:

1.KothariC.R(2016).,ResearchMethodology, SultanChandpublications,NewDelhi.

ReferenceBooks:

1.KrishnaswamiO.R,RanganathamM(2016),MethodologyofResearchinSocial science,Himalaya PublishingHouse, Delhi.

2. Paneerselvam.R(2016),Researchmethodology,PHIlearning,NewDelhi.

3.Deepak Chawla and NeenaSodhi (2016), Research Methodology, Vikas Publishing House,NewDelhi.

4. Gupta,S.P.(2007),Statistical Methods, SultanChand&Son Publications,NewDelhi.

Professional and Computer Ethics

Semester III   Hours of Instruction /week: 3T
21BEHS05   No. of credits: 3

Objectives:
> **CLO1:** To acquire knowledge on Engineering Ethics and Human Values
> **CLO2:** To be aware of professional and ethical responsibilities associated with
>   computer, privacy and security

UNIT I   Human Values   9
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others –Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment –Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II   Engineering Ethics   9
Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III   Safety, Responsibilities and Rights   9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT IV   Engineering as Social Experimentation and Global Issues   9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law -Multinational Corporations – Environmental Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility**.**

UNIT V   Ethics in Computing   9
Definition of Computer Ethics – areas of computer ethics –-computer security – security measures – cybercrime – cyber laws - privacy and security ethics – ethics in software development – ethics for IT Professionals & users – digital discrimination – new frontiers for computer ethics: Artificial Intelligence, Visualization and cyberspace – Ethical, Privacy and security issues in the online   social network ecosystem.

                                                                     Total Hours: 45

References:
1. ***Mike W. Martin and Roland Schinzinger.(2003). Ethics in Engineering.***Tata McGraw Hill, New Delhi.
2. ***Govindarajan M, Natarajan S, Senthil Kumar V. S. (2004). Engineering Ethics.***Prentice Hall of India, New Delhi.
3. ***Charles B. Fleddermann. (2004).Engineering Ethics.***Pearson Prentice Hall, New Jersey.
4. ***Charles E. Harris, Michael S. Pritchard and Michael J. Rabins.(2009). Engineering Ethics – Concepts and Cases.***Cengage Learning.

5. *John R Boatright. (2003).Ethics and the Conduct of Business.*Pearson Education, New Delhi.
6. *Edmund G Seebauer and Robert L Barry.(2001). Fundamentals of Ethics for Scientists and Engineers.*Oxford University Press.
7. *Joseph MiggaKizza (2016).Ethics in Computing: A Concise Module.*Springer International Publishing.

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

CO1: Familiarize the fundamental operation in ethics through professional manner.
CO2: Analyze the skills as the responsible Experimenters as Engineers and learn the concepts of moral leadership.
CO3: Apply the ethics in society related to engineering and realize the responsibilities and rights in the Society.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	M	-	-	-	M	-	-	-	-	-	-
CO2	M	-	-	-	-	M	-	-	M	-	-	L
CO3	L	-	M	-	-	-	H	-	-	-	-	-

Probability and Statistics

Semester III   **Hours of Instruction /week:**   3T+1Tu
  21BESM07   **No. of credits:**   4

Objectives:

CLO1: To gain fundamental knowledge of the basic probability concepts and statistical tools.

CLO2: To investigate the performance of engineering processes through probability and statistical models.

UNIT I   Probability and Random Variables   **12**

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

UNIT II   Two – Dimensional Random Variables   **12**

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

UNIT III   Test of Significance – Small Samples   **12**

Large sample test for single proportion – Difference of proportions – Single mean – Difference of means and difference of standard deviations.

UNIT IV   Test of Significance – Large Samples   **12**

Student's t distribution – test for single mean and difference of means – FDistribution – Test for difference between population variances –Chi-square distribution – Observed and theoretical frequencies – Test of independence of attributes.

UNIT V   Analysis Using Software Tools   **12**

Analysis of the above statistical concepts using R Programming (Unit V is only for gaining knowledge in software applications and not included in theory exams).

                                                     Total Hours: **60**

References:
1. ***Gupta S.C. and Kapoor V.K. (2007).Fundamentals of Applied Statistics.***Fourth Edition.Sultan Chand and Sons. New Delhi.
2. ***T.Veerarajan (2010).Probability.Statistics and Random Processes with queueing theory and queueing networks.***Third Edition. Tata McGraw –Hill.
3. ***E.Kreyszig (2014).Advanced Engineering Mathematics.***Eighth Edition.John Wiley and Sons (Asia) Ltd. Singapore.
4. ***Dennis G. Zill and Michael R.Cullen (2012).Advanced Engineering Mathematics.***Second edition.CBS Publishers.
5. Open Source software tools

Course Outcomes:

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

CO1: Apply the concepts of probability and standard distributions in engineering problems.

CO2: Formulate statistical concepts to analyze and interpret engineering data.

CO3: Demonstrate a solid understanding sampling interval estimation and testing of Hypothesis.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	-	-	-	-	-	-	-	-	-	M
CO2	H	H	M	-	-	L	-	-	-	-	-	M
CO3	H	H	M	L	-	L	-	-	-	-	-	M

Computer Architecture

Semester III   **Hours of Instruction /week: 3T+1Tu**
21BEOS01   **No. of credits: 4**

Objectives:

CLO1: To impart basic concepts of structure and operation of a digital computer and working of arithmetic operations.

CLO2: To gain knowledge on different types of memories and communication with I/O devices and standard I/O interfaces.

UNIT I   **Basic Structure of Computers**   **12**

Functional units – Basic operational concepts – Bus structures – Memory locations and addresses – Instruction and instruction sequencing – Addressing modes and Assembly language.

UNIT II   **Arithmetic Operations**   **12**

Addition and subtraction of signed numbers – Design of Fast adders – Multiplication of signed numbers – Fast multiplication – Integer division – Floating point numbers and operations.

UNIT III   **Processor and Parallelism**   **12**

Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control – Pipelining: Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration.

UNIT IV   **Memory System**   **12**

Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Cache memories - Performance consideration – Virtual memory- Memory Management requirements – Associative memories – Secondary storage – Case Study: Multi core processor and its memory

UNIT V   **Multicore Architecture**   **12**

Secondary storage Multicore Processors – Centralized and Distributed shared – memory architecture – Cluster computers – Accessing I/O devices – Interrupts – Direct Memory Access HP Moonshot.

                                         Total Hours: 60

References:

1. ***Carl Hamachar, ZvoncoVranesic and SafwatZaky.(2012). Computer Organization.***Sixth Edition.McGraw-Hill.
2. ***John P. Hayes (2013). Computer Architecture and Organization.***Third edition. Tata McGraw-Hill
3. ***David A. Patterson and John L. Hennessy (2012).Computer Organization and Design: The Hardware/Software Interface.***Fourth edition. Elsevier
4. ***John Paul Shen and Mikko H. Lipasti (2013).Modern Processor Design: Fundamentals of Superscalar Processors.***First Edition. Tata McGraw-Hill
5. https://www.coursera.org/
6. www.nptel.ac.in

Course Outcomes:

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

CO1: Identify the basic concepts of architecture and implement the arithmetic operators

CO2: Apply knowledge about various processor, control unit and memory systems in computer architecture.

CO3: Analyze the processor concepts by introducing multi-core, cluster, shared and distributed architecture concepts.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	-	-	-	-	-	M	-	-	-	-	M
CO2	H	H	M	M	-	-	-	-	-	-	-	-
CO3	M	H	-	-	-	-	-	-	-	-	-	M

Analog and Digital Electronics

Semester III   **Hours of Instruction /week: 3T**
 21BEOS02   **No. of credits: 3**

Objectives:
  CLO1: To study and learn the fundamentals of electronic semiconductor devices.
  CLO2: To Design combinational and sequential circuits and to design and to design the digital circuits.

UNIT I   Field Effect Transistor   9
Field Effect Transistors: Junction Field Effect Transistors - MOSFETs - Differences between JFETs and MOSFETs - Biasing MOSFETs - FET Applications - CMOS Devices.

UNIT II   Operational Amplifier   9
Introduction to Operational Amplifier: Ideal v/s practical Opamp - Performance Parameters - Operational Amplifier Application Circuits: Peak Detector Circuit – Comparator - Active Filters - Non - Linear Amplifier - Relaxation Oscillator - Current-To-Voltage Converter - Voltage-To- Current Converter
.

UNIT III   Combinational Logic Circuits   9
The Basic Gates: Review of Basic Logic gates. Combinational Logic Circuits: Sum-of-Products Method - Truth Table to Karnaugh Map - Pairs Quads – and Octets - Karnaugh Simplifications - Don't-care Conditions - Product-of-sums Method - Product-of-sums simplifications - Simplification by Quine - McClusky Method

UNIT IV   Data Processing Circuits   9
Multiplexers – Demultiplexers - 1-of-16 Decoder - BCD to Decimal Decoders - Seven Segment Decoders – Encoders - Exclusive-OR Gates, Parity Generators and Checkers - Magnitude Comparator - Programmable Array Logic - Programmable Logic Arrays.

UNIT V   Sequential Logic Circuits   9
Flip-Flops: RS Flip-Flops Gated Flip-Flops - Edge-triggered RS FLIP-FLOP - Edge-triggered D FLIP-FLOPs - Edge-triggered JK FLIP- FLOPs. Registers: Types of Registers - Serial In - Serial Out - Serial In - Parallel out - Parallel In - Serial Out, Parallel In - Parallel Out. Counters - D/A and A/D Converters.
                                                          Total Hours: 45

References:
  1. ***Anil K Maini.VarshaAgarwal (2012).Electronic Devices and Circuits.***Wiley.
  2. ***Donald P Leach. Albert Paul Malvino&GoutamSaha (2015).Digital Principles and Applications.***Eighth Edition.Tata McGraw Hill.
  3. ***M Morris Mano (2008).Digital Logic and Computer Design.***Tenth Edition.Pearson Education.
  4. ***R D Sudhaker Samuel (2010).Illustrative Approach to Logic Design.***Sanguine-Pearson Education.

Course Outcomes:

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

CO1: Design and use semiconductor devices and operational amplifier for various applications in computer and peripherals.

CO2: Design and implement combinational and data processing.

CO3: Apply the Knowledge gained in the design of sequential circuits

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	-	-	-	-	-	L	-	-	-
CO2	H	H	H	-	H	-	-	-	M	-	-	-
CO3	H	H	M	-	-	-	-	-	L	-	-	-

Data Structures and Algorithms

Semester III   Hours of Instruction /week: 3T
21BEOC01   No. of credits: 3

Objectives:

CLO1: To acquire the basic concepts of ADTs and learn linear data structure
CLO2: To understand sorting, searching and hashing algorithms

UNIT I   Introduction   9
Introduction to Data Structures - Classification of Data Structures - Operations on Data Structures - Abstract Data Type - Algorithms - Different approaches to designing an algorithm - Time and Space complexity - Asymptotic Notations – Lists - Singly Linked Lists - Circular Linked Lists - Doubly Linked Lists - Circular Doubly Linked Lists - Header Linked Lists - Multi-Linked Lists - Applications of Linked Lists.

UNIT II   Stacks and Queues   9
Introduction to Stacks - Array representation of Stacks - Operations on Stacks - Linked Representation of Stacks - Operations on Linked Stack - Multiple Stacks - Applications of Stacks - Introduction to Queues - Array representation of Queues- Linked representation of Queues - Types of Queues - Applications of Queues - Priority Queue - Binary heaps - Applications of priority heaps.

UNIT III   Trees   9
Introduction - Types of Trees - Creating a binary tree from a general tree - Traversing a binary tree- Huffman's Tree - Applications of Trees - Binary search trees - Operations on Binary search trees - Threaded Binary Trees - AVL Trees - Hash Tables - Hash Functions - collision.

UNIT IV   Graphs   9
Introduction - Directed Graphs - Bi-connected Components - Representation of Graphs - Graph Traversal algorithms - Topological Sorting - Shortest path algorithms - Minimal spanning trees and algorithms -Applications of Graphs.

UNIT V   Sorting and Searching   9
Selection sort - Insertion Sort - Shell Sort - Heap Sort - Merge Sort - Quick Sort - Bucket Sort and Radix Sort - External Sorting - Linear Search - Binary Search.

                                                           Total Hours: 45

References:
1. ***M.A Weiss (2014). Data Structures and Algorithm Analysis in C.*** Fourth Edition.Pearson Education.
2. ***ReemaThareja (2014).Data Structures Using C***.Second Edition.Oxford University Press.
3. ***Sanjay Pahujia (2010). A Practical approach to Data Structures and Algorithms.***First Edition.A New Age International.
4. ***Rance D. Necaise (2011).Data Structures and Algorithms Using Python.***John Wiley &Sons,Inc.
5. www.nptel.ac.in

Course Outcomes:

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

CO1: Apply the concept of ADTs for linear data structures.

CO2: Design programs using a variety of linear and non-linear data structures such as stacks, queues, binary trees, search trees, heaps, graphs, and B-trees.

CO3: Analyze and apply suitable algorithms, stacks, queues, sorting, searching and hashing technique to solve problems.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	-	M	-	-	-	-	-	-	-	L
CO2	H	M	H	M	-	-	-	-	M	-	-	L
CO3	M	H	M	-	-	-	-	-	M	L	M	M

Database Management Systems

Semester III   **Hours of Instruction /week: 3T**
21BEOC02   **No. of credits: 3**

Objectives:

>   **CLO1:**To learn the concepts of basic query language.
> **CLO2:**To analyse the fundamental concepts of transaction processing, concurrency control techniques and recovery procedures.

UNIT I   Relational Databases   9
Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL – Dynamic SQL

UNIT II   Relational Data Model   9
Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First – Second – Third Normal Forms – Dependency Preservation – Boyce Code Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III   Transactions   9
Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT IV   Implementation Techniques   9
RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

UNIT V   Advanced Topics   9
Distributed Databases: Architecture – Data Storage – Transaction Processing – Object-based Databases: Object Database Concepts – Object-Relational features – ODMG Object Model, ODL – OQL - XML Databases: XML Hierarchical Model – DTD – XML Schema – XQuery – Information Retrieval: IR Concepts – Retrieval Models – Queries in IR systems.

Total Hours: 45

References:
1.   ***Abraham Silberschatz, Henry F. Korth. S Sudharshan (2011).Database System Concepts.***Sixth Edition.Tata McGraw-Hill International Edition.
2.   ***RamezElamsri.Durvasul VLN Somayazulu.Shamkant B Navathe. Shyam K Gupta (2013). Fundamentals of Database Systems.***Seventh Edition.Pearson Education.
3.   ***Raghu Ramakrishnan, Johannes Gehrke (2013). Database Management Systems****.Third Edition .Tata McGraw Hill.
4.   www.spoken tutorial.org.
5.   www.nptel.ac.in

Course Outcomes:

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

CO1: Map ER Model to relational model to perform database design effectively.
CO2: Identify the transactions and estimate the procedures for controlling the consequences of concurrent data access techniques and query processing.
CO3: Describe distributed, semi-structured and unstructured database systems.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	M	M	M	-	L	M	M	M	M
CO2	M	H	M	H	M	-	M	L	M	-	M	M
CO3	H	M	M	M	M	M	M	L	M	L	M	M

Data Structures and Algorithms Practicals

Semester III   **Hours of Instruction /week: 3P**
21BEOC03   **No. of credits: 1.5**

Objective:

   CLO1: To implement the concepts of various data structures and to have a comprehensive understanding of various algorithms.

List of Experiments:
1. Array implementation of Stack and queue
2. Implementation of Linked Lists
3. Linked list implementation of Stack and queue
4. Implementation of Stack Applications
5. Implementation of Binary trees
6. Implementation of Binary search Tree
7. Implementation of AVL Tree
8. Implementation of Pre-order, In-order and Post-order Tree Traversals
9. Implementation of Hashing Technique
10. Implementation of Breadth First Search and Depth First Search
11. Implementation of searching and sorting algorithms

                                                           Total Hours: 45

Software Requirements:

    Turbo C, C++ and Python

References:
1. ***M.A Weiss (2014). Data Structures and Algorithm Analysis in C.*** Fourth Edition. Pearson Education.
2. ***ReemaThareja (2014).Data Structures Using C***.Second Edition.Oxford University Press.
3. ***Sanjay Pahujia (2010). A Practical approach to Data Structures and Algorithms.***First Edition.A New Age International.
4. ***Rance D. Necaise (2011).Data Structures and Algorithms Using Python.***John Wiley & Sons, Inc.

Course Outcomes:

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

   CO1:   Perform various stack, queue and linked list operations and develop simple applications.

   CO2:   Solve trees, graph and hashing related problems.

   CO3:   Implement various sorting and searching algorithms in data structures.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	-	L	-	-	L	-	M	M
CO2	M	M	M	M	-	L	-	-	M	-	L	M
CO3	M	M	H	L	L	L	-	L	M	-	M	M

Database Management Systems Practicals

Semester III　　　　　　　　　　　　　**Hours of Instruction /week:**　3P
21BEOC04　　　　　　　　　　　　　　　**No. of credits:**　1.5

Objectives:
　CLO1: To implement the concepts of database design model, perform operations usingquery language.
　CLO2: To provide an understanding of new developments and trends in developing a database.

List of Experiments:
　　1.　Data DefinitionLanguage (DDL) commands-data Manipulation Language (DML) and Data Control Language (DCL).
　　2.　Programs using Data definition –Table creation and Constraints.
　　3.　Programs using Insert, select, update and delete commands.
　　4.　Programs using Nested queries and join queries.
　　5.　Apply multiple sub-queries and Correlated sub-queries.
　　6.　Programs using Object and set operators in relational database.
　　7.　Programs using Control structures.
　　8.　Programs to create database triggers
　　9.　Creation of Views-Synonyms-Sequence-Indexes-save point.
　　10.　Creating a database using various constraints.
　　11.　Design a database and implement with a front end tool.
　　12.　Mini Project (Application Development using Oracle/ Mysql)

　　　　　　　　　　　　　　　　　　　　　　　　　　Total Hours:　45
Software Requirements:
　　Oracle 11g

References:
　　1.　*Steven Feuerstein- Bill Pribyl (2014). Oracle PL/SQL Programming*.Sixth Edition. O'Reilly Media.
　　2.　*RamezElamsri.Durvasul VLN Somayazulu.Shamkant B Navathe. Shyam K Gupta (2013). Fundamentals of Database Systems.*Seventh Edition.Pearson Education.

