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 Artificial Intelligence and Data Science

Program Specific Outcomes:

The graduates in AI & DS will be able to

PSO1: Apply the concepts learnt through courses like Data Structures, Data Mining, Cloud Computing, Machine Learning, Data Science, Computer Vision, Data Visualization and programming languages to solve real life problems

PSO2: Acquaint with the contemporary trends in industries and thereby innovate novel solutions to existing problems

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 Computer Ethics	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)**							
	21BEAS01	Computer Architecture	3	1/0	3	50	50	100	4
III		**Core Courses** **Professional Core (PC)**							
	21BEAC01	Foundations of Data Science	3	-	3	50	50	100	3
	21BEAC02	Data Structures and Algorithms	3	-	3	50	50	100	3
	21BEAC03	Database Management Systems	3	-	3	50	50	100	3
	21BEAC04	Data Structures and Algorithms Practicals	-	0/3	3	50	50	100	1.5
	21BEAC05	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** **Engineering Sciences (ES)**							
	21BEAS02	Software Engineering	4	-	3	50	50	100	4
III		**Core Courses** **Professional Core (PC)**							
	21BEAC06	Artificial Intelligence	3	-	3	50	50	100	3
	21BEAC07	Microprocessors and Microcontrollers	3	0/2	3	50	50	100	4
	21BEAC08	Python for Data Science	3	-	3	50	50	100	3
	21BEAC09	Operating Systems	3	-	3	50	50	100	3
	21BEAC10	Operating Systems Practicals	-	0/3	3	50	50	100	1.5
	21BEAC11	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)**							
	21BEAC12	Big Data Analytics	3	-	3	50	50	100	3
	21BEAC13	Information Retrieval	3	-	3	50	50	100	3
	21BEAC14	Automata and Compiler Design	3	1/0	3	50	50	100	4
	21BEAC15	Computer Networks	3	-	3	50	50	100	3
	21BEAC16	Data Mining	3	-	3	50	50	100	3
	21BEAC17	Computer Networks Practicals	-	0/3	3	50	50	100	1.5
	21BEAC18	Data Mining and Big Data Analytics Practicals	-	0/3	3	50	50	100	1.5
III		**Professional Elective(PE)**							
		Elective – I (PE1/ PE2)	3	-	-	-	-	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)**							
	21BEAC19	Software Project Management	3	-	3	50	50	100	3
	21BEAC20	Cloud Computing	3	-	3	50	50	100	3
	21BEAC21	Internet and Web Technology	3	-	3	50	50	100	3
	21BEAC22	Natural Language Processing	4	-	3	50	50	100	4
	21BEAC23	Internet and Web Technology Practicals	-	0/3	3	50	50	100	1.5
	21BEAC24	Cloud Computing Practicals	-	0/3	3	50	50	100	1.5
	21BEAC25	Mini Project	-	0/4	-	100	-	100	2
III		**Professional Electives (PE)**							
		Elective – II (PE1/ PE2)	3	-	-	-	-	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-V	-	-	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*
Seventh Semester									
III		**Core Courses Professional Core (PC)**							
	21BEAC26	Machine Learning	3	-	3	50	50	100	3
	21BEAC27	Artificial Neural Networks and Deep Learning	3	-	3	50	50	100	3
	21BEAC28	Machine Learning Practicals	-	0/3	3	50	50	100	1.5
	21BEAC29	Artificial Neural Networks and Deep Learning Practicals	-	0/3	3	50	50	100	1.5
	21BEAC30	Industrial Internship[#]	-	-	-	100	-	100	1
	21BEAC31	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	-	3	50	50	100	3
		Elective – VI (PE1/PE2) Title of MOOC (SWAYAM-NPTEL) ##	3	-	3	50	50	100	3
III		**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
	21BEMA01	Artificial Intelligence and Data Science-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)**							
	21BEAC32	Research Project Phase II	-	0/20	-	100	100	200	10
								Total Credits	**165**
	21BEAMC1	**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. Artificial Intelligence and Data Science

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	23BEMA01	Artificial Intelligence and Data Science	-	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) MOOCs to be completed through SWAYAM – NPTEL as an alternative to two Professional Electives, Elective V & Elective VI (#with credit transfer). Additionally, one core/non-core MOOC through SWAYAM - NPTEL to be completed with 2/3 credits (8 weeks/12 weeks) between 3rd and 7th 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) AI Domain

Part	*Semester*	*Course Code*	*Name of the Course*
III	Semester V Elective –I	21BEAE01	Pattern Recognition
		21BEAE02	AI in Health Care Applications
		21BEAE03	Image and Video Processing
	Semester VI Elective –II	21BEAE04	Human Computer Interaction
		21BEAE05	Game Theory in AI
		21BEAE06	Streaming Analytics
	Semester VI Elective –III	21BEAE07	Business Intelligence
		21BEAE08	Virtual and Augmented Reality
		21BEAE09	Application of Machine Learning in Industries
	Semester VII Elective -IV	21BEAE10	Convolutional Neural Networks
		21BEAE11	Cognitive Computing
		21BEAE12	Computer Vision
	Semester VII Elective -V	21BEAE13	**MOOC (12 Weeks Course in SWAYAM- NPTEL)**
	Semester VII Elective -VI	21BEAE14	**MOOC (12 Weeks Course in SWAYAM- NPTEL)**

LIST OF PROFESSIONAL ELECTIVES (PE2) Data Science Domain

Part	*Semester*	*Course Code*	*Name of the Course*
III	Semester V Elective –I	21BEAE21	Data Science Applications of Vision
		21BEAE22	Models of Computation
		21BEAE23	Agent based Intelligent System
	Semester VI Elective –II	21BEAE24	Edge Computing
		21BEAE25	Text Mining
		21BEAE26	Web Analytics and Development
	Semester VI Elective –III	21BEAE27	Big Data Security
		21BEAE28	Time Series Analysis and Forecasting
		21BEAE29	Data Intensive Computing
	Semester VII Elective -IV	21BEAE30	Cloud Data Management
		21BEAE31	Social Media Analytics
		21BEAE32	Block Chain
	Semester VII Elective -V	21BEAE33	**MOOC (12 Weeks Course in SWAYAM- NPTEL)**
	Semester VII Elective -VI	21BEAE34	**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 RajendranEngineering 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. 17th Edition.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**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
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

Environmental Science
(Common to all branches)

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

	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	-	-

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, $w = z + a, az, \frac{1}{z}$

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 2nd Edition, Tata McGraw Hill Publishing Co.Ltd, New Delhi.
2. ***P.Kandaswamy, K.Thilagavathy and K.Gunavathy (2014), Engineering Mathematics,*** 10th Revised Edition, S. Chand & Co, New Delhi.

References:

1. ***E.Kreyszig (2014), Advanced Engineering Mathematics***, 8thEdition, 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,***9thEdition**,**John Wiley and Sons.
4.***Dr. B. S. Grewal (2014), Higher Engineering Mathematics***, 43rdEdition, Khanna Publishers, New Delhi.
5.***Jain R.K. and Iyengar S.R.K. (2007), Advanced Engineering Mathematics,***3rdEdition, 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)

Semester II **Hours of Instruction/week: 2T**

21BEMC02

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 –F distribution – 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*.** Sultan Chand and Sons. New Delhi. Fourth Edition
2. ***Gupta A.K. (2008). Engineering Management. T***. Fourth Edition, Tata McgrawHill.***T.Veerarajan (2010). Probability. Statistics and Random Processes with queuing theory and queuing networks.*** Tata McGraw –Hill. Third Edition.
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, student 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**
21BEAS01 **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. Tata 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.*** Elsevier. Fourth edition.
4. ***John Paul Shen and Mikko H. Lipasti(2013) Modern Processor Design: Fundamentals of Superscalar Processors. Tata McGraw-Hill.*** First edition.

5. www.coursera.org
6. www.nptel.ac.in

Course Outcomes:

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

CO1: Outline 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	-	-	-	M	-	-	-	-	M
CO2	H	H	M	M	-	-	-	-	-	-	-	-
CO3	M	H	-	-	-	-	-	-	-	-	-	M

Foundations of Data Science

Semester III **Hours of Instruction/week: 3T**
21BEAC01 **No.of credits: 3**

Objectives:

CLO1: Tounderstand the fundamental concepts of data science.
CLO2: To gain knowledgeon various machine learning algorithms used in data science process.

UNIT I Introduction to Data Science 9

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Data Scientist - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.

UNIT II Big Data 9

Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.

UNIT III Machine Learning 9

Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms.

UNIT IV Deep Learning 9

Introduction – Deep Feedforward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning.

