MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

MADANAPALLE

(UGC-AUTONOMOUS)

www.mits.ac.in

COMPUTER SCIENCE & ENGINEERING

(Data Science)

Course Structure

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the academic year 2020-21

and

B. Tech. Lateral Entry Scheme from the academic year 2021-22

B.TECH. COMPUTER SCIENCE & ENGINEERING

(Data Science)

B. Tech Computer Science & Engineering (Data Science)

Vision and Mission of the Institution

Vision	To become a globally recognized research and academic institution and thereby contribute to technological and socio-economic development of the nation
Mission	To foster a culture of excellence in research, innovation, entrepreneurship, rational thinking and civility by providing necessary resources for generation, dissemination and utilization of knowledge and in the process create an ambience for practice-based learning to the youth for success in their careers.

Vision and Mission of the Department

Vision	To become recognized data science center, emphasizing academic excellence, pioneering research, and data driven solutions, contributing significantly to global technological advancement and socio-economic development..
Mission	➢ To foster a culture that empowers students with state-of-the-art laboratories and learned faculty to compete in the data driven world. ➢ To provide a dynamic atmosphere for data-driven exploration in collaboration with global industry and research organization, encouraging innovation and entrepreneurship. ➢ To nurture professional ethics, inter-disciplinary and practice-based learning among students to serve the society.

B. Tech Computer Science & Engineering (Data Science)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Apply advanced skills in data analysis, utilizing cutting edge tools and techniques in higher studies, and excel in diverse professional settings.

PEO2: Demonstrate a strong aptitude for innovation and entrepreneurship, by creating novel solutions and contributing to industry and society.

PEO3: Collaborate with a culture of ethical and interdisciplinary thinking and address complex challenges.

PROGRAM OUTCOMES (POs)

At the end of the programme, graduate will be able to

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Demonstrate in statistical analysis, machine learning, and visualization, extracting insights from complex datasets.

PSO2: Apply data-driven approaches to solve intricate problems, communicate findings, and drive strategic outcomes.

PSO3: Develop and apply advanced data modeling techniques to make accurate predictions, including predictive analytics and forecasting.

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

Branch: COMPUTER SCIENCE & ENGINEERING

(Data Science)

Total Credits	160 Credits for 2020(Regular) & 121 Credits for 2021(Lateral Entry) Admitted Batch
	163 Credits for 2021(Regular) & 124 Credits 2022(Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No	Title	Duration
1	Induction Program (Mandatory)	Three weeks duration at the start of First Year (Refer Annexure - I)
2	Holistic Development Activities (Every Student from Semester 2 – 8 should register for at least one activity)	Three hours per week (Activity list is enclosed in Annexure - I)
3	Virtual Laboratory (Students are encouraged to choose and register for any of the Virtual laboratories he /she is interested)	As specified by the Virtual Laboratory

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R20 - Curriculum Structure

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT101	Engineering Calculus	3	1	0	4	4
2	BSC	20PHY102	Applied Physics	3	1	0	4	4
3	ESC	20EEE101	Basic Electrical Engineering	3	1	0	4	4
4	ESC	20CSE101	Programming for Problem Solving (Python)	2	0	3	5	3.5
5	HSMC	20ENG201	English for Professional Purposes Laboratory	0	0	2	2	1
6	BSC	20PHY201	Physics Laboratory	0	0	3	3	1.5
7	ESC	20EEE201	Electrical Engineering Laboratory	0	0	3	3	1.5
Total				**11**	**3**	**11**	**25**	**19.5**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20ENG101	Professional English	3	0	0	3	3
2	BSC	20MAT110	Linear Algebra	3	0	0	3	3
3	BSC	20CHE101	Engineering Chemistry	3	0	0	3	3
4	ESC	20CSE102	C Programming and Data Structures	3	0	0	3	3
5	ESC	20ME101	Engineering Graphics	2	0	2	4	3
6	BSC	20CHE201	Chemistry Laboratory	0	0	3	3	1.5
7	ESC	20CSE201	C Programming and Data Structures Laboratory	0	0	3	3	1.5
8	ESC	20CSE202	Engineering and IT Workshop	0	0	3	3	1.5
Total				**14**	**0**	**11**	**25**	**19.5**

(L = Lecture, T = Tutorial, P = Practical)