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

　　CO1:　　Infer database language commands to create simple database.
　　CO2:　　Analyze the database using queries to retrieve records.
　　CO3:　　Develop solutions using database concepts for real time requirements.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	M	M	M	-	-	-	-	L	M	M
CO2	H	M	M	H	M	-	-	-	L	L	M	M
CO3	M	M	H	M	H	-	M	-	M	L	L	L

Consumer Affairs
(Non-Credit Mandatory Course)

Semester III   Hours of Instruction /week: 3T
 21BEMC03

Objective:
CLO1: This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights, provides understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.

UNIT I   Conceptual Framework   9
Consumer and Markets:
Concept of Consumer - Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets - E-Commerce with reference to Indian Market.Concept of Price in Retail and Wholesale - Maximum Retail Price (MRP) - Fair Price – GST - Labelling and packaging along with relevant laws - Legal Metrology.
Experiencing and Voicing Dissatisfaction:
Consumer buying process - Consumer Satisfaction/dissatisfaction – Grievances – complaint - Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

UNIT II   The Consumer Protection Law in India   9
Objectives and Basic Concepts:
Consumer rights and UN Guidelines on consumer protection - Consumer goods - Defect in goods - Spurious goods and services – Service - Deficiency in service - Unfair trade practice - Restrictive trade practice.
Organizational set-up under the Consumer Protection Act:
Advisory Bodies: Consumer Protection Councils at the Central - State and District Levels; Adjudicatory Bodies: District Forums - State Commissions - National Commission: Their Composition – Powers - and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

UNIT III   Grievance Redressal Mechanism under the Indian Consumer   9
                Protection Law
Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases - Relief/Remedy available; Temporary Injunction - Enforcement of order – Appeal - Frivolous and vexatious complaints; Offences and penalties.
Leading Cases decided under Consumer Protection law by Supreme Court/National Commission:
Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

UNIT IV   Role of Industry Regulators in Consumer Protection   9
  I   Banking: RBI and Banking Ombudsman
  II   Insurance: IRDA and Insurance Ombudsman
  III   Telecommunication: TRAI
  IV   Food Products: FSSAI
  V   Electricity Supply: Electricity Regulatory Commission
  VI   Real Estate Regulatory Authority
            Contemporary Issues in Consumer Affairs

UNIT V

<div align="right">**9**</div>

Consumer Movement in India:
Evolution of Consumer Movement in India. Formation of consumer organizations and their role in consumer protection. Misleading Advertisements and sustainable consumption. National Consumer Helpline - Comparative Product testing - Sustainable consumption and energy ratings.

Quality and Standardization:

Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (1S1), Ag- mark, Hallmarking. Licensing and Surveillance; Role of International Standards: 1SO an Overview.

Note: Unit II and III refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified.

<div align="right">**Total Hours: 45**</div>

References:
1. ***Khanna, Sri Ram, SavitaHanspal, SheetalKapoor, and H.K. Awasthi.(2007) Consumer Affairs,*** University Press.
2. ***Choudharv, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure,*** Deep and Deep Publications Pvt. Ltd.
3. ***Subramainam, R(2013).***Professional Ethics**. Oxford University Press- New Delhi.
4. ***Suresh Misra and SapnaChadah (2012). Consumer Protection in India: Issues and concerns***, IIPA, New Delhi
5. ***RajyalaxrniRao (2012), Consumer is King,*** Universal Law Publishing Company
6. ***Empowering Consumers e-book***,
7. ***The Consumer Protection Act, 1986 and its later versions***.

Articles:
1. Misra Suresh, (Aug 2017) "Is the Indian Consumer Protected? One India One People.
2. Raman Mittal, SonkarSumit and ParineetKaur (2016) Regulating Unfair Trade Practices: An Analysis of the Past and Present Indian Legislative Models, Journal of Consumer Policy.
3. Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTS Institute for Regulation and Competition position paper. Available online at www.cuts- international.org/doc01.doc
4. KapoorSheetal (2013) "Banking and the Consumer" Akademos (ISSN 2231-0584)
5. Bhatt K. N., Misra Suresh and ChadahSapna (2010).Consumer, Consumerism and Consumer Protection, Abhijeet Publications.
6. KapoorSheetal (2010) "Advertising-An Essential Part of Consumer's Life-Its Legal and Ethical Aspects", Consumer Protection and Trade Practices Journal, October 2010.
7. Verma, D.P.S. (2002). Regulating Misleading Advertisements, Legal Provisions and Institutional Framework.Vikalpa.Vol. 26:No. 2. pp. 51-57.

Periodicals:
1. Consumer Protection Judgments (CPJ) (Relevant cases reported in various issues)
2. Recent issues of magazines: International Journal on consumer law and practice, National Law School of India University, Bengaluru
3. 'Consumer Voice', Published by VOICE Society, New Delhi.

Websites:
www.ncdrc.nic.in
www.consumeraffairs.nic.in
www.iso.org.
www.bis.org.in
www.consumereducation.in
www.consumervoice.in
www.fssai.gov.in
www.cercindia.org

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

CO1: Understand the concepts of consumer, markets, relevant laws and grievances.
CO2: Awareness of Grievance Redressal Mechanism under the Indian Consumer Protection Law and Case studies.
CO3: Awareness of contemporary issues in consumer affairs and knowledge of quality and standards.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	-	-	-	-	-	L	L	L	L	-
CO2	M	M	-	-	-	-	-	L	L	L	L	-
CO3	M	M	-	-	-	-	-	L	L	L	L	-

Discrete Mathematics and Linear Algebra

Semester IV   **Hours of Instruction /week: 3T+1Tu**
  21BESM09   **No. of credits: 4**

Objectives:

   CLO1: To emphasize the importance of logical thinking and its application to Computer science.

   CLO2: To enhance knowledge in the basic concepts of linear algebra.

UNIT I   Logic   12

Statements - Truth Table – connectives - Normal forms - predicate Calculus - Inference theory for statement calculus and Predicate Calculus.

UNIT II   Combinatorics   12

Review of Permutation and combination - Mathematical Induction - Pigeon hole principle - Principle of inclusion and exclusion - generating function - Recurrence relations.

UNIT III   Algebraic Systems   12

groups – monoids - groups- permutation group – Cosets - Lagrange's theorem - Group homomorphism – Kernel - Rings and Fields (definition and Examples only).

UNIT IV   Linear Equations   12

System of Linear Equations - Row reduction and Echelon forms - Rank of a matrix - Inverse of a matrix – Determinants - Cramer's rule.

UNIT V   Vector Spaces   12

Vector Spaces- Subspaces- Linear dependence and independence- basis-dimensions- Inner product-Orthogonality- Orthogonal basis and projections- Gram Schmidt process-orthogonal Complements- Least square problems.

                                                              Total Hours: 60

References:

   1.   ***Kenneth H. Rosen. Kamala Krithivasan (2012). Discrete Mathematics and its Applications(with combinatorics and Graph theory)***. Tata McGraw – Hill Publishing   company Ltd. New Delhi.
   2.   ***J.P. Tremblay and R. Manohar (2008).Discrete Mathematical Structure and its Application to Computer Science.***TMG Edition. Tata Mcgraw-Hill Publishing company Ltd.,New   Delhi.
   3.   ***Grewal B. S. (2020). Higher Engineering Mathematics.***44th edition.Khanna Publishers. New Delhi.
   4.   ***David C Lay (2010). Linear Algebra and its Applications***.2ndEdition.Addison - Wesley.

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

CO1: Apply the mathematical logic and counting principles in problem solving
CO2: Analyze the basic discrete structures and algorithms using algebraic techniques
CO3: Apply the knowledge of linear equations and vector spaces in solving engineering Problems

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	H	-	M	-	-	-	-	-	-	-	M
CO2	H	H	-	-	-	-	-	-	-	-	-	M
CO3	H	H	-	-	-	-	-	-	-	-	-	M

Software Engineering

Semester IV   **Hours of Instruction/week   4T**
 21BEOC05   **No. of credits: 4**

Objectives:

        CLO1: To understand various processes and methodology required in software projects and testing methods.

        CLO2: To model, plan, execute and test software projects.

UNIT I   Introduction   12

Software Engineering Paradigm-Software Process- Life cycle models - system Engineering- Computer based system- Verification- Validation- Development Process- System Engineering Hierarchy

UNIT II   Software Requirements   12

Functional and non-functional – User- System- Requirement Engineering Process- Feasibility Studies- Elicitation- Validation and Management- Software Prototyping- Prototyping in the software Process- Rapid prototyping techniques- User Interface prototyping –S/W document- Analysis and modeling-data, functional and behavioral models-Structural analysis and data dictionary

UNIT III   Design Concepts and Principles   12

Design process and concepts- Modular design- Design heuristic- Design model and document- Architectural design- Software architecture- Data design- Transform and transaction mapping- User interface design- Real time systems- Real time software design- System design-SCM-SCM process-Software configuration items

UNIT IV   Testing   12

Taxonomy of software testing-Levels- Test activities- Types of S/W test- Black box testing- Testing boundary conditions- Structural testing- Test coverage criteria based on data flow mechanisms-Regression testing- S/W testing strategies- Strategic approach and issues-Unit testing- Integration testing- Validation testing- System testing and debugging

UNIT V   Software Project Management   12

Measures and Measurements- S/W complexity- Size measure- Data and logic structure measure-Information flow measure- Software cost estimation- Function point model- COCOMO Model- Software maintenance- Taxonomy of CASE tools

Total Hours: 60

References:

1. ***Roger S. Pressman (2014).Software Engineering: A practitioner's Approach***. Seventh Edition.Tata McGraw-Hill International Edition.
2. ***Ian Sommerville.(2012).Software Engineering***.Ninth Edition.Pearson Education Asia.
3. ***BahramiAli(2012).Object Oriented Systems Development.*** Tata McGraw-Hill.
4. ***Dr.Shivani Joshi(2014).Object Oriented Analysis and Design with UML Patterns.***S.Chand (G/L) & Company Ltd.

Course Outcomes:
At the end of the course, students will be able to :
  CO1: Identify and formulate various software process modeling and methodologies through the systematic approaches and diagnostic tools.
  CO2: Analyse software engineering projects through software design and construction using Object Oriented methodologies, testing and management to deliver robust software components.
  CO3: Determine various software testing methods, tools and appropriate project management approach in successful software development.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	H	L	-	-	-	-	-	-	-	L	-
CO2	M	H	M	H	-	-	-	-	-	L	M	-
CO3	M	H	M	L	M	-	-	-	-	L	M	-

Artificial Intelligence

Semester IV	**Hours of Instruction /week: 3T**
21BEOC06	**No. of credits: 3**

Objectives:

    CLO1: To understand what Artificial Intelligence is and where it is used.
    CLO2: To use various techniques and strategies of AI for data searching,
        learning and decision making.

UNIT I   Introduction   9
Introduction – Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents – Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II   Problem Solving Method   9
Problem solving Methods - Search Strategies x- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

UNIT III   Knowledge Representation   9
First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining- Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering- Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

UNIT IV   Software Agents   9
Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among agents – Trust and Reputation in Multi-agent systems.

UNIT V   Applications   9
AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot.

Total Hours: 45

References:
1. *S. Russell and P. Norvig (2011).Artificial Intelligence: A Modern Approach*.Third Edition.Prentice Hall.
2. *I. Bratko (2011).Prolog: Programming for Artificial Intelligence*.Fourth edition. Addison-Wesley Educational Publishers Inc.
3. *M. Tim Jones (2011). Artificial Intelligence: A Systems Approach*.First Edition.Jonesand Bartlett Publishers - Inc.
4. *Gerhard Weiss (2013).Multi Agent Systems*.Second Edition.MIT Press.

Course Outcomes:
At the end of the course, students will be able to :
  CO1: Compare AI with human intelligence and traditional information processing and discuss its strength, limitations and applications to human centered problems.
  CO2: Identify and formulate algorithms related to searching, problem solving and knowledge representation methods..
  CO3: Apply appropriate techniques of AI to solve the societal problem and interpret the knowledge in various domains using software agents.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	L	M	-	L	-	-	L	-	-
CO2	H	H	H	H	M	-	-	-	-	L	-	-
CO3	H	M	H	H	M	-	M		-	L	-	-

Semester IV   **Hours of Instruction /week: 3T+2P**
 21BEOC07   **No. of credits: 4**

Objectives:

CLO1: To understand the architecture, accessing data and instruction from memory for processing.

CLO2: To Analyze the system model for real world problems with data acquisition, processing and decision making with aid of microcontrollers and advanced processors.

UNIT I   **Overview of Microprocessor and ALP**   **9**

Microprocessor pin diagram, Architecture, Memory Interfacing- addressing mode and Instruction set-Tools- Assembler Directives, Editor, assembler, debugger, simulator and emulator. E.g., ALP Programs-Arithmetic Operations and Number System Conversions, Programs using Loops, If then else, for loop structures.

UNIT II   **8051 Microcontroller**   **9**

Microcontrollers and Embedded Processors-Block Diagram of 8051 - PSW and Flag Bits - 8051 Register Banks and Stack - Internal Memory Organization of 8051 – I/O Port Usage in 8051 - Types of Special Function Registers and their uses in 8051- 8051 Addressing Modes.

UNIT III   **ARM Processor**   **9**

RISC revolution - Accessing external memory in RISC systems – Reducing the branch penalties – Branch prediction – ARM processors – ARM registers – ARM instructions – ARM built-in shift mechanism – ARM branch instructions – sequence control – Data movement and memory reference instructions.

UNIT IV   **ARM and THUMB Instruction Sets**   **9**

Data Processing Instructions-Conditional Executions-Load and Store Instructions - Multiplication Instructions-Software Interrupt Instructions-Branching Instructions-Barrel Shifting Operations-Stack in ARM-Programs with ARM Core-THUMB State in ARM Core.

UNIT V   **IoT Processor**   **9**

Introduction to IoT - IoT Applications based on Pi-Installing and configuration IoT – Framework - GPIO Control over Web Browser - Creating Custom Web Page for LAMP - Interfacing light emitting diodes (LEDs) – switch – buzzer - Raspberry Pi sensor interfacing.

                                                   Total Hours: 45

List of Experiments:

1. Design and develop an assembly language program for basic arithmetic and Logical operations of 8086 microprocessor.
2. Develop an assembly language program for the code conversion, decimal arithmetic and Matrix operations using 8086 microprocessor.
3. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers for using 8051 microcontroller.
4. Write an assembly language program includes the interfacing of LEDs and Seven segment displays using 8051 microcontroller.
5. Write the programs and simulate ARM assembly language programs for data transfer, arithmetic and logical operations.
6. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen using IOT Processor (Raspberry pi).

                                                   Total Hours: 30

References:
1. ***Barry B.Brey(2019).The Intel Microprocessors 8086/8088, 80, 86, 80286, 80386 80486,Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture Programming and interfacing.*** Prentice Hall of India Private Limited. New Delhi.
2. ***John Peatman(2018.)Design with Microcontroller.*** McGraw Hill Publishing Co Ltd, NewDelhi.
3. ***Rajkamal(2018).The concepts and feature of micro controllers 68HC11, 8051 and 8096.***S Chand Publishers. New Delhi.
4. ***Alan Clements(2017)The Principles of Computer Hardware.*** Oxford University Press. Third Edition.
5. ***Vijay Madisetti and ArshdeepBahga(2014)Internet of Things (A Hands-on-Approach).*** firstEdition.VPT.
6. ***Francis da Costa(2013)Rethinking the Internet of Things: A Scalable Approach to Connecting Everything.***First Edition. Apress Publications.
7. www.nptel.ac.in

Course Outcomes:

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

CO1: Distinguish and analyze the properties of Microprocessors& Microcontrollers.
CO2: Analyze the data transfer information through serial & parallel ports.
CO3: Interpret their practical knowledge through IOT processor.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	H	H	-	-	-	-	-	-	-	-	H
CO2	-	-	-	H	M	-	H	-	-	-	-	-
CO3	-	-	-	H	H	-	-	-	M	-	-	H

Design and Analysis of Algorithms

Semester IV   **Hours of Instruction /week: 3T+1Tu**
  21BEOC08   **No. of credits: 4**

Objectives:
   CLO1: To understand the different problem solving strategies to solve real life problems.
   CLO2: Toanalyse performance of different types of algorithm techniques to solve
          problems of various level of complexity.

UNIT I   Introduction   12
Notion of an Algorithm – Fundamentals of Algorithmic - Problem Solving – Important Problem Types -– Fundamentals of the Analysis of Algorithm Efficiency – overview of Asymptotic Notations – Analysis of recursive algorithms through recurrence relations: Substitution method – Recursion tree method and Masters' theorem.

UNIT II   Brute Force and Divide-and-Conquer Methods   12
Brute Force: Closest - Pair and Convex - Hull Problems - Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem.
Divide and conquer method: Merge sort – Quick sort – Binary search – finding maximum and minimum – Strassen's Matrix Multiplication - Closest - Pair and Convex - Hull Problems.

UNIT III   Dynamic Programming and Greedy Methods   12
Dynamic Programming: Warshalls and Floyds Algorithms - Optimal Binary Search Trees- 0/1 knapsack using dynamic programming – Travelling salesman problem.
Greedy Technique: General Method – Knapsack problem – Prim's algorithm- Kruskal's Algorithm - Dijkstra's Algorithm – Huffman trees.

UNIT IV   Backtracking, Branch and Bound Methods   12
Backtracking: N-Queens Problem - Graph coloring - Hamiltonian's Circuit - Subset sum problem Branch and Bound: 0/1 Knapsack **-** Assignment Problem - Traveling Salesman Problem.

UNIT V   NP-Hard and NP-Complete Problems   12
P and NP problems – NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem – Knapsack problem.