UNIT V Data Visualization 9

Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js.

Total Hours: 45

References:

1. ***Davy Cielen, Arno D. B. Meysman, Mohamed Ali. (2016). Introducing Data Science.*** First Edition, Manning Publications Co.
2. ***R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani.(2013).An Introduction to Statistical Learning: with Applications***. First Edition, Springer.
3. ***Ian Goodfellow, Yoshua Bengio, Aaron Courville (2016). Deep Learning.***First Edition, MIT Press**.**
4. ***D J Patil, Hilary Mason, Mike Loukides, (2018).Ethics and Data Science***. First Edition,O' Reilly.
5. ***Joel Grus, (*2015). Data Science from Scratch: First Principles with Python,**

First Edition. O'Reilly.
6. ***Cathy O'Neil, Rachel Schutt(*2013*).*Doing Data Science, Straight Talk from the Frontline,*First Edition. O' Reilly.
7. ***Jure Leskovec, AnandRajaraman, Jeffrey David Ullman(*2014*).Mining of Massive Datasets.***Second Edition. Cambridge University Press.

Course Outcomes:

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

CO1: Discuss on the operation of various data preparation techniques.

CO2: Analyze the problems in handling large data and data visualization techniques

CO3: Applyvarious machine learning and deep learning techniques for simple applications.

CO-PO MAPPING

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

Data Structures and Algorithms

Semester III **Hours of Instruction/week: 3T**
21BEAC02 **No.of credits: 3**

Objectives:

CLO1: To acquire the basic concepts of ADTs and learn linear data structures.

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 – collisions.

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,OxfordUniversity 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, student will be able to:

CO1: Apply the concepts of ADTsfor 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**
21BEAC03 **No.of credits: 3**

Objectives:

CLO1: To learn the concepts of basic query language.

CLO2: Toanalyze 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, student 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	H	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**
21BEAC04 **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- Post-order Tree Traversals.
9. Implementation of Breadth First Search and Depth First Search
10. Implementation of Hashing Techniques
11. Implementation of searching and sorting algorithms

Total Hours: 45

Software Requirements:

Turbo C,C++,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.

Course Outcomes:

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

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

CO2: Solve trees, graphand hashing related problems.

CO3: Implement various sorting and searching algorithms.

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**
21BEAC05 **No.of credits: 1.5**

Objectives:

CLO1: To implement the concepts of database design model, perform operations using query language.

CLO2: To provide an understanding of new developments and trends in developing a Database.

List of Experiments:

1. Data Definition Language(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, student 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

Objectives:

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 Re-dressal Mechanism under the Indian Consumer Protection Law 9

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

UNIT V Contemporary Issues in Consumer Affairs 9

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.

Total Hours: 45

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. ***Raghu Ramakrishnan - Johannes Gehrke (2013). Database Management Systems***. Third Edition. Tata McGraw Hill.
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

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:

1. www.ncdrc.nic.in
2. www.consumeraffairs.nic.in
3. www.iso.org.
4. www.bis.org.in
5. www.consumereducation.in
6. www.consumervoice.in
7. www.fssai.gov.in
8. www.cercindia.org

Course Outcomes:

At the end of the course, student 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	PO10	PO11	PO12
CO1	M	M	-	-	-	-	-	L	L	L	L	M
CO2	M	M	-	-	-	-	-	L	L	L	L	M
CO3	M	M	-	-	-	-	-	L	L	L	L	M

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 Tables – 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

Semi 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,*** Forty fourth edition. Khanna Publishers. New Delhi.
4. ***David C Lay (2010). Linear Algebra and its Applications***, Second Edition. Addison -Wesley.

Course Outcomes:

At the end of the course, student 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	PO10	PO11	PO12
CO1	H	H	-	M	-	-	-	-	-	-	-	M
CO2	H	H	-	-	-	-	-	-	-	-	-	M
CO3	H	H	-	-	-	-	-	-	-	-	-	M

Software Engineering

Semester IV **Hours of Instruction /week: 4T**
21BEAS02 **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.ShivaniJoshi(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 modelling and methodologies through the systematic approaches and diagnostic tools.

CO2: Analyze 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	PO10	PO11	PO12
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**
21BEAC06 **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 Methods 9
Problem solving Methods – Search Strategies – 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, student 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 and problem solving methods.

CO3: Apply appropriate techniques of AI to solve the societal problem using various logic and knowledge representation techniques 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	-	-

Microprocessors and Microcontrollers

Semester IV **Hours of Instruction/week: 3T+2P**
21BEAC07 **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– BarrelShifting 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.*** Third Edition.Oxford University Press
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 ConnectingEverything.*** First Edition. Apress Publications
7. www.nptel.ac.in

Course Outcomes:

At the end of the course, student 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	PO10	PO11	PO12
CO1	H	H	H	-	-	-	-	-	-	-	-	H
CO2	-	-	-	H	M	-	H	-	-	-	-	-
CO3	-	-	-	H	H	-	-	-	M	-	-	H

Python for Data Science

Semester IV **Hours of Instruction/week: 3T**

21BEAC08 **No. of credits: 3**

Objectives:

CLO1: To provide comprehensive knowledge of python programming paradigms required for Data Science.

CLO2: To analyze the significance of python program development environment by working on real world examples.

UNIT I Introduction to Python 9

Structure of Python Program – Underlying mechanism of Module Execution – Branching and Looping – Problem Solving Using Branches and Loops – Functions – Lists and Mutability – Problem Solving Using Lists and Functions.

UNIT II Sequence Data types and Object-Oriented Programming 9

Sequences – Mapping and Sets– Dictionaries – Classes: Classes and Instances-Inheritance-Exceptional Handling – Introduction to Regular Expressions using "re" module.

UNIT III NumPy 9

Basics of NumPy – Computation on NumPy – Aggregations – Computation on Arrays – Comparisons – Masks and Boolean Arrays – Fancy Indexing – Sorting Arrays –Structured Data: NumPy's Structured Array.

UNIT IV Data Manipulation with Pandas 9

Introduction to Pandas Objects – Data indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing –Combining Data Sets – Aggregation and Grouping – Pivot Tables – Vectorized String Operations – Working with Time Series – High Performance Pandas – Query.

UNIT V Visualization and Matplotlib 9

Basic functions of matplotlib – Simple Line Plot – Scatter Plot – Density and Contour Plots – Histograms – Binnings and Density – Customizing Plot Legends – Colour Bars –Three Dimensional Plotting in Matplotlib.

Total Hours: 45

References:

1 ***Wes McKinney (2018). Python for Data Analysis: Data Wrangling with PandasNumpy and Python.***Second Edition O'Reilly

2 ***Jake VanderPlas. (2017). Python Data Science Handbook: Essential Tools for Working with Data.***O'Reilly.

Course Outcomes:

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

CO1: Identify the need for data science and relevant Python functions and libraries.

CO2: Employ efficient storage and data operations using NumPy arrays and apply powerful manipulations and wrangling operations on data using Pandas.

CO3: Interpret and visualize data using Matplotlib and analyze data and build linear models.

CO-PO MAPPING

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

Operating Systems

Semester IV **Hours of Instruction/week: 3T**
21BEAC09 **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 Silberschat, 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, student 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	L	-	-	-	M	M
CO3	M	M	M	L	L	-	-	-	M	-	-	H

Operating Systems Practicals

Semester IV **Hours of Instruction/week: 3P**
21BEAC10 **No.of credits: 1.5**

Objectives:

CLO1: To implement the concepts of operating system in Linux environment and learn 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, student will be able to:

CO1: Design and write Linux commands and shell programming.

CO2: Implement CPU scheduling algorithms 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**

21BEAC11 **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
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
6. and Tic-Tac-Toe
7. Plotting Graphs in python
8. Implementation of Image processing functions
9. Build applications using NLTK package
10. Creation of Simple Chatbots
11. Design of Voice Assistant
12. Study of AI applications
13. 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, student 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	PO10	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**
21BEAC12 **No. of credits: 3**

Objectives:

CLO1: To Understand the foundation of Map Reduce and Hadoop platform.
CLO2: To gain knowledge on PIG, HBASE and NoSQL for Big Data Analytics.

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***.First Edition**.** Morgan and Claypool Publishers-USA (MapReduce, Hadoop).
3. ***Tom White(2012).Hadoop: The Definitive Guide***-Third Edition. O`Reilly Publishers, USA,
4. 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	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

Information Retrieval

Semester V **Hours of Instruction/week: 3T**
21BEAC13 **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. Raghavan and 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,*** Second Edition. ACM Press Books

3 ***Bruce Croft, Donald Metzler and Trevor Strohman (2009). Search Engines: Information Retrieval in Practice,*** First Edition. Addison Wesley.