B. Tech Computer Science & Engineering (Data Science)

II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT111	Probability and Statistics for Computer Science	3	0	0	3	3
2	PCC	20CSD103	Computer System Architecture	3	0	0	3	3
3	PCC	20CSD104	Data Structures using Python	3	0	0	3	3
4	PCC	20CSD105	Object Oriented Programming - JAVA	2	1	0	3	3
5	PCC	20CSD106	Fundamentals of Artificial Intelligence	3	0	0	3	3
6	PCC	20CSD203	Data Structures using Python Laboratory	0	0	3	3	1.5
7	PCC	20CSD204	Object Oriented Programming - JAVA Laboratory	0	0	3	3	1.5
8	PCC	20CSD205	Fundamentals of Artificial Intelligence Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course-I (Refer ANNEXURE-IV)	1	0	2	3	2
10	MC	20CHE901	Environmental Science	2	0	0	2	0
Total				**17**	**1**	**11**	**29**	**21.5**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20HUM101	Economics and Financial Accounting for Engineers	3	0	0	3	3
2	BSC	20MAT112	Discrete Mathematical Structures	3	0	0	3	3
3	ESC	20CSD107	Operating Systems Fundamentals	3	0	0	3	3
4	PCC	20CSD108	Python for Data Science	3	0	0	3	3
5	PCC	20CSD109	Design and Analysis of Algorithms	2	1	0	3	3
6	PCC	20CSD206	Operating Systems Fundamentals Laboratory	0	0	3	3	1.5
7	PCC	20CSD207	Python for Data Science Laboratory	0	0	3	3	1.5
8	PCC	20CSD208	Design and Analysis of Algorithms Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course – II (Refer ANNEXURE-IV)	1	0	2	3	2
10	MC	20HUM901	Indian Constitution	2	0	0	2	0
Total				**17**	**1**	**11**	**29**	**21.5**

(L = Lecture, T = Tutorial, P = Practical)

B. Tech Computer Science & Engineering (Data Science)

III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20CSD110	Database Management System	2	1	0	3	3
2	PCC	20CSD111	Data Visualization	3	0	0	3	3
3	PCC	20CSD112	Machine Learning	3	0	0	3	3
4	OE		Open Elective – I	3	0	0	3	3
5	PE		Professional Elective- I	3	0	0	3	3
6	PCC	20CSD209	Data Visualization Laboratory	0	0	3	3	1.5
7	PCC	20CSD210	Machine Learning Laboratory	0	0	3	3	1.5
8	SC		Skill Oriented Course – III (Refer ANNEXURE-IV)	1	0	2	3	2
9	MC	20CE901	Disaster Management	2	0	0	2	0
10	PROJ	20CSD701	Summer Internship-1*	0	0	3	3	1.5
Total				**17**	**1**	**11**	**29**	**21.5**

* 2 Months internship during 2nd year summer vacation and to be evaluated in III Year I Semester

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20CSD113	Big Data Analytics	2	1	0	3	3
2	PCC	20CSD114	Deep Learning	3	0	0	3	3
3	PCC	20CSD115	Computer Networks	3	0	0	3	3
4	OE		Open Elective-2	3	0	0	3	3
5	PE		Professional Elective-2	3	0	0	3	3
6	PCC	20CSD211	Big Data Analytics Laboratory	0	0	3	3	1.5
7	PCC	20CSD212	Deep Learning Laboratory	0	0	3	3	1.5
8	PCC	20CSD213	Computer Networks Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course – IV (Refer ANNEXURE-IV)	1	0	2	3	2
10	MC	20HUM902**/20 HUM102#	Universal Human Values	2/3	0	0	2/3	0/3
Total				**17/18**	**1**	**11**	**29/30**	**21.5/24.5**

** 20HUM902 Universal Human Values is offered as non-credit mandatory course for 2020 (Regular) & 2021 (Lateral Entry) Admitted Batch

20HUM102 Universal Human Values is offered as three credit course for 2021 (Regular) & 2022(Lateral Entry) Admitted Batch onwards

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IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PE		Professional Elective-3	3	0	0	3	3
2	PE		Professional Elective-4	3	0	0	3	3
3	PE		Professional Elective-5	3	0	0	3	3
4	OE		Open Elective-3	3	0	0	3	3
5	OE		Open Elective-4	3	0	0	3	3
6	OE-HSMC		Open Elective-5 (Taken from Humanities & Social Science)	3	0	0	3	3
7	SC		Skill Oriented Course – V (Refer ANNEXURE-IV)	1	0	2	3	2
8	PROJ	20CSD702	Summer Internship-2*	0	0	6	6	3
Total				**19**	**0**	**8**	**27**	**23**

* 2 Months internship during 3rd year summer vacation and to be evaluated in IV Year I Semester

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	20CSD703	Project Work and Internship	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

(L = Lecture, T = Tutorial, P = Practical)

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ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