                                                                       Total Hours: 60

References:
   1. ***AnanyLevitin   (2017).Introduction   to   the   Design   and   Analysis   of Algorithms.***Third Edition.Pearson Education.
   2. ***Ellis Horowitz, SartajSahni, Sanguthevar. Rajasekaran (2010).Fundamentals of Computer Algorithms.***Galgotia Publication Pvt. Ltd., Reprint***.***
   3. ***Thomas H Cormen. Charles E Leiserson. Ronald L Revest.Clifford Stein (2014). Introduction to Algorithms.***3rdEdition. The MIT Press Cambridge.Massachusetts London***.***
   4. www.nptel.ac.in

Course Outcomes:

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

CO1: Identify different type of algorithms and techniques to analyse complex engineering problems and also to solve divide and conquer methods.

CO2: Investigate, predict and solve problems using algorithm design methods such as the greedy method, dynamic programming, backtracking and branch and bound.

CO3: Devise an algorithm using appropriate design strategies for NP-Hard and Complete problem.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	-	-	-	-	-	-	-	-	-	-
CO2	L	H	M	-	-	-	-	-	-	-	-	-
CO3	L	H	H	M	-	-	-	-	M	-	-	-

Operating Systems

Semester IV   **Hours of Instruction /week: 3T**
21BEOC09   **No. of credits: 3**

Objectives:
  CLO1: To learn the basic concepts and functions of operating system.
  CLO2: To analyze the concepts of process scheduling algorithms, deadlock, memory Management schemes and File handling.

UNIT I   Operating Systems Overview   9
Introduction – Functions of OS - Types of OS - Operating System Structure - Operating System Operations - Process Management – Memory Management – Storage Management – Protection Security - Operating System Services – User and Operating System Interface – System Calls – Types of System calls – System Programs - OS Generation - System Boot.

UNIT II   Process Management   9
Process Concept -   Process Scheduling -   Operations on Processes - Inter-process Communication – Threads – Overview - Multithreading models - Thread libraries, Threading issues, Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling.

UNIT III   Deadlock and Memory Management Strategies   9
Deadlock - System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock - Main Memory – Background – Swapping – Contiguous Memory Allocation – Paging – Segmentation.

UNIT IV   Virtual Memory Management   9
Virtual Memory – Background – Demand Paging - Page Replacement - Allocation of Frames - Thrashing - File Concept – Access Methods – Directory Structure – File Sharing – Protection.

UNIT V   File Systems and Secondary Storage Structure   9
File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management-Disk Structure – Disk Scheduling – Disk Management – Swap - Space Management - Case study: Linux OS –Windows OS.

                                                          Total Hours: 45

References:
  1. ***Abraham Silberschatz, Peter Baer Galvin and Greg Gagne (2016).Operating System Concepts***.Ninth Edition. John Wiley & Sons (Asia) Pvt. Ltd.
  2. ***Andrew S. Tanenbaum (2015). Modern Operating Systems.***Fourth Edition. Prentice Hall of India Pvt. Ltd.
  3. ***William Stallings (2018). Operating Systems: Internals and Design Principles.***Ninth Edition.Pearson Education.
  4. www.nptel.ac.in

Course Outcomes:

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

  CO1: Interpret the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS.

  CO2: Analyze the theory and implementation of processes, resource control, physical memory, virtual memory and scheduling.

  CO3: Evaluate the requirement for process synchronization and coordination, deadlock and file structures.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	-	-	M	M	-	-	L	M	M
CO2	M	M	H	M	-	L	H	-	-	-	M	M
CO3	M	M	M	L	L	-	-	-	M	-	-	H

Operating Systems Practicals

Semester IV   **Hours of Instruction /week:** 3P
21BEOC10   **No. of credits:** 1.5

Objective:
CLO1: To implement the concepts of operating system in Linux environment and various management schemes in operating systems.

List of Experiments:
1. General Purpose Commands and related shell programs.
2. Directory- file oriented Commands and related shell programs.
3. Process Oriented Commands and related shell programs.
4. Communication Commands- Pipes- Filters and related shell programs.
5. Network Related Commands and Job Handling Commands.
6. Control Structures in shell Programming and related shell programs.
7. Implementation of Shared memory and IPC
8. Write C program to implement Threading & Synchronization Applications
9. Implementation of Semaphores
10. Write C programs to implement the various CPU Scheduling Algorithms
11. Bankers Algorithm for Deadlock Avoidance
12. Implementation of Deadlock Detection Algorithm
13. Implementation of the following Memory Allocation Methods for fixed partition
    a) First Fit   b) Worst Fit   c) Best Fit
14. Implementation of the following Page Replacement Algorithms
    a) FIFO   b) LRU   c) LFU
15. Implementation of the following File Allocation Strategies
    a) Sequential   b) Indexed   c) Linked

Total Hours: 45

Software Requirements:
Linux ,Turbo C

References:
1. *Abraham Silberschatz. Peter B.Galvin. Greg Gagne. (2013). Operating System Concepts.* Ninth Edition- Wiley Publisher.
2. *William Stallings (2018). Operating Systems: Internals and Design Principles.* Ninth Edition.Pearson Education.

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

CO1: Design and write Linux commands and shell programming.
CO2: Implement CPU scheduling algorithm and IPC techniques.
CO3: Implement Deadlock techniques, memory management and page replacement schemes.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	L	-	-	-	-	M	L	-	L
CO2	M	M	M	-	-	-	-	-	M	L	M	-
CO3	H	M	M	-	-	-	-	-	M	M	M	-

Artificial Intelligence Practicals

Semester IV   **Hours of Instruction/week: 3P**
21BEOC11   **No. of credits: 1.5**

Objectives:
CLO1: To write python code to solve wide range of real world problems.
CLO2: To build intelligent applications in-line with the recent trends, tools and techniques.

List of Experiments:
1. Study of Tools and Libraries in Python for Artificial intelligence and Machine learning.
2. Implementation of simple python programs.
3. Implementation of Search Strategies.
4. Implementation of Logic programming to solve problems.
5. Design simple games like Hangman and Tic-Tac-To.
6. Plotting Graphs in python.
7. Implementation of Image processing functions.
8. Build applications using NLTK package.
9. Creation of Simple Chatbots.
10. Design of Voice Assistant.
11. Study of AI applications.
12. Creation of Intelligent Applications.

Total Hours: 45

Software Requirements:
   Python

References:
1. ***S. Russell and P. Norvig (2015).Artificial Intelligence: A Modern Approach.*** Third Edition, Prentice Hall.
2. ***Prateek Joshi (2017). Artificial Intelligence with Python.*** Packet Publishing.
3. ***Anthony Williams (2017). Python Programming.*** Create Space Independent Publishing Platform; Combined edition.

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

CO1:   Implement the real-world problems using python.
CO2:   Incorporate the usage of libraries and tools to develop sustainable solutions.
CO3:   Explore intelligent solutions incorporating AI trends and techniques.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO11	PO12
CO1	H	H	M	L	M	-	-	-	-	-	M
CO2	M	H	M	-	H	-	-	-	-	-	M
CO3	H	H	M	H	H	-	-	M	-	-	M

Big Data Analytics

Semester V   **Hours of Instruction /week: 3T**
21BEOC12   **No. of credits: 3**

Objectives:

        CLO1: To Understand the foundation of Map Reduce and Hadoop platform.
        CLO2: To gain knowledge on PIG,HBASE and R Programming Language.

UNIT I   Big Data   **9**
Characteristics - Data in the Warehouse and Hadoop. Use cases: Patterns for Big Data Deployment - IT for IT log analytics - Fraud detection patterns - Social media pattern - Risks, Big Data and the energy sector.

UNIT II   Map Reduce   **9**
Map Reduce (MR) basics - MR algorithm design - Inverted Indexing for Text Retrieval - Graph algorithms - Limitations of MR.

UNIT III   Hadoop   **9**
Hadoop distributed file system - Hadoop I/O - Developing a Map Reduce application - Setting up Hadoop Cluster - Administering Hadoop - Hadoop security – AWS - Running Hadoop on AWS.

UNIT IV   PIG and HBASE   **9**
PIG - HBASE: Pig Latin - User defined functions - Data processing operators – Hbasics – Installation – Clients – Examples - HBaseVs RDBMS.

UNIT V   NoSQL for Big Data Analytics   **9**
Introduction to NoSQL - aggregate data models - document data models - relationships - graph databases - schemaless databases - materialized views - distribution models - master-slave replication - peer-peer replication - sharding and replication - consistency.

                                                  Total Hours: 45

References:

1. ***Paul Zikopoulos (2012).Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data***.First Edition -Tata McGraw Hill Professional. USA.
2. ***Jimmy Lin and Chris Dyer (2010).Data Intensive Text Processing using MapReduce***.FirstEdition*.*Morgan and Claypool Publishers-USA.
3. ***Tom White. (2012).Hadoop: The Definitive Guide-***Third Edition. O`Reilly Publishers, USA,
4. ***Norman Matloff (2011).The Art of R Programming: A Tour of Statistical Software Design-*** No Starch Press, USA.
5. www.nptel.ac.in.

Course Outcomes:

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

CO1: Describe the basics of big data analytics and exposure to state-of-the-art data analytic tools and techniques.

CO2: Apply appropriate Map Reduce Logic for solving computational problems and learn about Hadoop distributed file systems

CO3: Analyze NoSQL and big data tools like PIG and HBase to develop data centric applications.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	H	M	H	H	M	-	-	-	-	-	M
CO2	H	H	M	H	H	L	-	-	-	-	-	M
CO3	M	H	H	H	H	H	-	-	-	-	-	H

Information Retrieval

Semester V   **Hours of Instruction /week: 3T**
21BEOC13   **No. of credits: 3**

Objectives:
> **CLO1:** To learn the information retrieval models, web based information retrieval techniques and document text mining.
> **CLO2:** To gain knowledge about the variety of basic principles, techniques for searching, managing, and mining information

UNIT I   Introduction   9

Introduction - History of IR - Components of IR - Issues – Open source Search engine Frameworks - The impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Vs Web Search - Components of a Search engine - Characterizing the web.

UNIT II   Information Retrieval   9

Boolean and vector - space retrieval models - Term weighting – TF - IDF weighting - cosine similarity – Pre-processing - Inverted indices - efficient processing with sparse vectors – Language Model based IR - Probabilistic IR – Latent Semantic Indexing - Relevance feedback and query expansion.

UNIT III   Web Search Engine – Introduction and Crawling   9

Web search overview – web structure – the user – paid placement – search engine optimization/ spam. Web size measurement - search engine optimization/spam – Web Search Architectures - crawling - Meta-crawlers- Focused Crawling - web indexes –- Near-duplicate detection – Index Compression – XML retrieval.

UNIT IV   Web Search – Link Analysis and Specialized Search   9

Link Analysis – hubs and authorities – Page Rank and HITS algorithms - Searching and Ranking - Relevance Scoring and ranking for Web – Similarity – Hadoop& Map Reduce - Evaluation - Personalized search - Collaborative filtering and content-based recommendation of documents and products – handling "invisible" Web - Snippet generation – Summarization - Question Answering - Cross - Lingual Retrieval.

UNIT V   Document Text Mining   9

Information filtering; organization and relevance feedback – Text Mining -Text classification and clustering - Categorization algorithms: naive Bayes; decision trees; and nearest neighbour - Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

                                         Total Hours: 45

References:
1. ***C.Manning, P. Raghavanand H. Schütze(2009). Introduction to Information Retrieval.*** Cambridge University Press.
2. ***Ricardo Baeza -Yates and BerthierRibeiro–Neto (2011). Modern Information Retrieval: The Concepts and Technology behind Search.*** 2nd Edition.ACM Press Books.
3. ***Bruce Croft, Donald Metzler and Trevor Strohman (2009). Search Engines: Information Retrieval in Practice.*** 1st Edition. Addison Wesley.
4. ***Mark Levene (2010). An Introduction to Search Engines and Web Navigation.*** 2nd Edition.John Wiley Pvt.Ltd.

Course Outcomes:

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

CO1: Illustrate the basic concepts of issues, components of IR and different models in IR.
CO2: Apply the web based information in web search engine and crawling techniques.
CO3: Analyze the Text mining concepts in IR algorithms.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	H	L	M	-	-	-	-	-	-	L
CO2	M	M	M	M	M	L	-	-	-	-	-	M
CO3	M	M	M	M	H	-	-	-	-	-	-	M

Automata and Compiler Design

Semester V   Hours of Instruction /week: 3T+1Tu
21BEOC14   No. of credits: 4

Objectives:

    CLO1: To understand the basic concepts, different phases of compiler and types of various parsers with several representations.

    CLO2: To design and convert finite automata for any given problem and   understand the operations of Turing machines.

UNIT I   Automata and Turing Machines   12

Formal Language and Regular Expressions: Languages – Definition Languages regular expressions – Finite Automata – DFA – NFA. Conversion of regular expression to NFA – NFA to DFA - Minimization of DFA - Pushdown Automata - Languages of a Pushdown Automata - Deterministic Pushdown Automata - Pumping Lemma for CFL - Turing Machine - Programming Techniques for Turing Machines.

UNIT II   Lexical Analysis and Parsing   12

Language processors - Phases of a compiler -   Lexical Analysis – Role of Lexical Analyzer – Input Buffering - Role of the parser –Writing Grammars - Top Down parsing -   Bottom-Up Parsing – LR Parsers**.**

UNIT III   Intermediate Code Generation   12

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: variants of Syntax Tree, Three Address Code, Types and Declarations, Type Checking – control flow –backpatching.

UNIT IV   Run-Time Environment and Code Generation   12

Run Time Environments - Storage Organization - Stack Allocation of Space, and Access to Nonlocal Data on the Stack - Heap Management – Code Generation: Issues in Code Generation - Design of a simple Code Generator.

UNIT V   Code Optimization   12

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic blocks - Global Data Flow Analysis - Loops in Flow Graphs.

                                                    Total Hours: 60

References:

1.   *Michael Sipser (2012). Introduction to the Theory of Computation,*Third Edition, Cengage Learning.
2.   *K.V.N. Sunitha, N.Kalyani (2016). Formal Languages and Automata Theory,* Pearson Education.
3.   *AlferdV.Aho. Monica S.Lam.Ravi Sethi, JeffereyD.Ullman (2014). Compilers Principles Techniques and Tools,* Second Edition, Pearson Education.
4.   *Keith D Cooper. and Linda Torczon (2012). Engineering a Compiler,* Morgan Kaufmann Publishers.
5.   *V.Raghavan (2011).Principles of Compiler Design,* Tata McGraw-Hill**.**
6.   **www.nptel.ac.in**

Course Outcomes:

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

CO1: Develop an automaton to finite automata for any given problem and interpret the different phases of the compiler design.

CO2: Solve problems in compilers using lexical analysis, construction of different parsers and intermediate generation of code.

CO3: Analyze the method for conversion of intermediate code to target code and identify the various types of environment and optimizations for code generation.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	H	M	M	-	-	-	L	-	-	-
CO2	M	H	H	M	M	-	-	-	L	L	-	-
CO3	M	H	H	H	M	-	-	-	-	L	-	-

Semester V	**Hours of Instruction /week: 3T**
21BEOC15	**No. of credits: 3**

Objectives:
>   **CLO1:** To understand the concepts of layering in networks.
>   **CLO2:** To learn the concepts related to network addressing and routing.

UNIT I   Physical Layer   9

Introduction: Uses of Computer Networks – Network Hardware - Network Software – Reference Models - OSI and TCP/IP models. Physical Layer: Guided Transmission Media Wireless Transmission – Communication Satellites – Digital Modulation and Multiplexing – Public Switched Telephone Network.

UNIT II   Data Link Layer and Medium Access Control   9

Data Link Layer: Design Issues - Error Detection and Correction – Elementary Data Link Protocols – Sliding Window Protocols.Medium Access Control – Multiple Access Protocols – Ethernet – Wireless LANs – Bluetooth – Data Link Layer Switching.

UNIT III   Network Layer   9

Network Layer Design Issues - Routing Algorithms: Flooding -Shortest Path Routing - Link Sate Routing - Hierarchical Routing – Broadcast- Multicast and Any cast Routings – Routing for Mobile and Ad Hoc Networks – Congestion Control Algorithms - Quality of Service – Internetworking – Network Layer in Internet - IPV4 and IPV6.

UNIT IV   Transport Layer   9

Transport Service – Elements of Transport Protocols - Congestion   Control – UDP : Introduction Remote Procedure Call – TCP: Introduction – Service Model – TCP Protocol - Segment Header TCP Connection Establishment - TCP Connection Release - TCP Connection Management Modeling - TCP Sliding Window - TCP Timer Management - TCP Congestion Control.

UNIT V   Application Layer   9

DNS-Domain Name System - Electronic Mail -World Wide Web: Architectural Overview Static and Dynamic Web Pages – HTTP.Streaming Audio and Video – Digital Audio and Video – Streaming Stored and Live Media Content Delivery.

Total Hours: 45

References:
1. *Andrew S Tanenbaum (2012). Computer Networks.*Prentice Hall of India**.**
2. *William Stallings (2016). Data and Computer Communications.*Prentice Hall of India.
3. *Behrou A. Forouzan (2015). Data Communication & Networks.*Tata McGraw Hill.
4. *M.Dave (2012).Computer Networks*.Centage learning.
5. www.nptel.ac.in

Course Outcomes:

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

CO1: Identify the functionality of different OSI layers and protocols in any computer network.

CO2: Formulate the various algorithms and mechanisms in data link and network layers.

CO3: Analyze the various features and operations of transport and application layers.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	H	L	L	-	-	-	L	-	-	-	L
CO2	M	H	M	L	M	L	-	-	-	L	-	L
CO3	M	M	M	L	M	L	L	L	-	L	-	M

Data Mining

Semester V
21BEOC16

Hours of Instruction /week: 3T
No. of credits: 3

Objectives:

CLO1: To understand the functionality of the various data warehousing components.

CLO2: To Inculcate knowledge on rule mining, classification and clustering techniques for retrieval of data and its application.

UNIT I   Data Warehousing and OLAP   9

Basic Concepts – Data Warehousing Components – Building a Data Warehouse Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support – Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations – OLAP and OLTP.

UNIT II   Introduction to Data Mining   9

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

UNIT III   Frequent Pattern Analysis   9

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

UNIT IV   Classification and Clustering   9

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection - Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis - Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data - Clustering with constraints.

UNIT V   Outlier Detection   9

Outlier Detection: Basic Concepts – Outlier Detection Methods – Statistical Approaches – Proximity Based Approaches – Clustering Based Approaches – Classification Based Approaches – Mining Contextual and Collective Outliers – Outlier Detection in High Dimensional Data – open source tools.