4 ***Mark Levene (2010). An Introduction to Search Engines and Web Navigation,*** Second Edition. John Wiley Pvt.Ltd.

Course Outcomes:

At the end of the course, student 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	PO10	PO11	PO12
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**
21BEAC14 **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, student will be able to:

CO1: Design or convert 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	PO10	PO11	PO12
CO1	M	M	H	M	M	-	-	-	L	-	-	-
CO2	M	H	H	M	M	-	-	-	L	L	-	-
CO3	M	H	H	H	M	-	-	-	-	L	-	-

Computer Networks

Semester V **Hours of Instruction/week: 3T**
21BEAC15 **No.of credits: 3**

Objectives:

CLO1: To understand the concept of layering in networks.

CLO2: To learn 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, student 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 layer.

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	PO10	PO11	PO12
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 **Hours of Instruction/week: 3T**
21BEAC16 **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.

2 ***Pang-Ning Tan. Michael Steinbach and Vipin Kumar (2009). Introduction to Data Minin****g*. 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, student 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 techniques 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	PO10	PO11	PO12
CO1	H	M	M	-	H	-	-	-	-	-	-	H
CO2	M	H	M	H	H	-	-	-	-	-	-	M
CO3	M	M	H	H	H	-	-	-	-	-	-	M

Computer Networks Practicals

Semester V **Hours of Instruction/week: 3P**
21BEAC17 **No.of credits: 1.5**

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 staterouting 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 Version 1.6/1.7,Packet tracer,OPNET, NS2/NS3

References:

1 ***Behrouz A. Forouzan(2007).Data Communications and Networking,*** Fourth Edition, 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, student 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	PO10	PO11	PO12
CO1	H	M	M	M	H	-	-	-	-	L	M	M
CO2	H	M	M	H	H	-	-	-	-	M	M	M
CO3	M	M	M	H	H	-	-	-	-	M	M	M

Data Mining and Big Data Analytics Practicals

Semester V **Hours of Instruction/week: 3P**
21BEAC18 **No.of credits: 1.5**

Objectives:

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:

Wekatool,Mango DB,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.*** CRC Press.

Course Outcomes:

At the end of the course, student 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	PO10	PO11	PO12
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

Semester VI **Hours of Instruction /week: 3T**
21BEAC19 **No.of credits: 3**

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 was 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	PO10	PO11	PO12
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**
21BEAC20 **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, student 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 models and explain the core issues of cloud computing such as resource 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	PO10	PO11	PO12
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 **Hours of Instruction/week: 3T**
21BEAC21 **No.of credits: 3**

Objectives:

CLO1: To categorize 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.First 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, student 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,AngularJS and MongoDB.

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

Natural Language Processing

Semester VI **Hours of Instruction/week: 4T**
21BEAC22 **No.of credits: 4**

Objectives:

CLO1: To learn the fundamentals of natural language processing.

CLO2: To apply various practical skills for the design and implementation of NLP systems.

UNIT I Introduction 9

Speech and Language Processing – Ambiguity – Models and algorithms – Language – Thought – Understanding Regular Expressions – Basic Regular Expression Patterns –Words – Text Normalization – Minimum Edit Distance – Automata – Words and Transducers – Morphology – Finite-State Morphological Parsing – Building A Finite-State Lexicon – Finite State Transducers – FSTS for Morphological Parsing – Combining FST Lexicon And Rules – The Porter Stemmer.

UNIT II Word Level Analysis 9

N-grams Language – N-grams – Evaluating Language Models – Generalization and Zeros – Smoothing – Kneser– Ney Smoothing – The Web and Stupid Backoff – Perplexity's Relation to Entropy – English Word Classes –The Penn Treebank Part-of-Speech Tagset – Part-of-Speech Tagging – HMM Part-of-Speech Tagging – Maximum Entropy Markov Models.

UNIT III Syntax Analysis 9

Constituency – Context-Free Grammars – Grammar Rules for English – Treebanks– Grammar Equivalence and Normal Form – Lexicalized Grammars – Ambiguity – CKY Parsing: A Dynamic Programming Approach – Partial Parsing – Probabilistic Context – Free Grammars – Probabilistic CKY Parsing of PCFGs – Problems with PCFGs – Improving PCFGs by Splitting Non-Terminals – Probabilistic Lexicalized CFGs – Probabilistic CCG Parsing – Evaluating parsers – Dependency Parsing.

UNIT IV Semantic Analysis 9

Logical Representations of Sentence Meaning – Computational Desiderata for Representations – Model-Theoretic Semantics –First-Order Logic – Event and State Representations – Description Logics – Linguistically Relevant Concepts – Syntax– Driven Semantic Analysis – Semantic Augmentations to Context – Free Grammar Rules – Word Senses and WordNet– Word Sense Disambiguation – Word Sense Induction – Semantic Roles – FrameNet– Semantic Role Labeling.

UNIT V Coreference Resolution and Discourse Coherence 9

Coreference Phenomena: Linguistic Background –Coreference Tasks and Datasets – Mention Detection – Architectures for Coreference Algorithms – Classifiers using hand-built features – A neural mention-ranking algorithm – Evaluation of Coreference Resolution – Entity Linking – Winograd Schema problems – Gender Bias in Coreference– Coherence Relations – Discourse Structure Parsing – Centering and Entity – Based Coherence – Representation learning models for local coherence – Global Coherence.

Total Hours: 45

References:

1 ***Daniel Jurafsky, James H. Martin (2019*). *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech.*** Pearson Publication**.**

2 ***Breck Baldwin (2015). Language Processing with Java and Ling Pipe Cookbook*,** Atlantic Publisher**.**

3 ***Richard M Reese (2015). Natural Language Processing with Java.*** O'Reilly Media**.**

4 ***NitinIndurkhya and Fred J. Damerau (2010). Handbook of Natural Language Processing*, Second Edition,** Chapman and Hall/CRC Press**.**

Course Outcomes:

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

CO1: Explain the knowledge of language at the levels of Morphology and Part of Speech Tagging.

CO2: Analyze a sentence to form a syntactic structure, Syntax Analysis and explore the role of semantics of sentences.

CO3: Design an innovative application using NLP components, coreference Resolution and Discourse Coherence.

CO-PO MAPPING

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

Internet and Web Technology Practicals

Semester VI **Hours of Instruction/week: 3P**

21BEAC23 **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 JS and 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,HTML5.Angular.JSMongoDB

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.*** First Edition .O'Reilly.

5 ***RashimMogha,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, student will be able to:

CO1: Identify the design applications using DHTML and Java Script.
CO2: Create dynamic web pages using scripting languages.
CO3: Develop web application using MongoDB, Database Connectivity and identify the environments that are currently available on the market to design web sites**.**

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**
21BEAC24 **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, student 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	PO10	PO11	PO12
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**
21BEAC26 **No.of credits: 3**

Objectives:

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

CLO2: Tostudy 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 – HypothesisSpaceSearch – 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 Basis Functions – 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) PrivateLimited.
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 the back propagation algorithm and genetic algorithms to various problems.

CO2: Apply the Bayesian, Computational Learning, to machine learning, Instant Based Learning concepts to 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

Artificial Neural Networks and Deep Learning

Semester VII **Hours of Instruction/week: 3T**
21BEAC27 **No.of credits: 3**

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 Goodfellow,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 .Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms***.O'Reilly publications

Course Outcomes:

At the end of the course, student 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	PO10	PO11	PO12
CO1	H	H	M	M	-	-	-	-	-	-	-	M
CO2	M	M	M	L	-	-	-	-	-	-	-	M
CO3	M	M	M	L	-	-	-	-	-	-	-	H

Machine Learning Practicals

Semester VII **Hours of Instruction/week: 3P**
21BEAC28 **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 (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, student 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

Artificial Neural Networks and Deep LearningPracticals

Semester VII **Hours of Instruction/week: 3P**
21BEAC29 **No.of credits: 1.5**

Objective:

CLO1: To design and implement different techniques to develop simple autonomous agents that make effective decisions in fully informed and partially observable, settings.

List of Experiments:

1. a)Write a program to perform basic operations
   b)To perform matrix operations
2. a)Write a program to plot multiple curves in single plot by creating a script file
   b) Write a program for plotting multiple curves in single figure
3. (a) To realize gates using Mcculloh Pitt model in Matlab
   (b) Write a program to implement XOR gate using Mcclloh-Pitts neuron
4. Write a program to illustrate how the perception learning rule works for non-linearly separable problems and Linearly non-separable vectors
5. Write a program for Pattern Classification using Perceptron network
6. Write a program for creating a Back Propagation Feed-forward neural network
7. Apply deep learning models for retrieval of information and machine translation.
8. Develop an artificial Intelligence system for the deep neural network-based applications.
9. Design of intelligent model using algorithms of deep learning.