Proficiency modules

- Basic Computer Proficiency
- Interpersonal Skills
- Computer Graphics
- Web Programming
- Mobile Apps
- Vocabulary Enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
6. Nature and Environment
7. Innovation

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ANNEXURE - II

OPEN ELECTIVE – I (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M01	Project Management for Managers	Management Studies
2	20HUM3M02	Ethics in Engineering Practice	Management Studies
3	20HUM3M03	E – Business	Management Studies
4	20CE3M01	Integrated Waste Management for Smart City	Civil
5	20CE3M02	Soil and Water Conservation Engineering	Civil
6	20CE3M03	Plastic Waste Management	Civil
7	20CE3M04	Safety in Construction	Civil
8	20ME3M01	Operations Management	Mechanical
9	20ME3M02	Operations Research	Mechanical
10	20ME3M03	Design Thinking and Innovation	Mechanical
11	20EEE3M01	Non-Conventional Energy Sources	EEE
12	20EEE3M02	Design of Photovoltaic Systems	EEE
13	20ECE3M01	Microprocessors and Interfacing	ECE
14	20ECE3M02	Microprocessors and Microcontrollers	ECE
15	20ECE3M04	System Design Through Verilog	ECE
16	20IE3M01	Intellectual Property Rights and Competition Law	Multidisciplinary
17	20IE3M02	Introduction to Research	Multidisciplinary
18	20IE3M03	Roadmap for Patent Creation	Multidisciplinary
19	20IE3M04	Energy Conversion Technologies (Biomass And Coal)	Multidisciplinary
20	20IE3M05	Research Methodology	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

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OPEN ELECTIVE – II (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20MAT301	Advanced Numerical Methods	Mathematics
2	20MAT302	Engineering Optimization	Mathematics
3	20PHY301	Optical Physics and its Applications	Physics
4	20PHY302	LASER Physics and Advanced LASER Technology	Physics
5	20CHE301	Introduction to Petroleum Industry	Chemistry
6	20CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
7	20CE301	Ground Improvement Techniques	Civil
8	20CE302	Environmental Impact Assessment	Civil
9	20CE303	Watershed Management	Civil
10	20ME301	Materials Science for Engineers	Mechanical
11	20ME302	Elements of Mechanical Engineering	Mechanical
12	20EEE301	Industrial Electrical Systems	EEE
13	20EEE302	Introduction to MEMS	EEE
14	20ECE301	Bio-Medical Electronics	ECE
15	20ECE302	VLSI Design	ECE
Any new Interdisciplinary courses can be appended in future.			

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OPEN ELECTIVE – III (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M04	Management Information System	Management Studies
2	20CE3M05	Remote Sensing and GIS	Civil
3	20CE3M06	Wastewater Treatment and Recycling	Civil
4	20CE3M07	Building Materials And Composites	Civil
5	20ME3M04	Power Plant Engineering	Mechanical
6	20ME3M05	Mechatronics and Manufacturing Automation	Mechanical
7	20EEE3M03	Introduction to Smart Grid	EEE
8	20EEE3M04	Transducers For Instrumentation	EEE
9	20IE3M06	Learning Analytics Tools	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

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OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20PHY303	Thin Film Technology and its Applications	Physics
2	20CHE303	Introduction to Nano Science and Technology	Chemistry
3	20CHE304	Computational Methods in Materials Science and Engineering	Chemistry
4	20CE304	Green Buildings and Energy Conservation	Civil
5	20CE305	Environmental Engineering	Civil
6	20ME303	Total Quality Management	Mechanical
7	20ME304	Entrepreneurship	Mechanical
8	20EEE303	Robotics	EEE
9	20EEE304	Electrical Safety	EEE
10	20ECE303	Embedded Systems	ECE
11	20ECE304	DSP Architecture	ECE
12	20ECE305	Community Radio Technology	ECE
Any new Interdisciplinary courses can be appended in future.			

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OPEN ELECTIVE – V (HUMANITIES) (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM301	Principles of Management	Humanities
2	20HUM302	Human Resource Development	Humanities
3	20HUM303	Soft Skills	Humanities
4	20HUM304	National Cadet Corps	Humanities
Any new Interdisciplinary courses can be appended in future.			

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ANNEXURE – III

List of Professional Electives

Professional Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	20CSD401	Time Series Analysis
2.	20CSD402	Cryptography and Network Security
3.	20CSD403	Software Engineering
4.	20CSD404	Web Technologies
5.	20CSD405	Digital Image Processing
Any advanced courses can be appended in future.		