Total Hours: 45

References:

1. ***Jiawei Han and MichaelineKamber (2012).Data Mining: Concepts and Techniques.***Fourth Edition. Morgan Kaufmann
2. ***Pang-Ning Tan.Michael Steinbach and Vipin Kumar (2009).****Introduction to Data Mining*.Pearson India.
3. ***Margaret H. Dunham, S. Sridhar (2010). Data Mining Introductory & Advance Topics***.Fourth edition.Pearson Education.
4. ***C.S.R. Prabhu (2010). Data Warehousing: Concept, Techniques, Products and Applications***. Prentice Hall of India.
5. ***Alex Berson and Stephen J. Smith (2016).Data Warehousing, Data Mining & OLAP.***Tata McGraw Hill.
6. www.nptel.ac.in.

Course Outcomes:

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

CO1: Design and apply suitable pre-processing and visualization techniques for data analysis and perform business analysis with OLAP tools.

CO2: Apply frequent pattern and association rule mining techiques for data analysis.

CO3: Analyze Classification, Clustering and outlier detection methods in advanced mining to solve real world problems

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	M	M	-	H	-	-	-	-	-	-	H
CO2	M	H	M	H	M	-	-	-	-	-	-	M
CO3	M	M	H	H	M	-	-	-	-	-	-	M

Computer Networks Practicals

Objective:
   CLO1: To Simulate various routing and switching protocols and wireless communication
          Technologies.

List of Experiments:
1. Study of Network simulator.
2. Practice different network commands available in Windows.
3. Write a program for File Transfer in client-server architecture using following
   methods:
   a) TCP/IP
   b) UDP
4. Simulate TCP Congestion Control mechanism using NS2/NS3/OPNET.
5. Implementation of a program for CRC and Hamming code for error handling.
6. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
7. Program using Distance vector and Link state routing algorithms.
8. Simulate Echo and Chat application using TCP & UDP.
9. Write a program for downloading a file from HTTP server.
10. Performance analysis of Network using NS2/NS3/OPNET.

                                                  Total Hours: 45

Software Requirements:
     Java, Packet Tracer, OPNET, NS2/NS3

References:
1. *BehrouzA.Forouzan(2007).Data Communications and Networking*. Fourth edition.Tata McGraw Hill Higher Education.
2. *William Stallings(2006).Data and Computer Communications.* Eighth Edition. Pearson
3. *James F. Kurose and Keith W. Ross.(2013).Computer Networking A Top-Down Approach.*Sixth Edition Pearson.

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

CO1:   Explore the various command line interface networking tools and summarize the working of application layer protocols.

CO2:   Demonstrate the operation of static and dynamic routing protocols and experiment intra and inter VLAN routing concepts.

CO3:   Analyze troubleshoot frame relay, LAN, PAP and CHAP.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	M	M	-	H	-	-	-	-	-	-	H
CO2	M	H	M	H	H	-	-	-	-	-	-	M
CO3	M	M	H	L	H	-	-	-	-	-	-	M

Data Mining and Big Data Analytics Practicals

Semester V   **Hours of Instruction /week: 3P**
21BEOC18   **No. of credits: 1.5**

Objective:
   CLO1: To explore tools and techniques for working with data mining and big data to solve
           practical problems.

List of Experiments:
   1. Implementation of Clustering algorithms
   2. Implementation of Classification algorithms
   3. Implementation of Regression
   4. Implementation of Association Rules.
   5. Implementation of Data Analysis-Visualization.
   6. Implementation of Map Reduce using Hadoop
   7. Implementation of In-database Analytics
   8. Implementation of Queries using Mongo DB
   9. Case Study on any Commercial applications
   10. Mini Project

                                                                   Total Hours: 45

Software Requirements:
       Weka tool, MongoDB, R, KNIME

References:
   1. *Jiawei Han and MichaelineKamber (2012).Data Mining: Concepts and Techniques.*Third
      Edition. Morgan Kaufmann.
   2. *Pang-Ning Tan.Michael Steinbach and Vipin Kumar (2009).Introduction to Data
      Mining.*Pearson India.
   3. *Kim H. Pries and Robert Dunnigan. 2015.Big Data Analytics: A Practical Guide for
      Managers.*CRCPress, 2015.

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

   CO1: Demonstrate the various data mining algorithms, techniques and apply preprocessing
           methods for any given raw data.
   CO2: Evaluate systematically supervised and unsupervised models and algorithms with respect
           to their accuracy.
   CO3: Apply tools and techniques in big data analytics.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	M	M	M	-	-	-	-	-	L	L
CO2	M	H	M	H	M	L	-	-	-	L	L	M
CO3	M	M	M	L	M	L	L	L	-	L	L	M

Software Project Management

Objectives:
>   **CLO1:** To enable the student to successfully manage a project in the business
>   environment.
>   **CLO2:** To learn how to organize themselves in a team to reach a joint goal with
>   limited resources.

UNIT I   Software Project Planning and Project Scheduling   9
Fundamentals of Software Project Management (SPM)- Need Identification, Vision and Scope document - Project Management Cycle - SPM Objectives - Management Spectrum- SPM Framework- Software Project Planning - Planning Objectives - Project Plan -Types of project plan - Structure of a Software Project Management Plan - Software project estimation - Estimation models -Decision process.

UNIT II   Risk Management, Resource Allocation and Monitoring   9
Categories of Risk –Risk Identification – Risk Assessment – Risk Planning and Control – Evaluating Risks to the Schedule – Applying the PERT technique – Monte Carlo Simulation – Critical Chain Concepts –The nature of Resources – Identifying and Scheduling Resource requirements –Publishing the Resource Schedule – Cost Schedules – The Scheduling Sequence –Creating the Framework – Collecting the Data – Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring.

UNIT III   Managing Contracts and Software Quality Assurance   9
Managing Contracts – Types of Contract – Stages in Contract Placement –Contract Management – Acceptance – Software Quality – The Place of Software Quality in Project Planning –Product Versus Process Quality Management – Quality Management Systems – Process Capability Models – Techniques to help Enhance Software Quality – Testing – Software Quality Attributes, Software Quality Metrics and Indicators.

UNIT IV   Managing People in Software Environments and Working in Teams   9
Understanding Behavior – Organization Behavior – Selecting the Right Person for the Job – Instruction in the Best Methods – Motivation. The Oldham-Hackman Job Characteristics Model – Stress – Health and Safety – Ethical and Professional Concerns – Working in Team – Becoming a Team – Decision Making – Organizational Structures – Coordination Dependencies – Dispersed and Virtual Teams– Communication Plans – Leadership.

UNIT V   Agile Software Project Management   9
Introduction to Agile project management-Agile Manifesto and Principles -Agile Software Development-Design and development practices in Agile projects -Scrum Methodology Elements and Terminology - Scrum Teams and Team Space - Scrum Planning - Agile Development- Tools for Agile project management - Lean-Agile Software Development Portfolio Management -Agile Practices into the Organization.

Total Hours: 45

References:
1. *S. A. Kelkar, (2013), Software Project Management, Third Edition,* PHI, New Delhi.
2. *Adolfo Villafiorita(2016). Introduction to Software Project Management.*CRC Press.
3. *Ashfaque Ahmed (2016).Software Project Management: A Process-Driven Approach.*CRC Press.
4. *Mark C. Layton, Steven J. Ostermiller, Dean J. Kynaston (2020). Agile Project Management for Dummies.*Wiley

Course Outcomes:

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

CO1: Describe how the software development process applied in a project, manage risks, develop and execute plans

CO2: Emphasize quality standards, manage people and learn tools which are relevant for the project in collaboration with the other team members

CO3: Appraise the business value of adopting Agile approaches and development practices

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	L	-	-	-	-	-	M	L	M	M
CO2	M	M	-	-	M	-	-	-	M	M	M	L
CO3	M	M	L	M	-	-	-	-	M	L	M	M

Cloud Computing

Semester VI   **Hours of Instruction /week: 3T**
21BEOC20   **No. of credits: 3**

Objectives:

    CLO1: To understand the concept of cloud computing.
    CLO2: To appreciate the emergence of cloud as the next generation computing
         Paradigm.

UNIT I   Introduction   9

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

UNIT II   Cloud Enabling Technologies   9

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

UNIT III   Cloud Architecture, Services and Storage   9

Layered Cloud Architecture Design – AWS Well-Architected Framework Design Principles-AWS Services & Service Categories- NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Amazon Elastic Block Store Console Demonstration- AWS S3-Cloud Storage Providers – S3- AWS IAM.

UNIT IV   Resource Management and Security in Cloud   9

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – AWS Shared Responsibility Model - AWS IAM Console Demonstration-Securing a New AWS Account - Securing a New AWS Account -Securing Data-Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V   Cloud Technologies and Advancements   9

Hadoop – MapReduce – Virtual Box - Amazon Cloud Watch- Google App Engine – Amazon EC2 Auto Scaling - Programming Environment for Google App Engine – Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

                Total Hours: 45

References:

1. ***Rittinghouse, John W., and James F. Ransome (2017).Cloud Computing: Implementation, Management and Security.***CRC Press,
2. ***Thomas Erl, ZaighamMahmood, and Ricardo Puttini(2013).Cloud Computing Concepts, Technology &Architecture.***Prentice Hall
3. ***A.Srinivasan,J.Suresh(2014). Cloud Computing, A practical approach for learning andImplementation.***Pearson Education
4. ***K. Chandrasekaran (2015).Essentials of Cloud Computing.***CRC Press

Course Outcomes:

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

CO1: Identify the main concepts,technologies,AWS cloud and learn the enabling technologies that help in the development of cloud.

CO2: Develop the ability to understand the architecture to compute, storage cloud, service, delivery modes and explain the core issues of cloud computing such as recourse management and security.

CO3: Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	M	L	-	M	-	-	-	-	L	M	M
CO2	M	M	H	M	M	-	-	-	M	H	M	M
CO3	M	M	M	M	H	-	-	-	H	M	M	L

Internet and Web Technology

Semester VI
21BEOC21

Hours of Instruction /week: 3T
No. of credits: 3

Objectives:
  CLO1: ToCategorize the basic concepts of Web servers, programming and Javascripts.
  CLO2:ToInterpret the working of an AngularJS as a web services and to implement the handling of data in Mongo DB.

UNIT I   Web Servers   9

Basic Web Concepts - Web based Client/Server model - Web Protocols- Working of web browser -Browser and Server Communication - DHTML - CSS - Filters and transition-Web Security – Fire Wall – Proxy Servers – Virtual Directories – MIME – HTTP Headers – Deployment using web servers.

UNIT II   Web Programming   9

HTML5 Structural Elements-Images – HTML5 Form Elements and Attributes - DHTML – CSS3-Selectors-Box model-Positioning elements-Colors-Shadows-Gradients–Transitions and Transformations-Client Side scripting - Control statements - Events - Cookies -Introduction to CGI Concepts - Server Side Technologies: PERL - Arrays - Strings - Files – Database.

UNIT III   Javascript   9

Core JavaScript – lexical structure – types-values and variables- expression and operators – statements – objects – arrays – functions- classes and modules- pattern matching with regular expressions- java script in web browser-the window objects-scripting documents-handling events.

UNIT IV   AngularJS   9

An Overview of the AngularJS Life Cycle-Integrating AngularJS with Existing JavaScript and jQuery-Adding AngularJS to the Node.js Environment-Bootstrapping AngularJS in an HTML Document- Creating a Basic AngularJS Application-Using AngularJS Templates to Create Views- Implementing Directives in AngularJS Views- Implementing AngularJS Services in Web Applications.

UNIT V   Node.JS and MongoDB   9

Using Events - Listeners - Timers and Callbacks in Node.js-5 Handling Data I/O in Node.js- Accessing the File System from Node.js- Implementing HTTP Services in Node.js- implementing Socket Services in Node.js- Scaling Applications Using Multiple Processors in Node.js- Implementing Express in Node.js- Understanding NoSQL and MongoDB- Manipulating MongoDB Documents from Node.js- Accessing MongoDB Documents from Node.js- Advanced MongoDB Concepts.

Total Hours: 45

References:
1. *Deitel&Deitel (2019).Internet and World Wide Web How to Program.* Pearson Education.
2. *Robert W. Sebesta (2015). Programming the World Wide Web.*Eighth Edition, Addison-Wesley.
3. *Brad Dayley(2014).Node.js, MongoDB, and AngularJS Web Development*. Addison-Wesley Professional.
4. *Brad Green ShyamSeshadri (2013).AngularJS.*O'Reilly.1st Edition.
5. *RashimMogha- V VPreetham (2011). Java Web Services Programming.* Wiley India Ltd.
6. *David Flanagan(2011).JavaScript The Definitive Guide*. O'Reilly Media. Inc.

Course Outcomes:

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

CO1: Interpret the concepts of the web servers and its working through virtual directories.

CO2: Acquire in depth knowledge in web services using the latest server side technologies.

CO3: Design and develop web server applications using Node JS and AngularJS.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	L	M	-	-	-	-	-	-	M	L
CO2	H	M	L	M	-	-	-	-	-	L	-	L
CO3	M	M	H	L	L	-	-	-	M	M	-	M

Data Privacy and Security

Semester VI   **Hours of Instruction /week:**   **3T**
21BEOC22   **No. of credits:**   **3**

Objectives:
  CLO1: To understand the knowledge of data hiding and the steganography types.
  CLO2: To inculcate the asymmetric, digital signature in cryptographic systems.

UNIT I   **Introduction**   **9**
Introduction: Mathematical background: Probability theory -Information theory - Complexity theory -Number theory. Symmetric (Private) Key Cryptographic Systems: Caesar – Affine - Monoalphabetic Substitution – Transposition - Homophonic substitution – Product ciphers - Lucifer and DES.

UNIT II   **Asymmetric (Public) Key Cryptographic Systems**   **9**
Concept of PKCS -RSA Cryptosystem- Variants of RSA - Primarily testing - Security of RSA - Elliptical Curve Cryptography. Stream ciphers and block ciphers: The one-time pad - Synchronous stream ciphers - Self-synchronizing stream ciphers - Feedback shift registers - Linear Complexity – Non-linear feedback shift registers - Stream ciphers based LFSRs.

UNIT III   **Digital Signatures**   **9**
Properties - Generic signature schemes - Rabin Lamport – Matyasmeyer- RSA - Multiple RSA and ElGamal Signatures - Digital signature standard - Blind Signatures- RSA Blind.Secret Sharing Algorithms: Threshold secret sharing - Shamir scheme - Blakley scheme and modular Scheme.Pseudo random number generators: Definition of randomness and pseudo-randomness - Statistical tests of randomness - Linear congruential generator.

UNIT IV   **Data Hiding**   **9**
Data hiding in text-Application of data hiding – Watermarking-Intuitive methods-Simple digital methods-Data hiding in Text-Mimic functions-Data hiding in images-LSB Encoding-Lossless data hiding.

UNIT V   **Spread Spectrum Steganography**   **9**
BPCS Steganography-Data hiding by Quantization – Patchwork-Signature casting in images-Transform domain methods-Robust datahiding in JPEG images-Detecting malicious tampering-Robust frequency domain watermarking.

                                                   Total Hours: **45**

References:
1. ***Padmanabhan T R. Shyamala C and HariniN(2011). Cryptography and Security.***Wiley Publications.
2. ***Josef Pieprzyk. Thomas Hardjono and Jenifer Seberry (2010).Fundamentals of Computer Security.***Springer Publications**.**
3. ***David Solmann (2012).Data Privacy and Security: Concepts and Techniques.***Pearson Education
4. ***Douglas R Stinson(2005). Cryptography:Theory and Practice.***CRC Press.

Course Outcomes:

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

CO1: Illustrate the concepts of Data Security and Data Privacy perspective in cryptographic systems.

CO2: Illustrate the concepts of digital signature and their hiding techniques for data privacy protection.

CO3: Apply the applications of data hiding and Spread Spectrum Steganography.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	M	M	-	-	-	-	-	-	-	-	H
CO2	M	H	M	H	M	-	-	-	-	-	-	M
CO3	M	M	H	L	M	-	-	-	-	-	-	M

Internet and Web Technology Practicals

Semester VI   Hours of Instruction /week: 3P
21BEOC23   No. of credits: 1.5

Objectives:

CLO1: To design and implement applications using the concepts of Web Technology.
CLO2: To create the web pages using AngularJS, Node JSand to create dynamic web
       pages using server side and client side scripting.

List of Experiments:

1. Create a simple webpage using DHTML

2. Design a HTML5 page with different types of frames such as floating frame, navigation frame & mixed frame.
3. Implement frames to include images and videos with the help of PERL technologies.
4. Create a Cascading Style sheet for designing the web page using values and variables of javascript.
5. Design a dynamic web page with validation using Angular.JS templates.
6. Create a web page with the following using Angular.JS services.
      i. Expressions
      ii. Filters
      iii. Events and change notification.
7. Simple application to demonstrate Database Connectivity using MongoDB.
8. Mini Project.

Total Hours: 45

Software Requirements:
       PERL, Java, HTML 5, Angular JS, MongoDB

References:
1. ***Deitel&Deitel (2019).Internet and World Wide Web How to Program.***Pearson Education.
2. ***Robert W. Sebesta (2015). Programming the World Wide Web,*** Eighth Edition, Addison-Wesley.
3. ***Brad Dayley(2014).Node JS, MongoDB, and AngularJS Web Development.*** Addison-Wesley Professional.
4. ***Brad Green ShyamSeshadri (2013).AngularJS.*** 1ˢᵗEdition.O'Reilly.
5. ***RashimMogha, V VPreetham (2011). Java Web Services Programming.***Wiley India Ltd.
6. ***David Flanagan(2011).JavaScript The Definitive Guide***. O'Reilly Media, Inc.