Total Hours: 45

Software Requirements:
MATLAB,Python

References:

1 ***Ian Goodfellow,YoshuaBengio*** **and** ***AaronCourville (2016).Deep Learning***.MIT Press.
2 ***Deep Learning with Python by François Chollet,*** Manning Publications Co
3 ***Deep Learning*** **- A Practical Approach by Rajiv Chopra**, Khana Publications,
4 ***Deep Learning by Ian Goodfellow and YoshuaBengio and Aaron Courville*** Published by An MIT Press book
5 www.nptelvideos.in

Course Outcomes:

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

CO1: Demonstrate knowledge of learning algorithms and concept learning through implementation for sustainable solutions of applications.

CO2: Design a Pattern Classification using Perceptron network, Back Propagation Feed-forward neural network.

CO3: Develop a system for implementing the deep neural network-based applications.

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

Pattern Recognition

PE1 **Hours of Instruction/week: 3T**
Semester V **No.ofcredits: 3**
21BEAE01

Prerequisite:

- Artificial Intelligence

Objectives:

CLO1: To understand the concepts of fundamental pattern recognition

CLO2 : To learn the basics of feature extraction and feature selection in machine learning.

UNIT I Concepts of Pattern Recognition 9

Clustering, Classifiers – Machine learning – Types of data: Features and patterns – Domain of a variable – Types of features – Proximity measures – Mean dissimilarity– Peak dissimilarity – correlation coefficient – Dynamic time wrapping distance.

UNIT II Feature Extraction and Feature Selection 9

Types of Feature Selection – Mutual Information for feature selection – Chi-square Statistic – Goodman–Kruskal Measure –Laplacian Score – Singular Value Decomposition (SVD) – Nonnegative Matrix Factorization (NMF) – Random Projections (RPs) for Feature Extraction – Ranking for Feature Selection – Feature Selection for Time Series Data.

UNIT III Classification 9

Classification in High – Dimensional Spaces – Random Forests – Linear Support Vector Machine(SVM) – Logistic Regression – Semi-supervised Classification – Classification of Time Series Data.

UNIT IV Baye's Decision Theory 9

Introduction – Bayes decision theory – Discriminant functions and decision surfaces – Bayes classification for normal distribution – Estimation of unknown probability density function – Nearest Neighbour rule.

UNIT V Soft Computing Technique 9

Introduction –Fuzzy Classification –Rough Classification – Gas – Neural Networks for Classification – Multi-label Classification.

Total Hours 45

References:

1. ***Segrios Theodoridis, Konstantinos Koutroumbas and Elsevier (2013).Pattern Recognition,*** Fourth Edition. Elsevier Science.
2. ***V.Susheela Devi and M. NarasimhaMurty(2010). Pattern Recognition an Introduction.***ISSI Press**.**
3. ***Sergios Theodoridis, Aggelos Pikrakis, Konstantinos Koutroumbas, Dionisis Cavouras (2010). Introduction to Pattern Recognition: A Matlab Approach.*** Elsevier Science.
4. **www.*swayam.gov.in/nd1_noc19_ee56/***

Course Outcomes:

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

CO1: Identify the basic concepts of data, pattern based on features and extraction methods

CO2: Interpret basic concept of classification and analyze the classification method based on decision theory and soft computing.

CO3: Analyze concept of baye's decision theory and classification using soft computing technique

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	L	-	-	-	-	L	L	-	-
CO3	M	M	M	-	-	-	-	-	M	-	M	M

AI in Health Care Applications

PE1 **Hours of Instruction/week: 3T**

Semester V **No.ofcredits: 3**

21BEAE02

Prerequisite:

- Artificial Intelligence

Objectives:

CLO1: To understand the role of AI and its application in healthcare now and in the near future

CLO2 : To understand what Artificial Intelligence and Machine Learning are, what are their benefits and limits

UNIT I Introduction to Artificial Intelligence in Health Care 9

Terminologies – Computational models of intelligence; conceptual frameworks from cognitive and educational psychology – Neuroscience – Information theory and linguistics; philosophical foundations of AI.

UNIT II Myths about AI Applications in Health Care 9

AI origins and definition – AI healthcare myths – AI myths – AI Is an existential threat – AI is just Machine Learning – AI overpromises and under delivers – True conversational AI already exists – AI as overlord – AI technology Myths – AI – First healthcare

UNIT III Artificial Intelligence in the Health Sector 9

Monitoring health through wearables and personal devices –Making smartphone selfies into powerful diagnostic tools – Revolutionizing clinical decision Making with artificial Intelligence at the bedside –Cognitive systems in hospital claims management – Benefits for health sectors – Diagnosis processes – Treatment protocol development – Drug development – Personalized medicine and Patient monitoring and care.

UNIT IV Artificial Intelligence Versus Human Intelligence 9

Artificial Narrow Intelligence (ANI) Artificial General Intelligence (AGI) – Artificial Super Intelligence –Artificial Intelligence application – Manufacturing robots. – Self driving cars – Smart assistants – Disease mapping – Human intelligence –Humans in learning – understanding and solving problem

UNIT V Future of Artificial Intelligence in the Health Sector 9

Real world applications of AI in Medicine –Health trending and analytics – Patient Risk Identification – Administrative workflows – Image analysis – Robotic surgery – Virtual assistants and clinical decision support.

Total Hours: 45

References:

1. ***Dr.Parag Suresh Mahajan MD(2021).Artificial Intelligence in Healthcare,Second Edition.Notion Press.***

2. ***Dr Parag Suresh Mahajan MD(2019). Artificial Intelligence in Healthcare: AI, Machine Learning, and Deep and Intelligent Medicine Simplified for Everyone,*** Medmantra, LLC.

Course Outcomes:

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

CO1: Identify the models of human and artificial intelligence, specifically computational models of intelligence.

CO2: Apply appropriate intelligent system models and computational tools to specific problems in biomedicine and healthcare.

CO3: Analyze the performance of specific models as applied to biomedical problems, and justify their use and limitations.

CO-PO MAPPING

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

Image and Video Processing

PE1 **Hours of Instruction/week: 3T**
Semester V **No.ofcredits: 3**
21BEAE03

Prerequisites:

- Probability and Statistics, Discrete mathematics and linear algebra

Objectives:

CLO1: To learn the fundamentals of Image processing and its techniques.

CLO2: Toidentify the issues in image and Video processing.

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, Joem Ostarmann 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, student will be able to:

CO1: Compare the basics and fundamentals of digital image processing andvideo 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

Human Computer Interaction

PE1 **Hours of Instruction/week: 3T**
Semester VI **No.ofcredits: 3**
21BEAE04

Prerequisite:

- Foundation of Data science

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 and Prototyping – 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. Janet Finlay. Gregory Abowd and Russell Beale (2012) .Human Computer Interaction***. Third Edition. Tata McGraw Hill.
2. ***Brian Fling (2009).Mobile Design and Development.*** First Edition. 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, student 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

Game Theory in AI

PE1 **Hours of Instruction/week: 3**
Semester VI **No. of credits: 3**
21BEAE05

Prerequisite:

- Artificial Intelligence

Objectives:

CLO1: To understand the process of game design and development
CLO2: To learn about various types of games and their strategies.

UNIT I Introduction 9

Elements of Game theory – Examples – Strategic Games – 2 Player Strategy Games – payoffs – Minimax – Weak and Strong Domination – Saddle Points – Nash Equilibrium – Prisoner's Dilemma – Stag Hunt – Matching pennies – BOS – Multi NE – Cooperative and Competitive Games – Strict and Non Strict NE – Best response functions for NE.

UNIT II Combinatorial Games 9

Combinatorial games – Winning and losing positions – Subtraction Game – 3Pile and K-Pile Games – Proof of Correctness – Variations of K-Pile Games – Graph Games – Construction – Proof of finiteness – SG theorem for sum of games.