Professional Elective – II (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	20CSD4M01	Augmented Reality and Virtual Reality
2.	20CSD4M02	Introduction to Soft Computing
3.	20CSD4M03	Online Privacy
4.	20CSD4M04	Privacy and Security in Online Social Media
5.	20CSD4M05	Ethical Hacking
6.	20CSD4M06	Mobile Computing
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	20CSD406	Social Media Analytics
2.	20CSD407	Information Retrieval System
3.	20CSD408	Nature Inspired Computing for Data Science
4.	20CSD409	Software Project Management
5.	20CSD410	Database Security
6.	20CSD411	Cognitive Science and Analytics
Any advanced courses can be appended in future.		

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Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	20CSD412	Video Analytics
2.	20CSD413	Malware Analysis
3.	20CSD414	GPU Programming using CUDA
4.	20CSD415	Predictive Analysis in IoT
5.	20CSD416	Design Patterns
6.	20CSD417	Text Analytics and NLP
Any advanced courses can be appended in future.		

Professional Elective – V		
Sl. No.	**Course Code**	**Course Title**
1.	20CSD418	Exploratory Data Analysis
2.	20CSD419	Software Quality Assurance
3.	20CSD420	Reinforcement Learning
4.	20CSD421	Recommender System
5.	20CSD422	Advanced Python Programming
6.	20CSD423	Human Computer Interaction
Any advanced courses can be appended in future.		

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ANNEXURE – IV

SKILL ORIENTED COURSES

Skill Oriented Course – I		
Sl. No	**Course Code**	**Course Title**
1	20CSD601	Web Scripting
2	20CSD602	Android Application Development
Any advanced courses can be appended in future		

Skill Oriented Course – II		
Sl. No	**Course Code**	**Course Title**
1	20ENG601	Corporate Communication
Any advanced courses can be appended in future		

Skill Oriented Course – III		
Sl. No	**Course Code**	**Course Title**
1	20CSD603	Multimedia Computing
2	20CSD604	R Programming for Data Science
Any advanced courses can be appended in future		

Skill Oriented Course – IV		
Sl. No	**Course Code**	**Course Title**
1	20CSD605	Full Stack Development
2	20CSD606	UML Design
3	20CSD607	DevOps
Any advanced courses can be appended in future		

Skill Oriented Course – V		
Sl. No	**Course Code**	**Course Title**
1	20CSD608	Blockchain Development
2	20CSD609	Cryptography Algorithms
3	20CSD610	Advanced Machine Learning
Any advanced courses can be appended in future		

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ANNEXURE - V

Honors in Computer Science & Engineering (Data Science)

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Elective Course (Choose any two from three courses)**	20HDCSD101	Federated Machine Learning	3	0	0	3	3
2		20HDCSD102	Business Intelligence	3	0	0	3	3
3		20HDCSD103	Advanced Algorithms	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
III Year II Semester								
4	**Professional Elective Course (Choose any two from three courses)**	20HDCSD104	NoSQL	3	0	0	3	3
5		20HDCSD105	Intelligent Agents	3	0	0	3	3
6		20HDCSD106	Information Theory and Coding	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
IV Year I Semester								
7	**Professional Elective Course (Choose any two from three courses)**	20HDCSD107	Healthcare Data Analytics	3	0	0	3	3
8		20HDCSD108	Machine Translation	3	0	0	3	3
9		20HDCSD109	Data Science for Business	3	0	0	3	3
10	**SOC**	20HDCSD601	Cloud Computing	1	0	2	3	2
	Sub Total			**7**	**0**	**2**	**9**	**8**
	Total			**19**	**0**	**2**	**21**	**20**

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I Year I Semester

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B. Tech I Year I Semester

20MAT101 ENGINEERING CALCULUS

L	T	P	C
3	1	0	4

Pre-requisite: Mathematics at Intermediate or Equivalent Level

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –

1. To introduce the basic concepts of definite integrals, improper integrals, Beta and Gamma functions.
2. To acquire knowledge on mean value theorems in calculus.
3. To illustrate various techniques of testing the convergence of infinite series and introduces the functions of sine and cosine series.
4. To familiarize the knowledge of limit, continuity and the derivatives, extreme values in Multivariable.
5. To emphasize the role of Double and Triple integrals in dealing with area and volume of the regions.

UNIT I INTEGRAL CALCULUS 12 hours

Definite integrals; Applications of definite integrals to evaluate area and length of curves, surface areas and volumes of revolutions; Beta and Gamma functions and their properties.

UNIT II DIFFERENTIAL CALCULUS 12 hours

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders (without proofs); indeterminate forms, Maxima and minima.