Course Outcomes:

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

CO1: Learn, apply and Design applications using DHTML and Java Script.
CO2: Demonstrate the PERL programming language for designing dynamic web pages.
CO3: Develop web application using MongoDB, Database Connectivity and identify the environments that are currently available on the market to design web site**s.**

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	H	H	-	-	-	-	-	L	M
CO2	M	H	M	H	M	L	-	-	-	L	H	M
CO3	M	M	M	M	M	L	L	-	-	L	L	M

Cloud Computing Practicals

Semester VI　　　　　　　　　　　　　　　　　　**Hours of Instruction /week:　3P**
21BEOC24　　　　　　　　　　　　　　　　　　`No. of credits:　1.5

Objectives:
　　　CLO1: To develop web applications in cloud
　　　CLO2: To learn the design and development process involved in creating a cloud based
　　　　　　　Application

List of Experiments:
1. Install Virtualbox/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Apply GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Procedure to transfer the files from one virtual machine to another virtual machine.
7. Procedure to launch virtual machine (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.
9. AWS S3
10. AWS IAM

　　　　　　　　　　　　　　　　　　　　　　　Total Hours:　45

Software Requirements:
　　　Hadoop, Own Cloud, VMWare, CloudSim, python/java, Linux

References:
1. ***Thomas Erl, ZaighamMahmood, and Ricardo Puttini(2013).　Cloud Computing Concepts, Technology & Architecture.***Prentice Hall
2. ***A.Srinivasan, J.Suresh(2014). Cloud Computing, A practical approach for learning and Implementation.*** Pearson Education

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

　CO1: Design and deploy a web application in a PaaS environment.
　CO2: Learn how to simulate a cloud environment to implement new schedulers and Install and use a generic cloud environment that can be used as a private cloud.
　CO3: Manipulate large data sets in a parallel environment.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	H	M	M	-	-	-	M	L	M	M
CO2	M	H	M	M	M	L	-	-	M	M	M	M
CO3	M	M	H	M	M	L	L	L	M	L	M	M

Machine Learning

Semester VII	**Hours of Instruction /week:**	**3T**
21BEOC26	**No. of credits:**	**3**

Objectives:

    CLO1: To understand the need of machine learning for various problem solving.

    CLO2: To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.

UNIT I   Introduction   9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning –Representation – Algorithm – Heuristic Space Search.

UNIT II   Neural Networks and Genetic Algorithms   9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks andBack Propagation Algorithms – Advanced Topics – Genetic Algorithms – HypothesisSpace Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III   Bayesian and Computational Learning   9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum DescriptionLength Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve BayesClassifier – Bayesian Belief Network – EM Algorithm – Probability Learning –Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV   Instant Based Learning   9

K- Nearest Neighbour Learning – Locally weighted Regression – Radial BasisFunctions – Case Based Learning.

UNIT V   Advanced Learning   9

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – FirstOrder Rules – Sets of First Order Rules – Induction on Inverted Deduction – InvertingResolution – Analytical Learning – Perfect Domain Theories – Explanation BaseLearning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning –Temporal Difference Learning.

        Total Hours: 45

References:

1   *Tom M. Mitchell (2013).Machine Learning.* McGraw-Hill Education (India) Private Limited.

2   *Christopher Bishop (2016). Pattern Recognition and Machine Learning.*Springer.

3   *EthemAlpaydin, (2004).Introduction to Machine Learning (Adaptive Computation and Machine Learning),* The MIT Press**.**

4   *Trevor Hastie, Robert Tibshirani, Jerome Friedman (2013). The Elements of Statistical Learning.*Springer (freely available online).

5   *Stephen Marsland (2009). Machine Learning: An Algorithmic Perspective,* CRC Press.

Course Outcomes:

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

CO1: Discuss the basic concepts of machine learning, decision tree algorithm and apply back propagation algorithm and genetic algorithm to various problems.

CO2: Apply the concepts of learning and Instant based learning in machine learning.

CO3: Analyze and suggest appropriate machine learning approaches for various types of problems.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	-	M	-	-	-	M	L	M	M
CO2	H	M	M	M	H	-	-	-	M	M	M	M
CO3	M	M	M	M	H	-	-	-	M	M	M	M

Mobile Application Development

Semester VII   **Hours of Instruction /week: 3T**
21BEOC27   **No. of credits: 3**

Objectives:

       CLO1: To understand the programming technologies, design and development
               related to mobile applications.
       CLO2: To study the various design and development related to mobile applications.

UNIT I   **Introduction**   **9**

Introduction to mobile applications –Embedded systems -Market and business drivers for mobile applications –Publishing and delivery of mobile applications –Requirements gathering and validation for mobile applications

UNIT II   **Basic Design**   **9**

Introduction –Basics of embedded systems design –Embedded OS -Design constraints for mobile applications- both hardware and software related – Architecting mobile applications – User interfaces for mobile applications –touch events and gestures –Achieving quality constraints –performance- usability – security- availability and modifiability.

UNIT III   **Advanced Design**   **9**

Designing applications with multimedia and web access capabilities –Integration with GPS and social media networking applications –Accessing applications hosted in a cloud computing environment –Design patterns for mobile applications.

UNIT IV   **Technology I -Android**   **9**

Introduction –Establishing the development environment –Android architecture –Activities and views –Interacting with UI –Persisting data using SQLite Packaging and deployment – Interaction with server side applications –Using Google Maps- GPS and Wifi –Integration with social media applications.

UNIT V   **Technology II -IOS**   **9**

Introduction to Objective C –IOS features –UI implementation –Touch frameworks – Datapersistence using Core Data and SQLite –Location aware applications using Core Location andMap Kit –Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

                                                     Total Hours: 45

References:

   1   *David Mark. Jack Nutting. Jeff LaMarche and Frederic Olsson (2013).BeginningIOS 6 Development: Exploring the iOSSDK.* Apress.
   2   *Jeff McWherter and Scott Gowell(2012). Professional Mobile Application Development-* Wrox.
   3   *James Dovey and Ash Furrow (2012).Beginning Objectives C.* Apress.
   4   *Charlie Collins. Michael Galpin and Matthias Kappler(2012). Android in Practice.* DreamTech.

Course Outcomes:

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

CO1: Identify the three main mobile platforms and their ecosystems, namely Android, iOS, and Phone Gap/WebOS.

CO2: Analyze technologies and tools used in UI and features of network connectivity.

CO3: Express knowledge on network connectivity and communication across mobile networks and develop knowledge in mobile application development

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	-	-	-	-	-	-	M	-	M
CO2	M	H	M	M	M	-	-	-	L	L	M	M
CO3	M	H	H	M	H	-	-	-	L	M	M	M

Machine Learning Practicals

Semester VII   Hours of Instruction /week: 3P
21BEOC28   No. of credits: 1.5

Objective:
CLO1: To make use of the data sets in implementing the machine learning algorithms.

List of Experiments:
1. Implement and demonstrate the FIND-S algorithm.
2. 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.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm.
5. Write a program to implement the naïve Bayesian classifier.
6. Write a program to construct a Bayesian network considering medical data using Java/Python ML library classes/API.
7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.
8. Implement the non-parametric Locally Weighted Regression algorithm.

Total Hours: 45

Software Requirements:
Java, Python,MATLAB

References:
1. *Christopher Bishop (2016). Pattern Recognition and Machine Learning*.Springer.
2. *EthemAlpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series),* Third Edition, MIT Press,2014
3. *Oliver Theobald (2017).Machine Learning with Python: A Practical Beginners' Guide.*
4. *Trevor Hastie, Robert Tibshirani, Jerome Friedman (2013). The Elements of Statistical Learning.*Springer (freely available online).

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

CO1: Identify the implementation procedures for the machine learning algorithms.
CO2: Design Java/Python programs for various Learning algorithms.
CO3: Apply Machine Learning algorithms to solve real world problems

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	H	-	-	-	M	L	L	M
CO2	M	M	H	M	H	-	-	-	M	M	M	M
CO3	M	H	M	M	H	-	-	-	M	M	M	M

Mobile Application Development Practicals

Semester VII   Hours of Instruction /week: 3P
21BEOC29   No. of credits: 1.5

Objective:
   CLO1: To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.

List of Experiments:
   1. Develop an application that uses GUI components, Font and Colours.
   2. Develop an application that uses Layout Managers and event listeners.
   3. Write an application that draws basic graphical primitives on the screen.
   4. Develop an application that makes use of databases.
   5. Develop an application that makes use of Notification Manager
   6. Develop a native application that uses GPS location information
   7. Implement an application that writes data to the SD card
   8. Implement an application that creates an alert upon receiving a message
   9. Develop a mobile application to send an email.
   10. Develop a Mobile application for simple needs (Mini Project)

                                                            Total Hours: 45

Software Requirements:
Android Studio/Eclipse IDE

References:
   1. *David Mark. Jack Nutting. Jeff LaMarche and Frederic Olsson (2013).BeginningIOS 6 Development: Exploring the iOSSDK.*Apress.
   2. *Jeff McWherter and Scott Gowell(2012). Professional Mobile Application Development-*Wrox.
   3. *James Dovey and Ash Furrow (2012).Beginning Objectives C.*Apress.
   4. *Charlie Collins. Michael Galpin and Matthias Kappler(2012). Android in Practice.*DreamTech.

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

   CO1:   Develop mobile applications using GUI and Layouts.
   CO2:   Design and implement Android's User interface functions.
   CO3:   Analyze and discover own mobile app for simple needs.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	H	H	L	-	-	M	M	H	M
CO2	M	M	H	H	M	L	-	-	M	L	M	M
CO3	M	M	M	H	M	L	-	-	M	L	M	M

PE 1	**Hours of Instruction /week: 3T**
Semester V	**No. of credits: 3**
21BEOE01	

Prerequisite:
- Software Engineering

Objectives:

CLO1: To study various software testing methods, software testing management and usage of automated testing tool.

CLO2: To compare various software testing methods and check the behaviour.

UNIT I   Introduction   9

Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions –Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples– Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.

UNIT II   Test Case Design   9

Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing –Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. Structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.

UNIT III   Levels of Testing   9

The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing –Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.

UNIT IV   Test Data Management   9

People and organizational issues in testing – Organization structures for testing teams – testingservices – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

UNIT V   Automation Testing   9

Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics-open source automation tools.

Total Hours: 45

References:

1. *M.G.Limaye(2014).Software Testing – Principles, Techniques and Tools*, Tata McGraw-Hill.
2. *SrinivasanDesikan and Gopalasamy Ramesh (2006). Software Testing Principles and Practices.* Pearson Education.
3. *NareshChauhan,(2010),Software Testing Principles and Practices*, Oxford University Press.
4. *Paul Ammann and Jeff Offutt(2016).Introduction to Software Testing*, Second Edition, Cambridge University Press.

Course Outcomes:

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

CO1: Analyze the different approaches used for test case design and test data management.

CO2: Design the suitable test cases for software testing.

CO3: Use the automated testing tools to check the behaviour of the real time application.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	M	M	-	-	-	L	L	M	M
CO2	M	M	H	M	M	-	-	-	M	L	M	-
CO3	M	M	M	H	M	-	L	-	M	L	M	-

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Java Programming

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PE 1	**Hours of Instruction /week: 3T**
Semester V	**No. of credits: 3**
21BEOE02	

Prerequisite:

- C Programming

Objectives:

CLO1: To understand and gain knowledge on the basic concepts of OOPs language using Java.
CLO2: To learn to Utilize appropriate methods to write programs for specific applications.

UNIT I   Introduction to Java   9
Overview of OOP concepts – Comparison of C++and Java - Java Fundamentals -Data Types – Variables - Arrays - Operators-Control Statements – Classes – Methods –Constructors-Garbage Collection.

UNIT II   Inheritance and Exception Handling   9
Inheritance – Packages and Interfaces - Exception Handling Fundamentals – Java's Built-in Exceptions-Creating new Exception subclasses.

UNIT III   Polymorphism and Multithreading   9
Polymorphism- Abstract classes and methods-Overloading-Overriding-final methods and classes –Multithreaded programming –The Thread class and the Runnable Interface-Creating multiple threads-Synchronization- Auto boxing and Annotations (Metadata).

UNIT IV   AWT & Applets   9
AWT Classes- AWT Controls - Applet Basics - Applet Architecture – Applet Life Cycle – Paint and Repaint methods - Swing – Swing Components, Working with Graphics and Texts - Working with Colours and Font – Event Handling – Adapter Classes

UNIT V   Files and Streams   9

Files and streams –Byte Stream-I/O Stream, File I/O Stream, Byte Array I/O Stream-Character Stream-File Reader and Writer, Char Array Reader and Writer-Serialization.

<div align="right">

Total Hours: 45

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References:
1. *Muneer Ahmad Dar(2020). JAVA Programming Simplified: From Novice to Professional - Start at the Beginning and Learn the World of Java.* BPB Publications
2. *Herbert Schildt (2021). Java: The Complete Reference.* Twelfth Edition. Tata McGraw Hill.
3. *DeitelH.M. and Deitel P.J. (2014). Java: How to Program.* Tenth Edition. Pearson Education Asia.
4. *Balagurusamy E. (2014). Programming with Java: A Primer. Fifth Edition. McGraw Hill.*

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

CO1: Develop java programs using OOP principles and demonstrate the concepts of inheritance and Exception handling.

CO2: Apply the concepts of polymorphism and multithreading to create java applications.

CO3: Develop GUI based applications using Applet and AWT and utilize appropriate Java Stream Classes to Solve IO Related Problems.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	L	-	-	-	M	-	L	L
CO2	H	M	H	M	M	-	-	-	M	L	M	M
CO3	H	M	H	M	L	-	-	-	M	-	L	M

Adhoc and Sensor Networks

PE 1   **Hours of Instruction /week: 3T**
Semester V   **No.of credits: 3**
21BEOE03

Prerequisite:

- Computer Networks

Objectives:

CLO1: To study the requirement of adhoc networks and their architecture.
CLO2: To use various protocols to design adhoc networks as well as sensor networks
and integrate them to engineering problems keeping routing and energy management in mind.

UNIT I   Adhoc Networks Fundamentals and MAC Protocols   9
Issues in Ad hoc wireless networks – Ad hoc Wireless Internet - Issues in Design of MAC
Protocols – Design Goals – MAC Protocol Classifications – Contention-Based MAC
Protocols – Reservation Mechanisms – Scheduling Mechanisms – Using Directional Antennas
– Other MAC Protocols – MAC Layer QoS Solutions

UNIT II   Adhoc Networks Routing Protocols   9
Issues in Routing Protocol - Challenges in providing QoS – Classification of Routing
Protocols – Table Driven Routing Protocols (DSDV, CGSR, OLSR) – On-Demand Routing
Protocols (DSR, AODV, TORA) – Hybrid Protocols (CEDAR, ZRP) – Hierarchical Routing
Protocols(HSR, FSR) - Efficient Flooding Mechanisms – Power-Aware Routing Protocols –
Architecture Reference Model for Multicast Routing Protocols – Classifications – Tree-Based
Multicast Routing Protocols – Mesh-Based Multicast Routing Protocols – Energy-Efficient
Multicasting – Multicasting with QoS Guarantees

**UNIT III   Adhoc Networks Transport Layer Protocols and Energy   9
                     Management**
Issues in Design of Transport Layer Protocols – Design Goals – TCP over Ad hoc – Other
Transport Layer Protocols – Need for Energy Management in Ad Hoc Wireless Networks –
Classification of Energy Management Schemes – Battery Management Schemes –
Transmission Power Management Schemes – System Power Management Schemes.

UNIT IV   Wireless Sensor Networks   9
Motivation – Challenges and Constraints – Ad-hoc Vs sensor networks – Sensing Subsystem
– Processor Subsystem – Communication Interfaces – Prototypes - Sensor Network
architecture– Applications of sensor networks – Enabling Technologies for Wireless Sensor
Networks – Data Dissemination – Data Gathering –Location discovery – Quality of Sensor
Networks

UNIT V   Sensor Networks MAC and Routing Protocols   9
Characteristics of MAC & Routing Protocols in Sensor Networks – Contention-Free MAC
Protocols (TRAMA, LEACH) – Contention-Based MAC Protocols (SMAC, TMAC) – Hybrid
MAC (ZMAC) – Routing Metrics – Flooding and Gossiping – Data centric Routing –
Location Based Routing – QoS Based Routing

                                                               Total Hours: 45

References:

1. *Carlos De MoraisCordeiro, Dharma PrakashAgrawal, (2011). Ad Hoc and Sensor Networks: Theory and Application.*Second Edition, World Scientific Publishing.
2. *Waltenegus Dargie, Christian Poellabauer, (2010). Fundamentals of Wireless Sensor Networks Theory and Practice.* John Wiley and Sons.
3. *Fraser Cadger et al. (2013). A Survey of Geographical Routing in Wireless Ad-Hoc Networks.* IEEE Communications Surveys & Tutorials, Vol. 15, No. 2, Second Quarter.
4. *Jagannathan Sarangapani (2017). Wireless Ad Hoc and Sensor NetworksProtocols, Performance, and Control.* CRC Press

Course Outcomes:

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

CO1: Identify the issues and challenges in the design of wireless ad-hoc networks and sensor networks.

CO2: Discuss various layers in the adhocnetwork and protocols prescribed by IEEE.

CO3: Analyze adhoc and sensor networks for optimum routing, energy, and security for various applications.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	H	M	M	L	-	-	-	-	-	-	-	-
CO2	M	M	M	-	L	-	-	-	-	L	-	-
CO3	M	H	M	L	M	-	-	-	-	L	-	-

Cryptography and Network Security

PE 1	**Hours of Instruction /week: 3T**
Semester VI	**No.of credits: 3**
21BEOE04	

Prerequisite:
- Computer Networks.

Objectives:

CLO1: To impart concepts of Cryptography and Network Security used to provide confidentiality, integrity and authenticity.

CLO2: To recognize the various key distribution and management systems for security of a cryptosystem.

UNIT I   Introduction & Number Theory   9

Computer Security Concepts-OSI Security Architecture-Security Attacks- Security Services-Security Mechanisms- A Model for Network Security-Classical Encryption Techniques-Symmetric Cipher Model- Substitution Techniques- Transposition Techniques- Rotor Machines-Steganography- Number Theory- Prime Numbers- Fermat's and Euler's Theorems- Testing for Primality- The Chinese remainder theorem- Discrete logarithms.