UNIT III Extensive Games 9

Cournot's Oligopoly – Bertrand's Oligopoly – Electoral Competition – Median Voter Theorem– Auctions – role of knowledge – Decision making and Utility Theory – Mixed Strategy Equilibrium – Extensive Games with Perfect Information – Stackelberg's model of Duopoly – Buying Votes – Committee Decision making – Repeated Gmes – Prisoner's Dilemma – Supermodular Game and Potential games

UNIT IV Repeated Games 9

Playing Forever: Repeated Interaction with Infinitely Lived Players – Trench Warfare in World War I – Constructing a Repeated Game – Trench Warfare: Finite Horizon – Trench Warfare: Infinite Horizon

UNIT V Evolutionary Game Theory 9

Evolutionarily Stable Strategies – Hawk–Dove Conflict – Evolutionarily Stable Strategy – Properties of an ESS – Multipopulation Games – Evolution of Spite – Replicator Dynamics and the Hawk – Dove Game

Total Hours 45

References:

1. ***Martin Osborne, An Introduction to Game Theory,*** Oxford University Press.
2. ***Thomas Ferguson(2018).Game Theory***, World Scientific.
3. ***StefTijs. Introduction to Game Theory***, Hindustan Book Agency.
4. ***Allan MacKenzie, Game Theory for Wireless Engineers***, Synthesis Lectures On Communications.

Course Outcomes:

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

CO1: Understand the basics game theory and Combinatorial games for artificial intelligence domain

CO2: Analyze the concepts of game theory for learning techniques in artificial intelligence

CO3: Identify the Evolutionarily and repeated game in game theory

CO-PO MAPPING

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

Streaming Analytics

PE1 **Hours of Instruction/week: 3T**
Semester VI **No.ofcredits: 3**
21BEAE06

Prerequisite:

- Big Data Analytics

Objectives:

CLO1: To provide students with the knowledge and skill sets to work with very large datasets and continuous streaming data which need to be processed in realtime

CLO2 : To provide hands-on experience with the technologies that enable the ingestion and management of Big Data and real-time data.

UNIT I Introduction to Stream Computing 9

Streaming Data – Sources – Difference between Streaming Data and Static Data. Overview of Large Scale Stream Processing Engines – Issues in Stream Processing.

UNIT II Streaming Analytics Architecture 9

Phases in Streaming Analytics Architecture - Vital Attributes - High Availability – Low Latency– Horizontal Scalability-Fault Tolerance - Service Configuration and Management – Apache ZooKeeper.

UNIT III Data flow Management **9**

Distributed Data Flows – At Least One Delivery – Apache Kafka – Apache Flume – Zero MQ -Messages, Events, Tasks& File Passing.

UNIT IV Processing & Storing Streaming Data **9**

Distributed Stream Data Processing: Co-ordination, Partition and Merges, Transactions.Duplication Detection using Bloom Filters - Apache Spark Streaming Examples Choosing astorage system – NoSQL Storage Systems.

UNIT V Delivering Streaming Metrics **9**

Visualizing Data – Mobile Streaming Apps –Times Counting and Summation - Stochastic Optimization – Delivering Time Series Data.

Total Hours: 45

References:

1. ***Byron Ellis* (2014).*Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data,*** Wiley**,** First edition**.**
2. ***SherifSakr (*2014).*Large Scale and Big Data: Processing and Management,*** CRC Press.
3. ***Bill Franks* (2012).*Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics,*** Wiley.
4. ***Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman (2014*).*Mining of Massive Datasets,*** Cambridge University Press.
5. ***Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos*(*2011*).*Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data,*** McGraw-Hill, First edition.

Course Outcomes:

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

- **CO1:** Identify the need for stream computing and Comprehend the architecture of stream analytics.
- **CO2:** Build data flow management pipelines for streams and process the streaming data.
- **CO3:** Analyze the results of streaming analytics.

CO-PO MAPPING

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

Business Intelligence

PE1 **Hours of Instruction/week: 3T**
Semester VI **No.ofcredits: 3**
21BEAE07

Prerequisite:

- Data Mining

Objectives:

CLO1: To learn the concept of business intelligence analysis and its development

CLO2 : To analyze various Marketing models and future of business intelligence with emerging technologies

UNIT I Business Intelligence 9

Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

UNIT II Knowledge Delivery 9

The business intelligence user types – Standard reports – Interactive Analysis and Ad Hoc Querying – Parameterized Reports and Self-Service Reporting – dimensional analysis – Alerts/Notifications – Visualization: Charts – Graphs – Widgets – Scorecards and Dashboards, Geographic Visualization – Integrated Analytics – Considerations: Optimizing the Presentation for the Right Message.

UNIT III Efficiency 9

Efficiency measures – The CCR model: Definition of target objectives – Peer groups – Identification of good operating practices – cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis – outlier analysis.

UNIT IV Business Intelligence Applications 9

Marketing models – Logistic and Production models – Case studies.

UNIT V Future of Business Intelligence 9

Future of business intelligence – Emerging Technologies, Machine Learning – Predicting the Future – BI Search & Text Analytics – Advanced Visualization – Rich Report – Future beyond Technology.

Total Hours: 45

References:

1. ***Efraim Turban, Ramesh Sharda, Dursun Delen (2013). Decision Support and Business Intelligence Systems.*** Ninth Edition. Pearson Education.
2. ***David Loshin (2012).Business Intelligence: The Savvy Manager"s Guide.*** Second Edition. Morgan Kaufman
3. ***Carlo Vercellis (2009). Business Intelligence: Data Mining and Optimization for Decision Making.*** Wiley Publications.
4. ***Roland M. Müller, Hans-Joachim Lenz (2013). Business Intelligence.*** Springer Berlin Heidelberg.

Course Outcomes:

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

CO1: Understand the business intelligence architectures.
CO2: Summarize various knowledge delivery methods.
CO3: Apply business intelligence concepts in a problem.

CO-PO MAPPING

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

Virtual and Augmented Reality

PE1 **Hours of Instruction/week: 3T**
Semester VI **No.ofcredits: 3**
21BEAE08

Prerequisite:

- Discrete mathematics and linear algebra

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 .Reality The Power of AR and VR for BusinessSpringer International Publishing

Course Outcomes:

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

CO1: Formulate the various issues in fundamental concepts, components and visual computation of Virtual Reality.

CO2: Apply interactive Techniques and application of VR in Digital Entertainment.

CO3: Analyze the methods and visualization techniques in augmented reality.

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	M	M	M	-	-	-	-	M	-	L
CO3	M	H	M	M	-	-	M	-	-	-	-	L

Application of Machine Learning in Industries

PE1 **Hours of Instruction/week: 3T**
Semester VI **No.ofcredits: 3**
21BEAE09

Prerequisite:

- Big data Analytics

Objectives:

CLO1: To understand the basic concepts of machine learning and its applications.
CLO2: To study machine learning in Healthcare and Life Science.

UNIT I Machines Learning in Banking and Securities 9

Use of AI in banking and finance – Fraud detection –Tough competition in banking industry – Risk modelling and investment banks –Customer data management – Decreased customer experience and loyalty – Personalized marketing – Role of machine learning: Challenges of banking sector and securities – Widely used machine learning algorithms in banking and security.

UNIT II Chatbot 9

Deep learning approach – AI powered marketing systems – Deep learning in cyber security – Types of cyber-attacks in banks – Deep learning methods used in cyber security – Deep learning v/s restricted Boltzmann machines – Convolution Neural Networks (CNNs), Recurrent neural networks.

UNIT III Machine Learning in Communication and Media 9

Machine learning in communication –media and entertainment – Usage of machine learning in media – Machine learning techniques for customer sentiment analysis – World embedding's – Sentiment analysis with long short term memory networks – Real-time analytics in communication –media and entertainment industries – Real time analytics and social media – Deep learning for social media analytics – Recommendations engines– Collaborative filtering – Memory based collaborative filtering – Model based collaborative filtering – Content based filtering – Hybrid recommendation systems.

UNIT IV Machine Learning in Healthcare and Life Science 9

Applications of machine learning in health and life sciences – The most important applications of machine learning in healthcare – Role of machine learning in drug discovery – Medical image analysis – Why deep learning for medical image analysis – Neural network and deep learning architecture – Comparisons between architecture of different types of deep learning models – Machine learning in genetics and genomics – Genomics and AI background – Two category of genomics – How to use deep learning effectively – Interpreting deep learning models – Predictive medicine: Prognosis and diagnostics accuracy – Predictive medicine: Examples – ML applications in breast cancer diagnosis and prognosis.

UNIT V Case Studies **9**

Case study on Application of machine learning for financial risk management – Case study on Forecasting seasonal footwear demand using ML – Case study on insurance climb analysis using machine learning algorithms – Case study on Wind power forecasting based on daily mean wind speed and standard deviation – Forecasting accuracy of algorithms – Case study on Wind power forecasting based on only daily mean wind speed – Case study on Wind power forecasting for a different region.