UNIT II   Block Ciphers & Public Key Cryptography   9

Traditional Block Cipher Structure- Data Encryption Standard- examples- Strength of DES-Block Cipher Design Principles- Advanced Encryption Standard- Finite Field Arithmetic- AES Structure- AES Transformation Functions- AES Key Expansion- AES Example- Principles of Public-Key Cryptosystems- The RSA Algorithm- Diffie Hellman Key exchange-Elgamal Cryptographic System- Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT III   Hash Functions and Digital Signatures   9

Applications of Cryptographic Hash Functions- Two Simple Hash Functions- Requirements and Security- Hash Functions Based on Cipher Block Chaining- Secure Hash Algorithm (SHA)-Message Authentication Requirements- Message Authentication Functions- Requirements for Message Authentication Codes- Security of MACs- Digital Signature- Elgamal Digital Signature Scheme- Schnorr Digital Signature Scheme.

UNIT IV   Application Security   9

Distribution of Public Keys- X.509 Certificates- Kerberos- web security - secure Sockets Layer-Transport Layer Security- HTTPS- SSH- Wireless Network Security- Email security- Pretty Good Privacy- S/MIME- IP Security-overview- policy- Encapsulating Security Payload.

UNIT V   Malicious Software and Firewalls   9

Types of Malicious Software- Propagation- Infected Content- Viruses- Propagation-Vulnerability Exploit- Worms- Propagation- Social Engineering- SPAM- Trojans- Payload System Corruption- Payload Attack Agent- Zombie- Bots- Payload Information Theft-Keyloggers- Phishing- Spyware- Payload Stealthing- Backdoors- Rootkits- Intruders- Intrusion Detection- Password Management-

Firewalls- The Need for Firewalls- Firewall Characteristics- Types of Firewalls- Firewall Basing-Firewall Location and Configurations.

                                                                Total Hours: 45

References:
1. *William Stallings. (2015). Cryptography and Network Security.* 6th Edition. Pearson Education.
2. *AtulKahate (2019).Cryptography and Network Security.*4thEdition. Tata McGraw Hill.
3. *Charles Pfleeger. (2015).Security in Computing*. 5th Edition. Prentice Hall of India.
4. *Charlie Kaufman and Radia Perlman. Mike Speciner (2011). Network Security.* Second Edition. Private Communication in Public World.

Course Outcomes:

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

CO1:	Summarize the computer security concepts and describe the principles underlying Cryptographic techniques.
CO2:	Implement the main cryptographic concepts and technologies including symmetric and asymmetric encryption, hashing and digital signatures.
CO3:	Formulate the threats and vulnerabilities of malicious software in a network environment and design the security solution

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	H	M	M	M	L	L	M	-	-	-	L	-
CO2	H	M	M	L	M	-	-	-	-	-	L	-
CO3	M	M	L	L	M	L	-	-	-	-	M	-

PE 1   **Hours of Instruction /week: 3T**

Semester VI   **No. of credits: 3**

21BEOE05

Prerequisite:

- Operating systems

Objectives:

CLO1: To develop the skills necessary for systems programming and make effective use of Linux utilities and Shell scripting language

CLO2: To work with shell script to automate different tasks as Linux administration.

UNIT I   Linux Utilities and Shell programming   9

File handling utilities, Security by file permissions– Process utilities– Diskutilities– Networking commands– Filters– Text processing utilities and Backup utilities– Sed-Scripts– Operation– Addresses– Commands– Applications– awk-Execution– Fields and Records– Scripts– Operation– Patterns– Actions– Associative Arrays– String and Mathematical functions– System commands in awk– Applications.

UNIT II   Shell programming

Introduction– shell responsibilities– pipes and Redirection– here documents– running a shell script– the shell as a programming language– shell meta characters– file name substitution– shell variables – command substitution– shell commands– the environment– quoting– test command– control structures– arithmetic inshell– shell script examples– interrupt processing– functions– debugging shell scripts.

UNIT III   Files and Directories   9

File Concept – File types – File System Structure – file metadata-Inodes – kernel support for files – system calls for file I/O operations- Creating – removing and changing Directories- obtaining current working directory-getcwd – Directory contents – Scanning Directories- opendir – readdir – closedir – rewinddir functions.

UNIT IV   Process and Signals   9

Process concept– Layout of a C program image in main memory– Process environment – environment list – environment variables – Kernel support for process – process identification – process control - process creation – replacing a process image – waiting for a process– process termination – zombie process – orphan process – system call interface for process management- Differences between threads and processes – Introduction to signals– Signal generation.

UNIT V   Inter-process Communication   9

Introduction to IPC – IPC between processes on a single computer system – IPC between processes on different systems – pipes-creation – IPC between related processes using unnamed pipes – FIFOs-creation – IPC between unrelated processes using FIFOs (Named pipes) – Message Queues- Kernel support for messages – APIs for message queues – client/server example. Semaphores - Kernel support for semaphores – APIs for semaphores – file locking with semaphores.

                                                                  Total Hours: 45

References:

1. *Sumitabha Das (2017).Unix Concepts and Applications*, 4th Edition, TMH.
2. *S. Parker(2011). Shell Scripting,* Wiley India Pvt. Ltd.
3. *A. Hoover(2009).System Programming with C and Unix*, Pearson Education.
4. *W. R. Stevens(2007).Unix Network Programming*, PHI.
5. *S. G. Kochan and P. Wood(2003),Unix shell Programming*, 3rd edition, Pearson Education.

Course Outcomes:

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

CO1: Apply Linux utilities and Shell scripting language to solve Problems
CO2: Develop systems programming including file system programming, process and signal management, interprocess communication
CO3: Write network programs using Sockets.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	M	M	M	-	M	-	-	-	-	-	-	L
CO2	M	M	M	M	-	-	-	-	-	-	-	L
CO3	M	M	M	M	-	-	-	-	-	-	-	L

PE 1 Hours of Instruction /week: **3T**
Semester VI No. of credits: **3**
21BEOE06

Prerequisite:

- Software Engineering

Objectives:

CLO1: To acquire knowledge on agile software development process and to manage a project using scrum framework.
CLO2: To apply lean and agile development techniques to solve complex problems.

UNIT I **Fundamentals of Agile** **9**

The Genesis of Agile-Introduction and background-Agile Manifesto and Principles-Overview of Scrum-Extreme Programming-Feature Driven development-Lean Software Development-Agile project management-Design and development practices in Agile projects-Test Driven Development-Continuous Integration-Refactoring-Pair Programming-Simple Design-User Stories-Agile Testing-Agile Tools.

UNIT II **Agile Scrum Framework** **9**

Introduction to Scrum-Project phases-Agile Estimation-Planning game-Product backlog- Sprint backlog-Iteration planning-User story definition-Characteristics and content of user stories-Acceptance tests and Verifying stories-Project velocity-Burn down chart- Sprint planning and retrospective-Daily scrum-Scrum roles – Product Owner-Scrum Master-Scrum Team-Scrum case study-Tools for Agile project management.

UNIT III **Agile Testing** **9**

The Agile lifecycle and its impact on testing-Test-Driven Development (TDD)-xUnit framework and tools for TDD-Testing user stories - acceptance tests and scenarios-Planning and managing testing cycle-Exploratory testing-Risk based testing-Regression tests-Test Automation-Tools to support the Agile tester.

UNIT IV **Agile Software Design and Development** **9**

Agile design practices-Role of design Principles including Single Responsibility Principle-Open Closed Principle-Liskov Substitution Principle-Interface Segregation Principles-Dependency Inversion Principle in Agile Design-Need and significance of Refactoring-Refactoring Techniques-Continuous Integration-Automated build tools-Version control.

UNIT V **Industry Trends** **9**

Market scenario and adoption of Agile-Agile ALM-Roles in an Agile project-Agile applicability-Agile in Distributed teams-Business benefits-Challenges in Agile-Risks and Mitigation-Agile projects on Cloud-Balancing Agility with Discipline-Agile rapid development technologies.

Total Hours: **45**

References:
1. ***Robert C. Martin. (2003).Agile Software Development, Principles, Patterns and Practices-*** Prentice Hall
2. ***Ken Schawber, Mike Beedle (2004).Agile Software Development with Scrum.*** Pearson Education.
3. ***Lisa Crispin (2010).Agile Testing: A Practical Guide for Testers and AgileTeam.***Addison Wesley.
4. ***David J. Anderson and Eli Schragenheim(2003).Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results***. Prentice Hall.
5. ***Hazzan Orit and Dubinsky Yael. (2011).Agile Software Engineering Series: Undergraduate Topics in Computer Science***. Springer International.
6. ***Chung-Yeung Pang (2020). Software Engineering for Agile Application Development.*** IGI Global.

Course Outcomes:

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

CO1: Acquire knowledge for taking an Agile approach to software development and analyzeSCRUM framework and tools for Agile project management.

CO2: ApplyTestingusing Test Driven Development and refactoring to achieve Agility.

CO3: Analyze the role of approach in industry.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	M	M	M	M	M	M	-	-	-	-	-	M
CO2	H	M	M	H	M	L	-	-	-	-	-	M
CO3	M	M	M	M	M	M	-	-	-	-	-	M

Full Stack Software Development

PE 1	Hours of Instruction /week: 3T
Semester VI	No. of credits: 3
21BEOE07	

Prerequisite:
- Python Programming, Web Technology

Objectives:

    CLO1: To apply the concepts of python in web development.
    CLO2: To acquire skills and knowledge of web development.

UNIT I   Object Oriented Approach in Python   9

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading –Customizing Behavior Methods – Constructors – Polymorphism – Inheritance.

UNIT II   User Interface Applications in Python and Version Control   9
               System

Wxpython installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics – Collaborative Version Control Systems – GitCommands – Real Time Usage of Git Commands.

UNIT III   Flask Framework for Web Development   9

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules –Connection with Databases – Relational Database versus NoSQL – Modeling – MappingClasses to Mongodb – Building Data Layer with Mongo Engine.

UNIT IV   Real Time Deployment of Web Application   9

Deploy Web Applications with Flask and MongoDB – Example Applications – Blogs –Forums – Auto Evaluation of Student Assignments – Deployment Using AWS or GoogleCloud or Heroku.

UNIT V   Deployment of Software in Linux and Windows Platform   9

Deployment in Ubuntu Distribution – Creation of .Deb Executable File – Deployment inWindows – Creation of Standalone Executable – Test Cases.

               Total Hours: 45

References:
1. *Mark Lutz. (2013). Learning Python. Fifth Edition*. O' Reilly.
2. *Scott Chacon and Ben Straub. (2016).Pro Git. Free e-book under Creative commons, Second Edition.*Apress.
3. *Miguel Grinberg. (2014).* **Flask Web Development Developing Web Applications with Python.**O'Reilly.
4. http://zetcode.com/wxpython/

Course Outcomes:

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

CO1: Identify the object oriented approach and GUI applications in Python.
CO2: Deploy the developed web application using Flask in real time scenarios such as AWS.
CO3: Analyze the deployment of Software in Linux and Windows Platform

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	M	M	M	M	M	-	-	-	-	-	M
CO2	M	H	H	M	M	L	-	-	-	-	-	M
CO3	M	M	M	M	M	M	-	-	-	-	-	L

Block Chain

Prerequisite:
- Data Structures, Distributed Systems, Cryptography and Network Security

Objectives:
CLO1: To understand Blockchain's fundamental components, and examine Decentralization using blockchain.
CLO2: To gain knowledge on Emerging Trends in block chain.

UNIT I   Introduction to Blockchain   9
History of Blockchain – Types of Blockchain – Consensus – Decentralization usingBlockchain – Blockchain and Full Ecosystem Decentralization – Platforms forDecentralization.

UNIT II   Introduction to Cryptocurrency   9
Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks andPayments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations –Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts.

UNIT III   Ethereum   9
The Ethereum Network – Components of Ethereum Ecosystem – Ethereum ProgrammingLanguages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – SupportingProtocols – Solidity Language.

UNIT IV   Web3 and Hyperledger   9
Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks– Hyper ledger as a Protocol – The Reference Architecture – Hyper ledger Fabric –Distributed Ledger – Corda.

UNIT V   Alternative Blockchains and Next Emerging Trends   9
Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

Total Hours: 45

References:
1. *Imran Bashir (2018).Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained.*SecondEditionPacket Publishing.
2. *Draft version of S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan(2019).Blockchain Technology: Cryptocurrency and Applications*. Oxford University Press
3. *Josh Thompson(2017).Blockchain: The Blockchain for Beginnings, Guild to Block chain Technology and Blockchain Programming*.Create Space Independent Publishing Platform

Course Outcomes:

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

CO1: Identify the technology components of Blockchain and how it works behind the Scenes.

CO2: Devise solution using the Ethereum model.

CO3: Apply Hyperledger and its development framework in emerging trends.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	H	M	H	H	M	-	-	-	-	-	M
CO2	H	H	M	H	H	L	-	-	-	-	-	M
CO3	M	H	H	H	H	H	-	-	-	-	-	H

Virtual and Augmented Reality

PE 1   **Hours of Instruction /week: 3T**
Semester VI   **No.of credits: 3**
21BEOE09

Pre-requisite:
- Computer Vision

Objectives:

CLO1: To know the basic concepts of virtual reality and understand visual computation in computer graphics.

CLO2: To familiarize the interaction between system and computer and to know basic concepts of augmented reality.

UNIT I   Introduction of Virtual Reality   9

Fundamental Concept and Components of Virtual Reality - Primary Features and Present Development on Virtual Reality - Multiple Models of Input and Output Interface in Virtual Reality: Input - Tracker - Sensor - Digital Glove - Movement Capture - Video-based Input - 3D Menus & 3DScanner – Output - Visual /Auditory / Haptic Devices.

UNIT II   Visual Computation in Virtual Reality   9

Fundamentals of Computer Graphics - Software and Hardware Technology on Stereoscopic Display - Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.

UNIT III   Interactive Techniques in Virtual Reality   9

Body Track - Hand Gesture - 3D Manus - Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega - MultiGen - Virtools.

UNIT IV   Application of VR in Digital Entertainment   9

VR Technology in Film & TV Production - VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR.

UNIT V   Augmented and Mixed Reality   9

Taxonomy - technology and features of augmented reality - difference between AR and VR - Challenges with AR - AR systems and functionality - Augmented reality methods - visualization techniques for augmented reality - wireless displays in educational augmented reality applications - mobile projection interfaces - marker-less tracking for augmented reality - enhancing interactivity in AR environments - evaluating AR systems.

Total Hours: 45

References:
1. *Alan B. Craig (2013). Understanding Augmented Reality, Concepts and Applications,*Morgan Kaufmann.
2. *Alan Craig,William Sherman, Jeffrey Will* (2009).**Developing Virtual Reality Applications**, **Foundations of Effective Design**. Morgan Kaufmann.
3. *Burdea, G. C., P. Coffet*(2006).*Virtual Reality Technology*. Second Edition, Wiley-IEEE Press
4. *M. Claudia tom Dieck, Timothy Jung (2019). Augmented Reality and Virtual RealityThe Power of AR and VR for Business.* Springer International Publishing

Course Outcomes:

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

CO1: Explain the various issues in Augmented Reality and Virtual Reality.
CO2: Identify the basic concept and framework of virtual reality.
CO3: Analyze the computer-human interaction.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	-	-	-	-	-	M	-	L
CO2	M	M	L	-	M	-	-	-	-	-	-	L
CO3	M	H	M	M	-	-	M	-	-	-	-	L

Internet of Things and Applications

PE 1	**Hours of Instruction /week: 3T**
Semester VII	**No. of credits:3**
21BEOE10	

Pre-requisite:
- Computer Networks, Microprocessor and Microcontrollers

Objectives:

CLO1: To explore the architecture and protocols in Internet of Things.

CLO2: To analyse IoT applications using various protocols and communication standards.

UNIT I   Overview   9

IoT - An Architectural Overview – Building architecture - Main design principles and needed capabilities - An IoT architecture outline - standards considerations. 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 II   Reference Architecture   9

IoT Architecture-State of the Art – Introduction, State of the art – Reference Model and architecture – IoT Reference Model - 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.

UNIT III   Physical and Mac Layer Protocols   9

IoT Access Technologies: Physical and MAC layers – topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN

UNIT IV   Network and Application Layer Protocols   9

Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo – Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT V   Case Studies / Industrial Applications   9

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

Total Hours: 45

References:

1 *Jan Holler. VlasiosTsiatsis. Catherine Mulligan. Stefan Aves and StamatisKarnouskos, David Boyle (2014).From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence*. First Edition, Academic Press.

2 *Peter Waher. Learning Internet of Things (2013)*. PACKT publishing-Birmingham – Mumbai.

3 *Bernd Scholz-Reiter, Florian Michahelles (2013). Architecting the Internet of Things*. ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2-Springer**.**

4 *Vijay Madisetti and ArshdeepBahga. Internet of Things (A Hands-on-Approach) (2014).*First Edition-VPT.

Course Outcomes:

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

CO1: Classify M2M communication methods and protocols needed for IoT Technology.

CO2: Examine IoT Reference Architecture and make use of appropriate IoT protocols for various applications.

CO3: Design and Analyze the challenges in developing industrial applications for IoT.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	-	-	-	-	-	-	-	-	L
CO2	M	H	M	H	M	-	-	-	-	L	-	M
CO3	M	M	H	L	M	-	-	-	-	M	-	M

Information Security

PE 1	Hours of Instruction /week: 3T
Semester VII	No.of credits: 3
21BEOE11	

Pre-requisite:
- Computer Networks, Cryptography and Network security

Objectives:
CLO1: To understand the basics of information security.
CLO2: To learn the Protection Mechanisms in a Trusted Computing.

UNIT I   Introduction   9
Growing IT Security Importance and New Career Opportunities – Becoming an Information Security Specialist – Conceptualizing Information Security – Information Security Principles of Success.

UNIT II   Governance and Risk Management   9
Introduction – Security Policies Set the stage for Success – Four Types of Policies – Developing and Managing Security Policies –Providing Policy Support Documents – Suggested Standards Taxonomy – Security Architecture and Design : Introduction – Defining the Trust Computing Base – Protection Mechanisms in a Trusted Computing- Base – System Security Assurance Concepts.

**UNIT III   Business Continuity Planning And Disaster Recovery Planning &   9
                    Laws**
Overview of the Business Continuity Planning - Disaster Recovery Planning– Introduction to Laws , Investigations and Ethics – Types of Computer Crimes – How Cyber Criminals Commit Crimes – The Computer and the Law – Intellectual Property Law – Privacy and the Law – Computer Forensics – The Information Security Professionals Code of Ethics – Other Ethics Standards.