Total Hours: 45

References:

1. ***J. Paulo Davim, Shubhabrata Datta (2021). Machine Learning in Industry.*** Springer International Publishing.
2. ***Aboul-Ella Hassanien, Nilanjan Dey, Santosh Kumar Das, Shom Prasad Das (2020). Machine Learning Algorithms for Industrial Applications.*** Springer International Publishing.
3. ***Larrañaga, David Atienza, Javier Diaz-Rozo, Alberto Ogbechie, Carlos Esteban Puerto-Santana, Concha Bielza (2018). Industrial Applications of Machine Learning.*** CRC Press.

Course Outcomes:

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

CO1: Identify the concept of Machine Learning.
CO2: Familiarize with applications of Machine Learning in Banking sectors.
CO3: Appreciate the various applications in Communication, Media sectors, Health care and Life Sciences.

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	-	-	M
CO3	M	M	H	M	M	-	-	-	M	-	-	-

Convolutional Neural Network

PE1 **Hours of Instruction/week: 3T**
Semester VII **No.ofcredits: 3**
21BEAE10

Prerequisites:

- Discrete mathematics and Linear algebra, Artificial Neural Networks

Objectives:

CLO1: To familiarize how convolution networks are designed.

CLO2: To learn about feature extractions and classifications.

UNIT I Pattern classification 9

Linear classifier – multiclass classifier – Feature extraction – Artificial Neural Networks – Activation – Bias – initialization – convolution and pooling activities.

UNIT II Convolution Neural Networks 9

Deriving Convolution from fully connected layer – Role of convolution –Back propagation of convolution layers and pooling layers – Designing and training ConvNets.

UNIT III Layers in Convolution Neural Networks 9

Analyzing quantitative results from ConvNets – Other types of layers – Local response normalization – Spatial pyramid pooling – Mixed pooling – Batch normalization.

UNIT IV Classification of Traffic Signs 9

Introduction – Dataset preparation – Training and Validation curves – using ConvNets for traffic sign classification –Ensemble of ConvNets – Stability against Noise – Sliding window within ConvNets.

UNIT V Visualizing Neural Networks 9

Introduction – Data oriented techniques – Gradient based techniques – Inverting representation.

Total Hours: 45

References:

1. ***HamedHabibi Aghdam. ElnazJahani Heravi(2017).*** **Guide to Convolutional Neural Networks:** ***A Practical Application To Traffic Sign Detection And Classification.*** Springer.
2. ***Kevin P.Murphy(2012).Machine Learning: A Probabilistic Perspective***. MIT Press
3. ***CharuC.Aggarwal (2018).Neural Networks and Deep learning.*** Springer International Publishing.

Course Outcomes:

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

CO1: Outline the convolutional neural network and apply pattern classification in Neural networks.

CO2: Analyze the various layers and classifications of traffic signs in convolutional neural network.

CO3: Apply convolutional networks to visual detection and recognition tasks.

CO-PO MAPPING

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

Cognitive Computing

PE1 **Hours of Instruction/week: 3T**
Semester VII **No.ofcredits: 3**
21BEAE11

Prerequisite:

- Artificial Intelligence

Objectives:

CLO1: To familiarize with the concepts of Cognitive Computing.
CLO2 : To acquire knowledge on the 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 Systems 9

Intelligent Decision making – Fuzzy Cognitive Maps – Learning algorithms: Non-linear Hebbian Learning – Data driven NHL – Hybrid learning – Fuzzy Grey cognitive maps – 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 Tensor Flow 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, student 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	PO10	PO11	PO12
CO1	M	M	M	M	-	-	-	-	-	-	-	L
CO2	M	M	M	-	-	-	-	-	M	-	M	M
CO3	M	M	M	-	-	-	-	-	M	-	M	M

Computer Vision

PE1 **Hours of Instruction/week: 3T**
Semester VII **No.ofcredits: 3**
21BEAE12

Prerequisite:

- Image Processing

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 polarization 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. ***ChristianWohler(2013). 3D Computer Vision***. Second Edition. Springer.
3. ***Mark Nixon and Alberto S. Aquado (2012). Feature Extraction & Image Processing for Computer 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 by Variational Methods.***
6. ***Christian Woohler (2013). 3D Computer Vision: Efficient Methods and Applications.*** Second Edition. Springer

Course Outcomes:

At the end of the course, student 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	PO10	PO11	PO12
CO1	M	M	H	L	M	-	-	-	-	-	-	L
CO2	M	L	M	M	M	L	-	-	-	-	-	M
CO3	M	M	M	M	H	-	-	-	-	-	-	M

Data Science Applications of Vision

PE2 **Hours of Instruction /week: 3T**
SemesterV **No. of credits: 3**
21BEAE21

Prerequisite:

- Foundation of Data Science

Objectives:

CLO1: To understand the capability of a machine to get and analyze visual information and make decisions.

CLO2 : To learn methods and algorithms for Vision and to use deep learning for Vision tasks

UNIT I Introduction 9

Image Representation and Properties – Introduction – Image Representation – Image Digitization – Digital Image Properties Discrete Fourier Transform – Image Pre-Processing in Spatial and Frequency Domain: Pixel Brightness Transformation – Geometric Transformations Local Preprocessing.

UNIT II Image Smoothing and sharpening 9

Conventional image processing editing – filtering – extraction – classification-Edge Detectors – Corner Detectors – Convolution – Image Restoration – feature extraction filters Image recognition applications – character recognition –authentication of documents

UNIT III Image Segmentation 9

Image Segmentation – Thresholding Segmentation techniques – Deep learning for vision tasks – Object detection and semantic segmentation with Convolution Neural Networks – object segmentation from images and videos – identification of objects – Facial recognition – Emotion recognition – Active observation and inferences

UNIT IV Amazon Go and Detecting events 9

Introduction to Amazon Go detecting events for visual surveillance – autonomous driving video processing – Passive observation and analysis – observe and analyze objects overtime – Analysis of medical images – predictive analysis on medical images.

UNIT V Communicating with humans through vision 9

Communicating with humans through vision – situational awareness – detection and recognition – Control – visuallex icon design for interaction – multimodal integration – vision understanding – scene understanding – inference and decision making –video image characteristics – motion – brightness – trajectories – optical flow –activity recognition – segmentation – classification and location network –Image databases –indexing –image sequences.

Total Hours: 45

References:

1. ***Ian Goodfellow. Yoshuo Bengio and Aaron Courville(2017).Deep Learning(***Adaptive Computation and Machine Learning series),MIT Press**.**
2. ***Rafael C.Gonzalez and RichardE.Woods(2009).Digital Image Processing***, Third edition, Pearson Education,
3. ***AlokKumar Singh Kushwaha and Rajeev Srivastava(2014). Recognition of Humans and Their Activities for Video Surveillance.*** IGI Global.
4. ***Matthew Turk, GangHua(2013).*** **Vision-based Interaction.** First edition. Morgan Claypool

Course Outcomes:

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

CO1: Explore the methods and algorithms for Image processing

CO2: Apply vision algorithms in OpenCV for applications and scalable algorithms for large datasets in vision

CO3: Analyze deep neural architectures for image and video processing

CO-PO MAPPING

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

Models of Computation

PE2 **Hours of Instruction /week: 3T**
Semester V **No. of credits: 3**
21BEAE22

Prerequisite:

- Automata and compiler design

Objectives:

CLO1: To understand computation and computability concepts.
CLO2: To learn the abstractions of computation and their implementations.

UNIT I Turing Machine Model 9

Turing Machine Logic – Proof – Computability.

UNIT II Quantum Computation 9

Quantum Computing History –Postulates of Quantum Theory– Dirac Notation–the Quantum Circuit Model– Simple Quantum Protocols: Teleportation – Superdense Coding–Foundation Algorithms.

UNIT III Nature Inspired Computing 9

Nature-Inspired Computing Optimization and Decision Support Techniques – Evolutionary Algorithms – Swarm Intelligence – Benchmarks and Testing.

UNIT IV Social Computing 9

Social Computing Online communities – Online discussions – Twitter – Social Networking Systems – Web 2.0– social media – Crowdsourcing – Facebook– blogs–wikis–social recommendations – Collective intelligence.

UNIT V Evolutionary Computing 9

Evolutionary Computing Introduction to Genetic Algorithms– Genetic Operators and Parameters– Genetic Algorithms in Problem Solving– Theoretical Foundations of Genetic Algorithms– Implementation Issues.

Total Hours: 45

References:

1 ***Danah Boyd (2015) .It's Complicated: The Social Lives of Networked Teens,*** Yale University Press.