UNIT IV   Physical Security Control & Operations Security   9
Introduction – Understanding the Physical Security Domain – Physical Security Threats – Providing Physical Security – Introduction to Operations Security – Operations Security Principles – Operations Security Process Controls – Operations Security Controls in Action.

UNIT V   Access Control Systems & Cryptography   9
Introduction – Terms and Concepts – Principles of Authentication – Biometrics – Single Sign-On – Remote User Access and Authentication – Introduction to Cryptography – Applying Cryptography to Information Systems – Basic Terms and Concepts – Strength of Cryptosystems – Putting the Pieces to Work – Examining Digital Cryptography.

Total Hours   45

References:
1 *Mark Merkow and Jim Breithaupt (2007).Information Security: Principles and Practices.* Pearson Education
2 *Matt Bishop (2006).Computer Security: Art and Science.* Pearson Education
3 *Mark Rhodes-Ousley (2013).The Complete Reference -Information Security*. Second Edition. Mc Graw Hill Education,
4 **Michael E.** *Whitman* **and. Herbert J. Mattord.** *Principles of Information Security,*Vice President Editorial, Career Education &. Training Solutions, Fourth Edition.

Course Outcomes:

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

CO1: Discuss the IT Security principles and risk management concepts.
CO2:   Identify the Business continuity planning and disaster recovery planning & laws
CO3: Analyze various security threats and access control mechanism

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	L	L	-	-	-	-	-	L	-	L
CO2	M	M	M	M	-	M	L	-	-	-	-	L
CO3	M	H	M	M	L	-	-	-	M	L	M	L

Artificial Neural Network and Deep Learning

PE 1	Hours of Instruction /week: 3T
Semester VII	No.of credits: 3
21BEOE12	

Pre-requisite:
- Artificial Intelligence.

Objectives:

CLO1: To learn the concepts of neural networks and deep learning for solving real life problems

CLO2: To acquire knowledge on the applications of deep learning in various scenarios.

UNIT I   Introduction to Deep Learning   9

Introduction to Deep Learning: Basics: Biological Neuron, Idea of computational units – McCulloch– Pitts unit and Thresholding logic -Linear Perceptron -Perceptron Learning Algorithm -Linear separability. Convergence theorem for Perceptron Learning Algorithm.

UNIT II   Feedforward   9

Feed forward Networks: Multilayer Perceptron -Gradient Descent -Back propagation - Empirical Risk Minimization – regularization -auto encoders.

UNIT III   Convolutional Networks   9

The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet

UNIT IV   Recurrent Neural Networks   9

Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs

UNIT V   Deep Generative Models and Applications   9

Boltzmann Machines - Restricted Boltzmann Machines - Introduction to MCMC and Gibbs Sampling- gradient computations in RBMs - Deep Belief Networks- Deep Boltzmann Machines-Applications:Large-Scale Deep Learning-Computer -Speech Recognition - Natural Language Processing - Other Applications

Total Hours: 45

References:
1. *Ian Good fellow, YoshuaBengio and AaronCourville (2016).Deep Learning*. MIT Press.
2. *N.D.Lewis (2016).Deep Learning Made Easy with R: A Gentle Introduction for Data Science.* Createspace Independent Publishing Platform.
3. *Nikhil Buduma (2017) .Fundamentals of Deep Learning: Designing Next-Generation Machine IntelligenceAlgorithms*.O'Reilly publications.

Course Outcomes:

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

CO1: Describe a Neural Networks using Linear Perceptron and Convolutional Neural Networks using Tensor Flow.

CO2: Analyze and apply various neurons and memory augmented techniques in deep learning Computers.

CO3: Acquire knowledge in deep reinforcement learning and implement deep learning algorithms for real time applications.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	H	M	M	-	-	-	-	-	-	-	M
CO2	M	M	M	L	-	-	-	-	-	-	-	M
CO3	M	M	M	L	-	-	-	-	-	-	-	H

High Performance Computing

PE 2 **Hours of Instruction /week:** 3T
Semester V **No. of credits:** 3
21BEOE21

Prerequisite:
- Computer Architecture

Objectives:
> **CLO1:** To use HPC platforms and parallel programming models.
> **CLO2:** To assess the performance of HPC applications and their supporting hardware..

UNIT I Graphics Processing Units 9
Functional units- Basic operational concepts- Bus structures- Memory locations and addresses- Instruction and instruction sequencing- Addressing modes and Assembly language.

UNIT II GPGPU Programming 9
Vector Addition- Matrix Multiplication algorithms.1D - 2D and 3D Stencil Operations. Image Processing algorithms – Image Blur-Gray scaling. Histogramming – Convolution – Scan-Reduction techniques

UNIT III Integrated Cores 9
Introduction to Many Integrated Cores. MIC - Xeon Phi architecture. Thread hierarchy. Memory Hierarchy. Memory Bandwidth and performance considerations.

UNIT IV Shared Memory Parallel Programming 9
Symmetric and Distributed architectures. OpenMP - Thread creation- Parallel regions. Worksharing – Synchronization

UNIT V Message Passing Interface 9
Secondary storage Multicore Processors- Centralized and Distributed shared-memory architecture- Cluster computers- Accessing I/O devices – Interrupts- Direct Memory AccessHPE Moonshot

Total Hours: 45

References:
1. *Wen-Mei W Hwu. David B Kirk (2013). Programming Massively Parallel Processor. A Hands-on Approach. Third Edition,* Morgann Kaufmann Publisher*.*
2. *Robert Robey, Yuliana Zamora (2021). Parallel and High-Performance Computing.* Manning
3. *RezaurRahman(2013).Intel Xeon Phi Coprocessor Architecture and Tools.*Apress Open.
4. *Barbara Chapman(2008).Gabriele Jost, Ruud van der Pas.UsingOpenMP.*MIT Press*.*

Course Outcomes:

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

CO1: Design, formulate, solve and implement high performance versions of standard single threaded algorithms.

CO2: Demonstrate the architectural features in the GPU and MIC hardware accelerators.

CO3: Design programs to extract maximum performance in a multicore, shared memory execution environment processor.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	M	M	H	M	M	-	-	-	M	M	-	L
CO2	M	H	H	M	M	-	-	-	L	M	-	L
CO3	M	H	H	M	H	-	-	-	M	-	-	L

Image and Video Processing

PE 2   **Hours of Instruction /week:** **3T**
Semester VII   **No. of credits:**   **3**
21BEOE22

Prerequisite:
- Probability and linear algebra

Objectives:

CLO1: To learn the basic principles and tools used to process images and videos

CLO2: To apply appropriate techniques to real problems in image and video analysis.

UNIT I   Fundamentals of Image processing and Image Transforms   9

Basic steps of Image processing system sampling and quantization of an Image – Image Transforms 2 –D Discrete Fourier Transform- Discrete Cosine Transform (DCT) - Discrete Wavelet transforms

UNIT II   Image Processing Techniques   9

Image Enhancement: Spatial Domain methods: Histogram Processing- Fundamentals of Spatial Filtering-Smoothing Spatial filters-Sharpening- Spatial filters- Frequency Domain methods: Basics of filtering in frequency domain- image smoothing- image sharpening- selective filtering- Image Segmentation: Segmentation concepts- point- line and Edge detection-Thresholding- region based segmentation

UNIT III   Image Compression   9

Image compression fundamentals –coding redundancy- spatial and temporal redundancy. Compression models: Lossy and Lossless-Huffmann coding-Arithmetic coding-LZW coding-run length coding-Bit Plane coding-transform coding-predictive coding-wavelet coding-JPEG standards

UNIT IV   Video Processing   9

Analog video- Digital Video-Time varying Image Formation models: 3D motion models-Geometric Image formation-Photometric Image formation-sampling of video signals-filtering operations

UNIT V   2-D Motion Estimation   9

Optical flow-general methodologies-pixel based motion estimation-Block matching algorithm-Mesh based motion Estimation-global Motion Estimation-Region based motion estimation-multi resolution motion estimation. Waveform based coding-Block based transform coding-predictive coding-Application of motion estimation in video coding

Total Hours: 45

References:
1. ***Gonzales and Woods(2018).Digital Image Processing.*** Fourth Edition. Pearson Education.
2. ***A. Murat Tekalp (2015).Digital Video Processing.*** Pearson Education.
3. ***Yao wang, JoemOstarmann and Yaquin Zhang (2011).Video Processing and Communication.*** First Edition. Prentice Hall of India.
4. ***S.Shridhar(2016). Digital Image Processing.*** Oxford University Press.

Course Outcomes:

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

CO1: Compare the basics and fundamentals of digital image processing and video processing techniques such as digitization, sampling, quantization, and 2D-transforms.

CO2: Analyze the images using the techniques of smoothing, sharpening and enhancement.

CO3: Discuss the basics of segmentation, features extraction, compression and recognition methods for color models and explain 2-D Motion estimation techniques.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	M	M	-	M	-	-	L	H	L
CO2	H	M	M	M	M	-	M	-	-	L	M	L
CO3	M	M	M	M	M	-	-	-	-	L	-	L

Edge Computing

PE 2	**Hours of Instruction /week:** 3T
Semester V	**No. of credits:** 3
21BEOE23	

Prerequisite:
- Computer Networks

Objectives:

    CLO1: To understand the edge computing, purpose and architecture
    CLO2: To explore research, frameworks, and applications in Edge Computing.

UNIT I   Computing Paradigms   9

Introduction- Major Impacts of Computing - Parallel Computing- Distributed Computing - Cluster Computing - Utility Computing - Grid Computing - Cloud Computing– Other Computing Paradigms :Ubiquitous Computing - Jungle Computing - Fog Computing - Osmotic Computing - Data Centre Technology - Edge Data Centres.

UNIT II   Edge Computing Architecture   9

IoT Architecture and Core IoT Modules - A connected ecosystem, IoT versus machine – to -machine versus – SCADA - The value of a network and Metcalfe's and Beckstrom's laws IoT and edge architecture - Role of an architect - Understanding Implementations with examples - Example use case and deployment - Case study – Telemedicine palliative care Requirements – Implementation - Use case retrospective.

UNIT III   Edge Analytics and Edge Data Storage Security   9

Edge Data Analytics - Potential of Edge Analytics - Architecture of Edge Analytics - Machine Learning for Edge Devices - Data Security - Data Confidentiality – Authentication- Privacy-Preserving Schemes - Edge-Based Attack Detection and Prevention

UNIT IV   Edge Computing Technologies   9

Edge computing: ecosystem and players - Computing and networking collaborations for edge computing - Collaboration between edge computing and networks - Edge computing and PON - Edge computing and software-defined technology

UNIT V   Applications   9

Edge Computing with Blockchain - Edge Computing in Healthcare - Edge Computing/Analytics in Industrial IOT - Edge Computing High-Potential Use Cases :Autonomous Vehicles - Smart Cities. - Industrial Automation

                                                  Total Hours: 45

References:

1. *K. AnithaKumari, G. Sudha Sadasivam, D. Dharani, and M. Niranjanamurthy (2021). Edge Computing Fundamentals, Advances and Applications*, CRC Press
2. *Javid Taheri, Shuiguang Deng (2020). Edge Computing: Models, technologies and applications.* Institution of Engineering & Technology.
3. *Alex Marcham (2021). Understanding Infrastructure Edge Computing: Concepts, Technologies, and Considerations.* Wiley

Course Outcomes:

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

CO1: Explain the Edge Computing, definition, use case architecture and its core concepts

CO2: Identify Edge Analytics and Edge Data Storage Security

CO3: Analyze the technologies and applications of edge computing.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	-	-	M	-	-	M	-	-	L
CO2	M	M	M	-	M	M	-	-	H	-	-	L
CO3	M	M	H	M	M	-	-	-	M	-	-	-

Web Analytics and Development

PE 2	**Hours of Instruction /week:** 3T
Semester VII	**No. of credits:** 3
21BEOE24	

Prerequisite:
- Web Technology

Objectives:

   CLO1: To understand core research communities, publications, focused on web.
   CLO2: To apply social media using web analytics tools

UNIT I   Introduction   9

Introduction – Social network and Web data and methods - Graph and Matrices - Basic measures for individuals and networks - Information Visualization.

UNIT II   Web Analytics tools   9

Web Analytics tools:Click Stream Analysis - A/B testing - Online Survey.

UNIT III   Web Search and Retrieval   9

Web Search and Retrieval:Search Engine Optimization - Web Crawling and indexing - Ranking Algorithms - Web traffic models.

UNIT IV   Making Connection   9

Making Connection: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity.

UNIT V   Connection   9

Connection:Connection Search, Collapse, Robustness Social involvements and diffusion of innovation.

              Total Hours: 45

References:

1. ***Hansen, Derek, Ben Sheiderman, Marc Smith (2011)***. ***Analyzing Social Media Networks with NodeXL: Insights from a Connected World***. Morgan Kaufmann.
2. ***Avinash Kaushik(2009).Web Analytics 2.0: The Art of Online Accountability.*** Wiley
3. ***Avinash Kaushik (2007). Web Analytics: An Hour a Day.*** Wiley

Course Outcomes:

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

CO1: Become familiar with basic concepts of social media and analyze the web analytics tools.
CO2: Explore the knowledge of web crawling, indexing, ranking and model the web traffic.
CO3: Apply the concepts of connections in web analytics

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	M	-	M	-	-	-	M	-	-
CO2	H	H	M	-	M	-	-	-	M	M	M	-
CO3	M	M	M	-	M	-	-	-	-	M	L	-

Human Computer Interaction

PE 2	**Hours of Instruction /week:** 3T
Semester VI	**No. of credits:** 3
21BEOE25	

Prerequisite:
- Artificial Intelligence

Objectives:

CLO1: To learn basic of Human Computer Interaction and its design Technologies.

CLO2: To analyze and identify user models, user support, socio-organizational issues and stakeholder requirements of HCI systems.

UNIT I   Foundations of HCI   9

Human: I/O channels – Memory – Reasoning and problem solving-The Computer-Devices – Memory – processing and networks. Interaction. Models – frameworks – Ergonomics – styles – elements – interactivity – Paradigms - Case Studies

UNIT II   Design & Software Process   9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration andPrototyping.HCI in software process.Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles – standards – guidelines-rules. Evaluation Techniques – Universal Design

UNIT III   Model and Theories   9

HCI Models-Cognitive models – Socio-Organizational issues and stakeholder requirements – Communication and collaboration models – Hypertext-Multimedia and WWW.

UNIT IV   Mobile HCI 9 Mobile Ecosystem   9

Platforms-Application frameworks-Types of Mobile Applications – Widgets –Applications – Games- Mobile Information Architecture-Mobile 2.0-Mobile Design-Elements of Mobile Design Tools - Case Studies

UNIT V   Web Interface Design   9

Designing Web Interfaces – Drag & Drop-Direct Selection-Contextual Tools – Overlays-Inlays and Virtual Pages-Process Flow - Case Studies

Total Hours: 45

References:
1. *Alan Dix. JanetFinlay. Gregory Abowd and Russell Beale(2012).Human Computer Interaction*.Third Edition. Tata McGraw Hill.
2. *Brian Fling(2009).Mobile Design and Development.*FirstEdition.O'Reilly Media Inc.
3. *Bill Scott and Theresa Neil (2013). Designing Web Interfaces*.First Edition. O'Reilly.
4. *M.G. Helander(2014). Handbook of Human-Computer Interaction.* Elsevier Science

Course Outcomes:

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

CO1: Acquire knowledge in foundation of HCI and design effective dialog for HCI.

CO2: Design effective HCI for individuals and persons with disabilities and assess the importance of user feedback.

CO3: Outline the HCI implications for designing multimedia/ ecommerce/ e-learning Websites and develop meaningful user interface**.**

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	M	M	-	-	-	-	-	-	L
CO2	M	M	H	M	M	-	-	-	-	-	M	-
CO3	M	M	L	L	-	M	-	-	-	-	-	M

Object Oriented Analysis and Design

PE 2	Hours of Instruction /week:	3T
Semester VII	No. of credits:	3
21BEOE26		

Prerequisite:
- C Programming, Software Engineering

Objectives:

CLO1: To understand the basic concepts of Object, Classes and Inheritance.

CLO2: To gain knowledge in UML notations effectively for the design of object oriented systems.

UNIT I   Introduction   9

An Overview of Object-Oriented Systems Development-Object Basics-Objects-Objects are Grouped in Classes-Attributes-Object Behaviour and Methods-Objects Respond to Messages-Encapsulation and Information Hiding-Class Hierarchy-Polymorphism-Relationships and Associations-Aggregations and Object Containment-Object-Oriented Systems Development Life Cycle-Software Development Process-Building High-Quality Software-Use-Case Driven Approach.

UNIT II   Methodology,Modelling and UML   9

Object-Oriented Methodologies-Introduction-Rumbaugh et al's Object Modelling Technique-Booch Methodology-Jacobson et al. Methodologies-Patterns-Frameworks-Unified Approach-Unified Modelling Language-Introduction-Static and Dynamic Models-UML Diagrams-UML Class Diagrams-Use-Case Diagrams-UML Dynamic Modelling-Model Management-UML Extensibility-UML Meta-Model.

UNIT III   Object Oriented Analysis   9

Object-Oriented Analysis Process-Business Object Analysis-Use-Case Driven Object-Oriented Analysis-Business Process Modelling-Use-Case Model-Developing Effective Documentation--Classifications Theory-Approaches for Identifying Classes-Noun Phrase Approach-Common Class Patterns Approach-Use-Case Driven Approach-Classes-Responsibilities and Collaborators-Naming Classes.

UNIT IV   Object Oriented Analysis and Design   9

Identifying Object Relationships- Attributes and Methods –Associations-Super-Sub Class Relationships-A-Part-of Relationships-Aggregation-Case Study-Class Responsibility-Attributes for Bank Objects-Object Responsibility-Methods for Bank Objects-Object-Oriented Design Process and Design Axioms-Corollaries-Design Patterns.

UNIT V   Designing Classes and Access Layer   9

Object-Oriented Design-UML Object Constraint Language-Class Visibility-Refining Attributes-Designing Methods and Protocols-Packages and Managing Classes-Object Storage and Object Interoperability-Object Store and Persistence-Database Management Systems-Logical and Physical Database Organization and Access Control-Distributed Databases and Client-Server Computing-Distributed Objects Computing-Object-Oriented Database Management Systems-Object-Relational Systems-Multi-database Systems-Designing Access Layer Classes-Case Study.