2 ***Margaret M. Fleck(2013).Building Blocks for Theoretical Computer Science,*** University of Illinois, Urbana-Champaign**.**

3 ***G.Rozenberg, T.Back, J.Kok, Editors (2012). Handbook of Natural Computing,*** Springer Verlag**.**

4 ***Michael A. Nielsen & Isaac L. Chuang (2010). Quantum Computation and Quantum Information,*** Cambridge University Press

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

CO1: Identify the terminology of the theory of computing.
CO2: Incorporate the major results in computability and complexity theory.
CO3: Analyze the major models of computations

CO-PO MAPPING

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

Agent Based Intelligent Systems

PE2 **Hours of Instruction /week: 3T**
Semester V **No. of credits: 3**
21BEAE23

Prerequisite:

- Artificial Intelligence

Objectives:

CLO1: To comprehend the concepts and techniques dealing with the use of intelligent agents for computational tasks

CLO2 : To apply the principles and methods of intelligent agents to practical problems

UNIT I Introduction 9

Agents as a paradigm for software engineering – Agents as a tool for understanding human societies –Intelligent Agent: Agents and Objects – Agents and Expert Systems – Agents as Intentional Systems – Abstract Architectures for Intelligent Agents.

UNIT II Learning In Agents 9

Proportional case – Handling variables and qualifiers – Dealing with intractability – Reasoning with horn clauses – Procedural control of reasoning – Rules in production – Reasoning with Higher order Logics.

UNIT III Communication and Cooperation in Agents 9

Software tools for ontology – OWL - XML - KIF - Speech acts – Cooperative Distributed Problem Solving – Task Sharing and Result Sharing – Result Sharing – Combining Task and Result Sharing – Handling Inconsistency – Coordination – Multi agent Planning and Synchronization

UNIT IV Developing Intelligent Agent Systems 9

Situated Agents: Actions and Percepts – Proactive and Reactive Agents: Goals and Events – Challenging Agent Environments: Plans and Beliefs – Social Agents – Agent Execution Cycle – Deciding on the Agent Types – Grouping functionalities.

UNIT V Applications 9

Agent for workflow and business process management – Mobile agents – Agents for distributed systems – agents for information retrieval and management – agents for electronic commerce – agent for human – computer interface – agents for virtual environments-agents for social simulation.

Total Hours: 45

References:

1 ***Michael Wooldridge (2017). An Introduction to Multi Agent Systems,*** Create Space Independent Publishing Platform.

2 ***Stuart Jonathan Russell, Stuart Russell and Peter Norvig (2019). Artificial Intelligence: A Modern Approach.*** Third Edition,Pearson Education**.**

3 ***LinPadgham and Michael Winikoff (2005). Developing Intelligent Agent Systems: A Practical Guide***, Wiley publications

4 https://www.coursera.org/lecture/modeling-simulation-natural-processes/multi-agent-systems.

Course Outcomes:

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

CO1: Describe the structure of agents, tools for the use of intelligent agents and apply the reasoning mechanisms of proposition and predicate logic to agents

CO2: Execute different communication and co-operation methodologies in a multiagent setup

CO3: Use the learning mechanisms for developing intelligent agent and for different applications.

CO-PO MAPPING

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

Edge Computing

PE2 **Hours of Instruction /week: 3T**
Semester VI **No. of credits: 3**
21BEAE24

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. **9**

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 **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. SudhaSadasivam, D. Dharani, and M. Niranjanamurthy (2021). Edge Computing Fundamentals, Advances and Applications,*** CRC Press.
2. ***JavidTaheri and Shuiguang Deng (2020).Edge Computing: Models, technologies and applications***.
3. ***Alex Marcham (2021).Understanding Infrastructure Edge Computing: Concepts, Technologies, and Considerations.***

Course Outcomes:

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

CO1: Explore 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	-	-	-

Text Mining

PE2 **Hours of Instruction /week: 3T**
Semester VI **No. of credits: 3**
21BEAE25

Prerequisites:

- Data Mining, Information retrieval

Objectives:

CLO1: To understand the basic concepts in text extraction techniques and differentiate clustering and classification techniques on text.

CLO2: To analyze visualization methodologies and event detection methods.

UNIT I Text Extraction 9

Introduction to Time Series and Forecasting – Different types of data – Internal structures of time series Models for time series analysis – Autocorrelation and Partial autocorrelation – Examples of Time series Nature and uses of forecasting – Forecasting Process – Data for forecasting – Resources for forecasting.

UNIT II Clustering 9

Clustering: Multilingual document clustering: Multilingual LSA – Tucker1 method – PARAFAC2 method – LSA with term alignments – LMSA – LMSA with term alignments.

UNIT III Classification 9

Classification: Content – based spam email classification using machine – learning algorithms – Utilizing nonnegative matrix factorization for email classification problems – Constrained clustering with k-means type algorithms.

UNIT IV Anomaly and trend detection 9

Anomaly and trend detection: Text Visualization techniques such as tag clouds – authorship and change tracking – Data Exploration and the search for noval patterns – sentiment tracking – visual analytics and FutureLens – scenario discovery – adaptive threshold setting for novelty mining.

UNIT V Text streams 9

Text streams: Introduction – Text streams – Feature extraction and data reduction – Event detection – Trend detection – Event and trend descriptions – Embedding semantics in LDA topic models: Introduction– vector space modeling– latent semantic analysis– probabilistic latent semantic analysis– Latent Dirichlet allocation– embedding external semantics from Wikipedia– data–driven semantic embedding.

Total Hours: 45

References:

1. ***Michael W. Berry and Jacob Kogan (2012).Text Mining Applications and Theory***, Wiley publications.
2. ***Aggarwal, Charu C and Cheng Xiang Zhai(2012). Mining text data.*** Springer Science & Business Media,
3. ***Miner and Gary(2012).Practical text mining and statistical analysis for non-structured text data applications.*** Academic Press.

Course Outcomes:

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

CO1: Outline the basic concepts in extraction and clustering techniques in text mining.
CO2: Analyze the visualization methodologies in text analysis.
CO3: Apply event detection methods and text stream in Text Mining.

CO-PO MAPPING

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

Web Analytics and Development

PE2 **Hours of Instruction /week: 3T**
Semester VI **No. of credits: 3**
21BEAE26

Prerequisite:

- Internet and 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.
3. ***Alan Dix, Janet Finlay, Gre Goryd, Abowd, Russell Beale(2004). Human – Computer Interaction***, Third Edition, Pearson Education.

Course Outcomes:

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

CO1: Identify thebasic 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	M	M	M	-	M	-	-	-	M	M	M	-
CO3	M	M	M	-	M	-	-	-	-	M	L	-

Big Data Security

PE2 **Hours of Instruction /week: 3T**
Semester VI **No. of credits: 3**
21BEAE27

Prerequisite:

- Big Data Analytics

Objectives:

CLO1: To understand the characteristics of Big Data Security
CLO2 : To learn the basics of apache Kerberos and the key components of the Hadoop ecosystem security

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. ***Ben Spivey and Joey Echeverria(2015).Hadoop Security Protecting Your Big Data Problem***,O'Reilly Media.
2. ***Mark Van Rijmenam(2014)***. ***Think Bigger: Developing a Successful Big Data Strategy for Your Business***. First edition. Amazon
3. ***Frank Ohlhorst John Wiley &Sons(2013). Big Data Analytics: Turning Big Data into BigMoney***. John Wiley & Sons,
4. ***SherifSakr(2014).Large Scale and Big Data: Processing and Management***. CRC Press.
5. ***Sudeesh Narayanan(2013). Securing Hadoop***. Packet Publishing

Course Outcomes:

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

CO1: Explore 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	PO11	PO12
CO1	M	M	M	M	L	-	-	-	M	-	M	-
CO2	M	H	M	M	M	-	-	-	M	-	M	L
CO3	M	M	M	M	L	-	-	-	M	-	M	M

Time Series Analysis and Forecasting

PE3 **Hours of Instruction /week: 3T**
Semester VI **No. of credits: 3**
21BEAE28

Prerequisite:

- Probability and Statistics

Objectives:

CLO1: To understand the basic concepts in time series analysis and forecasting.

CLO2 : To impart the autoregressive integrated moving average modeling of stationary and non-stationary time series and compare with multivariate times series

UNIT I Introduction 9

Introduction to Time Series and Forecasting – Different types of data – Internal structures of time series Models for time series analysis – Autocorrelation and Partial autocorrelation – Examples of Time series Nature and uses of forecasting – Forecasting Process – Data for forecasting – Resources for forecasting.

UNIT II Statistics Background For Forecasting 9

Graphical Displays – Time Series Plots – Plotting Smoothed Data – Numerical Description of Time Series Data – Use of Data Transformations and Adjustments – General Approach to Time Series Modeling and Forecasting – Evaluating and Monitoring Forecasting Model Performance.

UNIT III Time Series Regression Model 9

Introduction – Least Squares Estimation in Linear Regression Models – Statistical Inference in Linear Regression – Prediction of New Observations – Model Adequacy Checking – Variable Selection Methods in Regression – Generalized and Weighted Least Squares – Regression Models for General Time Series Data– Exponential Smoothing – First order and Second order.

UNIT IV Autoregressive Integrated Moving Average (Arima) Models 9

Autoregressive Moving Average (ARMA) Models – Stationarity and Invertibility of ARMA Models – Checking for Stationarity using Variogram – Detecting Nonstationarity – Autoregressive Integrated Moving Average (ARIMA) Models – Forecasting using ARIMA – Seasonal Data – Seasonal ARIMA Models Forecasting using Seasonal ARIMA Models Introduction – Finding the "BEST" Model – Example.

UNIT V Multivariate Time Series Models And Forecasting 9

Multivariate Time Series Models and Forecasting – Multivariate Stationary Process – Vector ARIMA Models – Vector AR (VAR) Models – Neural Networks and Forecasting –Spectral Analysis – Bayesian Methods in Forecasting.

Total Hours: 45

References:

1. ***Alan B. Craig(2013).Understanding Augmented Reality, Concepts and Applications,***Morgan Kaufmann
2. ***Cryer, J. D and Chen, K. [CC](2008). Time Series Analysis with Applications in R, Second edition***
3. ***Burdea, G. C., P. Coffet (2006). Virtual Reality Technology***. Second Edition, Wiley-IEEE Press

Course Outcomes:

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

CO1: Identify the time series and forecasting process.

CO2: Analyze the linear regression model , variable selection methods and autoregressive moving average (ARMA) Models

CO3: Formulate the multivariate time series models and Bayesian methods inforecasting.

CO-PO MAPPING

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

Data Intensive Computing

PE2 **Hours of Instruction /week: 3T**
Semester VI **No. of credits: 3**
21BEAE29

Prerequisite:

- Big data Analytics

Objectives:

CLO1: To understand the basics of the various database systems including databases for Big data.

CLO2 : To learn about the architecture of data intensive computing and the applications that involve data intensive computing

UNIT I Introduction 9

Introduction to Distributed systems – Databases Vs. File Systems – Distributed file systems (HDFS) – Distributed Machine-Learning System – Data Parallelism – Characteristics – Hadoop – Execution Engines -Map Reduce- Distributed Storage System for Structured Data – No SQL databases – Casandra – MongoDB – Developing a Distributed Application.

UNIT II Architectures and Systems 9

High performance Network Architectures for Data intensive Computing – Architecting Data Intensive Software systems – ECL/HPCC: A Unified approach to Big Data – Scalable storage for Data Intensive Computing – Computation and Storage of scientific data sets in cloud – Stream Data Model – Architecture for Data Stream Management – Stream Queries – Sampling Data in a Stream Filtering Streams.

UNIT III Technologies and Techniques 9

Load balancing techniques for Data Intensive computing – Resource Management for Data Intensive Clouds – SALT – Parallel Processing – Multiprocessors and Virtualization in Data – Intensive Computing – Challenges in Data Intensive Analysis and Visualization – Large-Scale Data Analytics Using Ensemble Clustering – Ensemble Feature Ranking Methods for Data Intensive Computing Application – Record Linkage Methodology and Applications – Semantic Wrapper.

UNIT IV Security 9

Security in Data Intensive Computing Systems – Data Security and Privacy in Data – Intensive Supercomputing Clusters – Information Security in Large Scale Distributed Systems – Privacy and Security Requirements of Data Intensive Applications in Clouds.

UNIT V Applications and Future Trends 9

Cloud and grid computing for data intensive applications – Scientific applications – Bioinformatics – Large science discoveries – Climate change – Environment – Energy – Commercial applications – Future trends in data intensive computing.

Total Hours: 45

References:

1. ***Tom White (2010). Hadoop: The Definitive Guide.*** O'Reilly Media.
2. ***Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom(2013). Database Systems: The Complete Book***, Pearson,
3. ***Furht. Borko, Escalante and Armando (2011). Handbook of Data Intensive Computing,*** Springer**.**

Course Outcomes:

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

CO1: Identify the distributed system, architecture in intensive computing.
CO2: Discuss various technologies and techniques involved in intensive computing. .
CO3: Outline the various security techniques that are necessary for data intensive applications.

CO-PO MAPPING

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

Cloud Data Management

PE2 **Hours of Instruction/week: 3T**
Semester VII **No. of credits: 3**
21BEAE30

Prerequisites:

- Cloud computing, Convolution Neural Networks

Objectives:

CLO1: To familiarize the different types of cloud infrastructures

CLO2 : To manage cloud infrastructure in terms of organization, scale, and security

UNIT I Cloud Infrastructures 9

Cloud infrastructures– Public – Private–Hybrid – Service Provider Interfaces – Saas – Paas – Iaas – VDC Environments – Concept – Planning and design – Business Continuity and Disaster Recovery Principles – Managing VDC and Cloud Environments – Infrastructures– Scalability and Cloud Services – Large Scale Data Processing – Databases and Data Stores – Data Archival.

UNIT II Data Security 9

Storage Strategy and Governance – Security and regulations – Designing Secure Solutions – the considerations and Implementations involved – Securing storage in virtualized and Cloud environments – Monitoring and Management –Security Auditing and SIEM

UNIT III Data Location and Control 9

Architecture of Storage – Analysis and Planning – Storage Network Design Considerations – NAS and FC SANs –hybrid storage networking technologies (iSCSI, FCIP, FCoE) – Design for storage virtualization in cloud computing – Host system design considerations.

UNIT IV Global storage management locations 9

Global storage Management locations scalability – Operational efficiency – Global storage distribution – Terabytes to petabytes and greater – Policy based information management – metadata attitudes – File systems or Object storage

UNIT V Securing data for transport 9

Designing backup/Recovery solutions to guarantee data availability in a virtualized environment–Design a replication solution–Local remote and advanced–Investigate Replication in NAS and SAN environments–Data archiving solutions–Analyzing compliance and archiving design considerations.

Total Hours: 45

References:

1. ***Liang Zhao, Sherif Sakr, Anna Liu, Athman Bouguettaya (2014). Cloud Data Management.*** Springer International Publishing.
2. ***Lee Chao (2013). Cloud Database Development and Management.*** Taylor & Francis.
3. ***Greg Schulz(2011). Cloud and Virtual Data Storage Networking.****Auerbach Publications.*
4. ***Marty Poniatowski (2009). Foundations of Green IT. First Edition.****Prentice Hall.*
5. ***EMC Education Services (2012). Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments.*** Second Edition.Wiley.
6. ***Volker Herminghaus, Albrecht Scriba(2009). Storage Management in Data Centers.*** Springer.
7. ***Klaus Schmidt(2006). High Availability and Disaster Recovery.*** Springer.

Course Outcomes:

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

CO1: Explore the concepts and technologies of Cloud Computing, the security aspects associated with Cloud Computing

CO2: Analyze the virtual server component of Cloud Computing

CO3: Outline the Cloud storage and usage monitoring along with security mechanism

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	M	M	L	-	-	-	L	-	-	-	-	M
CO 2	M	H	M	M	M	-	L	-	M	M	M	M
CO 3	M	M	L	-	-	-	L	-	-	M	-	M

Social Media Analytics

PE 2
Semester VII
21BEAE31

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

Prerequisite:

- Artificial Intelligence and 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 Mining LinkedIn 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 Avinash Kohirkar (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, Techniques and 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

Block Chain

PE 2
Semester VII
21BEAE32

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

Prerequisites:

- Data Structures, Distributed Systems, Cryptography and Network Security

Objectives:

CLO1: To understand Block chain's fundamental components and examine decentralization using block chain.

CLO2: To gain knowledge on Emerging Trends in block chain.

UNIT I Introduction to Blockchain 9

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.

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 Programming Languages: Runtime Byte Code – Blocks and Block chain – Fee Schedule – Supporting Protocols – Solidity Language.

UNIT IV Web3 and Hyper ledger 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 Block chains 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.*** Second Edition. Packet Publishing.
2. ***S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan (2019). Blockchain Technology: Cryptocurrency and Applications***. Oxford University Press
3. ***Josh Thompson(2017). Block chain: The Block chain for Beginnings, Guild to Block chain Technology and Block chain 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 Block chain and how it works behind the Scenes.

CO2: Devise solution using the Ethereum model.

CO3: Apply hyper ledger and its development framework in emerging trends.

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