Total Hours: 45

References:
1. ***Bahrami Ali (2012). Object Oriented Systems Development.*** McGraw-Hill Professional.
2. ***Gandharba Swain (2010). Object Oriented Analysis and Design through Unified ModelingLanguage.***Laxmi Publications Ltd.
3. ***Raul Sidnei Wazlawick (2014). Object Oriented Analysis and Design for Information Systems: Modeling with UML, OCL and IFML***. Elsevier
4. ***K.Venugopal Reddy, Sampath Korra (2018). Object -Oriented Analysis and Design Using UML.*** BS Publications

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

CO1: Apply OO concepts to design software applications.
CO2: Explore the UML diagram in designing a software
CO3: Transform UML based software design into pattern-based design using design patterns.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	H	H	M	-	M	M	M	-	M
CO2	M	H	H	M	H	-	-	M	M	M	-	M
CO3	M	M	H	H	H	-	-	M	M	M	-	M

Robotics Technology

PE 2	**Hours of Instruction /week: 3T**
Semester VI	**No. of credits: 3**
21BEOE27	

Prerequisite:
- Artificial Intelligence

Objectives:
CLO1: To learn the concepts of Robotic system, its components and control related to robotics
CLO2: To provide knowledge on the sensor requirements, Micro/Nano robotics system and application of robotics

UNIT I   Introduction   9
Robot anatomy – Definition - law of robotics - History and Terminology of Robotics - Accuracy and repeatability of Robotics - Simple problems Specifications of Robot - Speed of Robot - Robot joints and links - Robot classifications - Architecture of robotic systems - Robot Drive systems Hydraulic - Pneumatic and Electric system.

UNIT II   End Effectors and Robot Controls   9
Mechanical grippers - Slider crank mechanism - Screw type - Rotary actuators - am type- Magnetic grippers - Vacuum grippers - Air operated grippers - Gripper force analysis - Gripper design - Simple problems - Robot controls - Point to point control - Continuous path control - Intelligent robot - Control system for robot joint - Control actions - Feedback devices – Encoder – Resolver – LVDT - Motion Interpolations - Adaptive control.

UNIT III   Robot Transformations and Sensors   9
Robot kinematics - Types - 2D - 3D Transformation – Scaling – Rotation – Translation - Homogeneous coordinates - multiple transformation - Simple problems. Sensors in robot – Touch sensors - Tactile sensor – Proximity and range sensors – Robotic vision sensor - Force sensor - Light sensors - Pressures ensures

UNIT IV   Robot Cell Design and Applications   9
Robot work cell design and control - Sequence control - Operator interface - Safety monitoring devices in Robot - Mobile robot working principle - actuation using MATLAB -NXT Software Introductions - Robot applications Material handling - Machine loading and unloading - assembly – Inspection –Welding - Spray painting and undersea robot.

UNIT V   Micro/Nano Robotics System   9
Micro/Nano robotics system overview - Scaling effect - Top down and bottom-up approach - Actuators of Micro/Nano robotics system - Nano robot communication techniques - Fabrication of micro/nano grippers - Wall climbing micro robot working principles - Biomimetic robot - Swarm robot - Nano robot in targeted drug delivery system.

Total Hours: 45

References:
1. ***S.R. Deb(2009). Robotics Technology and Flexible Automation.*** Second Edition. Tata McGraw-Hill Education.
2. ***Mikell P Groover& Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, AshishDutta(2012).Industrial Robotics- Technology Programming and Applications.***McGraw Hill.
3. ***Richard D. Klafter, Thomas. A, ChriElewski, Michael Negin(2011).Robotics Engineering an Integrated Approach.*** PHI Learning.
4. ***Carl D. Crane and Joseph Duffy (2008). Kinematic Analysis of Robot manipulators***. Cambridge University Press.

Course Outcomes:

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

CO1: Analyze the end effectors and robot controls to interact with real time environment.

CO2: Apply the Robot Transformations, Design and Sensors using MATLAB

CO3: Demonstrate the Micro/Nano robotic systems.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	H	M	-	-	M	L	-	M
CO2	H	H	M	H	H	L	-	-	L	M	-	M
CO3	M	H	H	H	H	H	-	-	L	M	-	H

<center>**Computational Intelligence**</center>

PE 2	**Hours of Instruction /week: 3T**
Semester VI	**No. of credits: 3**
21BEOE28	

Prerequisite:
- Artificial Intelligence, Soft Computing

Objectives:
CLO1: To provide a strong foundation on fundamental concepts in Computational Intelligence and apply these techniques in applications which involve perception, reasoning and learning.
CLO2: To learn about introduction of evolutionary computation, Genetic Algorithm and Optimization techniques.

UNIT I   Introduction   9
Historical development of Evolutionary Computation (EC) – Features of EC – Classification of EC - Advantages – Application Areas – Computational Intelligence Development.

UNIT II   Simulated Annealing   9
Introduction – Annealing schedule – Pseudo code – Parameter selection – Applications

UNIT III   Evolutionary Computation Theory   9
Overview - Genetic Algorithm (GA)– Simple Example Problem – Programming – Strategies – Genetic Programming – Implementation of Genetic Algorithm - Classification of GA – Applications.

UNIT IV   Ant Colony Optimization   9
Introduction – From real to artificial ants- Theoretical considerations – Convergence proofs – principles of ACO-ACO Algorithm – ACO and model-based search –Application.

UNIT V   Particle Swarm Optimization   9
Introduction – Principles of bird flocking and fish schooling – Evolution of PSO – Operating principles – PSO Algorithm – Neighborhood Topologies – Convergence criteria – Applications of PSO.

<div align="right">**Total Hours: 45**</div>

References:
1. *Andries P. Engelbrecht (2007).Computational Intelligence: An Introduction.*Second Edition.Wiley India (P) Ltd.
2. *S.Rajasekaran and G.A.V.Pai(2011).Neural Networks, Fuzzy Logic and Genetic Algorithms.*Prentice Hall of India.
3. *AmitKonar. (2005).Computational Intelligence: Principles Techniques and Applications.*Springer International Edition.
4. *S.N.Sivanandam and S.N.Deepa(2018).Principles of Soft Computing.* Third Edition.Wiley India (P) Ltd.

Course Outcomes:

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

CO1: Apply the concept of Computational Intelligence in various applications and howit is implemented in simulated Annealing.

CO2: Acquire the Knowledge genetic algorithm for a given problem in Evolution Computation Theory.

CO3: Implement the concepts of Ant Colony Optimization for a given problem and make use of the concepts of Particle Swarm Optimization to solve problems.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	H	M	-	-	-	-	-	M
CO2	H	H	M	H	H	L	-	-	-	-	-	M
CO3	M	H	H	H	H	H	-	-	-	-	-	H

Big Data Security

PE 2	**Hours of Instruction /week:** **3T**
Semester VI	**No. of credits:** **3**
21BEOE29	

Prerequisite:
- Big Data

Objectives:

CLO1: To understand the different technologies involved in securing and protecting the data.

CLO2: To explore authentication approaches, working with Kerberos, and securing Hadoop Clusters in order to organize data and keep it safe and secure.

UNIT I   Big Data Privacy, Ethics and Security   9

Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self-regulating –Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security.

UNIT II   Security, Compliance, Auditing, and Protection   9

Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems.

UNIT III   Hadoop Security Design   9

Kerberos – Default Hadoop Model without security - Hadoop Kerberos Security Implementation & Configuration.

UNIT IV   Hadoop Ecosystem Security   9

Configuring Kerberos for Hadoop ecosystem components – Pig, Hive, Oozie, Flume, HBase, Sqoop.

UNIT V   Data Security & Event Logging   9

Integrating Hadoop with Enterprise Security Systems - Securing Sensitive Data in Hadoop – SIEM system – Setting up audit logging in hadoop cluster

Total Hours: 45

References:

1. ***Indradip Banerjee, Shibakali Gupta, Siddhartha Bhattacharyya (2019). Big Data Security.*** Walter De Gruyter Publisher.
2. ***Ben Spivey, Joey Echeverria (2015). Hadoop Security Protecting Your Big Data Problem.*** O'Reilly Media.
3. ***Mark Van Rijmenam (2014). Think Bigger: Developing a Successful Big Data Strategy for Your Business. 1st Edition. Amazon***
4. ***SherifSakr (2014). Large Scale and Big Data: Processing and Management.*** CRC Press.
5. ***Sudeesh Narayanan (2013). Securing Hadoop.*** Packt Publishing

Course Outcomes:

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

CO1: Explain the significance of privacy, ethics in big data environment and the Intellectual Property Challenge

CO2: Analyze the steps to secure big data and Build security in Hadoop Kerberos

CO3: Outline security in Hadoop environment and its ecosystem and analyze data security and event logging

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12
CO1	M	M	M	M	M	-	M	-	M	L	-	L
CO2	M	M	M	M	-	-	M	-	M	-	-	L
CO3	M	H	M	M	-	-	M	-	L	-	-	L

Computer Vision

PE 2	**Hours of Instruction /week:** 3T
Semester VII	**No. of credits:** 3
21BEOE30	

Prerequisite:
- Image Processing, Linear Algebra, Probability

Objectives:

CLO1: To Understand the foundation of image mating, composting, editing and various camera parameters to grasp the principles of match moving and motion capture.

CLO2: To describe basic methods of Computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.

UNIT I   Introduction and Image Matting   9

Introduction – Computer Vision for Visual Effects – Matting Terminology – Blue–Screen – Green-Screen and Difference Matting – Bayesian Matting – Closed-Form Matting – Markov Random Fields for Matting – Random-Walk Methods – Poisson Matting – Hard-Segmentation-Based Matting – Video Matting – Matting Extensions.

UNIT II   Image Composition and Editing, Features and Matching   9

Compositing Hard-Edged Pieces – Poisson Image Editing – Graph-Cut Compositing – Image Inpainting –Image Retargeting and Recompositing - Video Recompositing – Inpainting and Retargeting - Feature Detectors – Feature Descriptors – Evaluating Detectors and Descriptors – Color Detectors and Descriptors – Artificial Markers.

UNIT III   Match moving and Motion Capture   9

Feature Tracking for Match moving – Camera Parameters and Image Formation – Single Camera Calibration- Extension of Match moving - Environment – Marker Acquisition and Clean-up – Forward Kinematics and Pose Parameterization – Inverse Kinematics – Motion Editing – Facial Motion Capture – Markless Motion Capture.

UNIT IV   Three-Dimensional Data Acquisition   9

Light Detection and Ranging (LiDAR) – Structured Light Scanning – Multi-View Stereo – Registering 3D Datasets – Triangulation-Based Approaches to Three-Dimensional Scene Reconstruction – Three Dimensional Pose Estimation and Segmentation Methods.

UNIT V   Methods of 3D Computer Vision   9

Intensity based and polarisation based approaches to 3d scene reconstruction – Shape from Shadow – Shape from Shading – Photometric Stereo – Shape from Polarisation – Point Spread Function Based Approaches to 3D Scene Reconstruction – The Point Spread Function – Reconstruction of Depth from Defocus –Reconstruction of Depth from Focus.

Total Hours: 45

References:

1. ***Richard J Radke (2013). Computer Vision for Visual effects.*** First Edition Cambridge University Press.
2. ***Christian Wohler(2013). 3D Computer Vision***. Second Edition. Springer.
3. ***Mark Nixon and Alberto S. Aquado (2012). Feature Extraction & Image Processing forComputer Vision***. Third Edition. Academic Press.
4. ***Ethem Alpaydin (2014). Introduction to Machine Learning. Third Edition. MIT Press.***
5. ***Amar Mitiche and J.K. Aggarwal(2013). Computer Vision Analysis of Image Motion byVariational Methods.***
6. ***Christian Woohler (2013). 3D Computer Vision: Efficient Methods and Applications.*** Second Edition. Springer

Course Outcomes:

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

CO1: Identify the Basic Concepts, Terminologies, theoretical aspects of computing with images, Image Matting, Composition and Image Matching.

CO2: Outline and evaluate the concept of match moving, Motion Capture and Kinematics.

CO3: Analyze the concept of three-Dimensional Data Acquisition and methods of 3D Computer Vision using Various Approaches

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	H	L	M	-	-	-	-	-	-	L
CO2	M	L	M	M	M	L	-	-	-	-	-	M
CO3	M	M	M	M	H	-	-	-	-	-	-	M

Cognitive Computing

PE 2   **Hours of Instruction /week: 3T**

Semester VII   **No. of credits: 3**

  21BEOE31

Prerequisite:
- Artificial Intelligence, Machine Learning.

Objectives:

CLO1: To Familiarize with the concepts of Cognitive Computing.

CLO2: To acquire knowledge on applying cognitive computing in various domains.

UNIT I   **Introduction to Cognitive Computing with AI**   **9**

Cognitive Computing – Cognitive Psychology - The Architecture of the Mind - The Nature of Cognitive Psychology – Cognitive architecture – Cognitive processes– The Cognitive Modeling Paradigms - Declarative / Logic based Computational cognitive modeling – connectionist models –Bayesian models. Introduction to Knowledge-Based AI – Human Cognition on AI

UNIT II   **Cognitive Computing with Inference and Decision Support**   **9**
                                 Systems

Intelligent Decision making – FuzzyCognitive Maps – Learning algorithms: Non-linearHebbianLearning – Data driven NHL - Hybrid learning – Fuzzy Grey cognitivemaps – Dynamic Random fuzzy cognitive Maps

UNIT III   **Cognitive Computing with Machine Learning**   **9**

Machine learning Techniques for cognitive decision making –Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies -Deep Learning

UNIT IV   **Cloud and Distributed Computing in Cognitive Computing**   **9**

The Role of Cloud and Distributed Computing in Cognitive Computing-Fundamental to Cognitive Computing Systems-Characteristics of Cloud Computing- Cloud Computing Models- Delivery Models of the Cloud- Managing Workloads - Security and Governance - Data Integration and Management in the Cloud

UNIT V   **Case Studies**   **9**

Cognitive Systems in health care – Cognitive Assistant for visually impaired – AI for cancer detection, Predictive Analytics - Text Analytics - Image Analytics -Speech Analytics – IBM Watson - Introduction to IBM's PowerAI Platform -Introduction to Google's TensorFlow Development Environment

Total Hours: 45

References:

1. *Hurwitz, Kaufman, and Bowles (2005).Cognitive Computing and Big Data Analytics*- Wiley. Indianapolis
2. *Jerome R. Busemeyer, Peter D. Bruza(2014).Quantum Models of Cognition and Decision.* Cambridge University Press.
3. *Emmanuel M. Pothos, Andy J. Wills(2011). Formal Approaches in Categorization.*Cambridge University Press.
4. *Nils J. Nilsson(2009). The Quest for Artificial Intelligence.*Cambridge University Press.

Course Outcomes:

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

CO1: Describe the architecture of cognitive computing and fuzzy based cognitive system

CO2: Analyze the use of cognitive computing in machine learning

CO3: Apply cognitive computing in various domains and analyze the significance of Cloud and Distributed Computing in Cognitive Computing

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	M	M	M	M	-	-	-	-	-	-	-	L
CO2	M	M	M	-	-	-	-	-	M	-	M	M
CO3	M	M	M	-	-	-	-	-	M	-	M	M

Social Media Analytics

PE 2	Hours of Instruction /week:	3T
Semester VII	No. of credits:	3
21BEOE32		

Prerequisite:
- Data Mining

Objectives:

CLO1: To Familiarize the concept of social media analytics and understand its significance.

CLO2: To Enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes

UNIT I   Introduction   9

Introduction to Social Media Analytics (SMA) - Social media landscape - Need for SMA - SMA in Small organizations - SMA in large organizations - Application of SMA in different areas Network fundamentals and models - The social networks perspective - nodes– ties and influencers - Social network and web data and methods.

UNIT II   Mining Twitter   9

Why Is Twitter All the Rage?Exploring Twitter's API– Fundamental Twitter Terminology– Creating a Twitter API Connection– Exploring Trending Topics– Searching for Tweets–Analyzing the 140 Character– Extracting Tweet Entities–Analyzing Tweets and Tweet Entities with Frequency Analysis– Computing the Lexical Diversity of Tweets– Examining Patterns in Retweets– Visualizing Frequency Data with Histograms.

UNIT III   Mining Facebook   9

Analyzing Fan Pages– Examining Friendships– and More Overview– Exploring Facebook's Social Graph API– Understanding the Social Graph API– Understanding the Open Graph Protocol–Analyzing Social Graph Connections–Analyzing Facebook Pages–Examining Friendships

UNIT IV   MiningLinkedIn   9

Overview– Exploring the LinkedIn API– Making LinkedIn API Requests– Downloading LinkedIn Connections as a CSV File– Clustering Data– Clustering Enhances User Experiences– Normalizing Data to Enable Analysis– Measuring Similarity– Clustering Algorithms.

UNIT V   Data Mining and Text Mining in Social Media   9

Introduction– Data Mining in a Nutshell– Social Media– Motivations for Data Mining in Social Media– Data Mining Methods for Social Media– Data Representation– Data Mining - A Process– Social Networking Sites: Illustrative Examples - Text Mining in Social Networks Introduction– Keyword Search– Query Semantics and Answer Ranking– Keyword search over XML and relational data– Keyword search over graph data.

Total Hours: 45

References:

1. *Matthew A. Russell (2013). Mining of Social Web.* Second Edition. *O'Reilly.*
2. *Matthew Ganis and AvinashKohirkar (2016). Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media.* Pearson Education
3. *GuandongXu –Yanchun Zhang and Lin Li (2011). Web Mining and Social Networking, Techniquesand Applications.* First Edition.Springer
4. *John G. Breslin– Alexander Passant and Stefan Decker(2009).The Social Semantic Web.*Springer.

Course Outcomes:

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

CO1: Apply knowledge for current web development in the era of Social Web.
CO2: Develop a model for integrating data for knowledge representation.
CO3: Apply the tools and an algorithm for mining in social networks.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	L	-	-	L	M	-	-	L
CO2	M	M	M	M	L	-	-	L	M	-	M	L
CO3	H	M	M	M	L	-	-	L	M	-	M	L