UNIT III SEQUENCE AND SERIES 12 hours

Sequence and Series, their Convergence and tests for convergence; Power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT IV MULTIVARIABLE DIFFERENTIAL CALCULUS 12 hours

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

UNIT V MULTIVARIABLE INTEGRAL CALCULUS 12 hours

Multiple Integration: double integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes (double integration), triple integrals, gradient, curl and divergence, Green's, Stokes and Gauss divergence theorems (without proofs).

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Course Outcomes:

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

1. Evaluate the definite integrals, Beta and Gamma functions and calculate length of curve and underlying area.
2. Relate the results of mean value theorems in calculus to Engineering problems.
3. Use the Power series and Fourier series for ascertaining the stability and convergence of various techniques.
4. Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.
5. Compute the area and volume by interlinking them to appropriate double and triple integrals.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42th Edition, 2012.
2. G. B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus Pearson education 11th Edition, 2004.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year I Semester

20PHY102 APPLIED PHYSICS

L	T	P	C
3	1	0	4

Pre-requisite: Plus two level physics course

Course Description:

Applied Physics for Electrical, Electronics and Computer Engineers is a basic physics course which provides fundamental knowledge to understand the concepts of Waves, Optics, Quantum Mechanics, Semiconductors, Lasers and Fiber Optics.

Course Objectives:

1. Expose students in understanding the basic laws of nature through wave equation using the principles of oscillations and waves.
2. Analyze and understand the concepts of waves and optics to prepare the students for advanced level courses.
3. Expose students to theoretical and mathematical aspects of Interference, Diffraction techniques, Polarization and Lasers for testing of materials.
4. Develop knowledge and understanding the fundamental concepts of Quantum mechanics, Semiconductors and Fiber Optics.
5. Adaptability to new developments in science and technology.

UNIT I WAVES AND OSCILLATIONS 11 hours

Simple harmonic motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Superposition of vibrations along same direction (equal frequency) and in perpendicular directions, Lissajous figures.

Transverse waves, one dimensional wave equation, solution for wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, reflection and transmission waves at boundary, standing waves, standing wave ratio.

UNIT II OPTICS 13 hours

Superposition of waves, interference of light by division of wavefront - Young's double slit experiment, interference of light by division of amplitude- interference in thin film by reflection, Newton's rings experiment.

Diffraction, Farunhofer diffraction due to single slit, double slit and Diffraction grating (Nslit).

Polarization, Types of polarization, Polarization by reflection, refraction and double refraction, Nicol's prism. Half wave and Quarter wave plates.

UNIT III QUANTUM MECHANICS 12 hours

De Broglie's hypothesis, Uncertainty principle (Qualitative only), Postulates of quantum mechanics, Time-dependent and time-independent Schrodinger equations for wave function, Free-particle wave function and wave-packets (group velocity & phase velocity), Solution of wave equation: Solution of stationary-state, Schrodinger equation for one dimensional problems – particle in a box, Scattering from a potential barrier and principle of tunnelling- operation of scanning tunnelling microscope.

UNIT IV FREE ELECTRON THEORY & SEMICONDUCTORS 12 hours

Free electron theory of metals (drift velocity and electrical conductivity), Fermi energy level, density of states, Kronig-Penney model (Qualitative only) and origin of energy bands, band structure of metals, semiconductors, and insulators. Direct and indirect bandgap semiconductors, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier concentration and temperature (equilibrium carrier statistics), Drift and Diffusion Current, Hall effect.

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UNIT V LASERS & FIBER OPTICS 12 hours

Introduction to lasers, characteristics of laser, spontaneous and stimulated emission, Einstein's coefficients; population inversion, excitation mechanisms, solid-state lasers – ruby laser, gas Lasers - He-Ne Laser, applications of lasers.

Fiber Optics: Principle, Construction and working of optical fiber, Acceptance angle, Numerical aperture, Types of fiber, Fiber optic communication system.

Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Describe a mathematical wave equation using the principles of waves and oscillations
2. Apply the knowledge for materials testing using Interference, Diffraction & Polarization techniques.
3. Understand the idea of wave function and to solve Schrodinger equation for simple potentials.
4. Explain the role of semiconductors in different realms of physics and their applications in both science and technology.
5. Acquire the basic knowledge of lasers and fiber optics.

Text Books:

1. Engineering Physics –Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics –K. Thyagarajan, McGraw Hill Publishers.

Reference Books:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
2. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.
3. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
4. Concepts of Modern Physics by Arthur Beiser, 7th Edition, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year I Semester

20EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	1	0	4

Pre-requisite Intermediate Physics

Course Description:

This course equips the students with a basic understanding of Electrical circuits and machines for specific applications. In specific, the course covers basic of DC circuit & its analysis, introduction to single-phase and three-phase AC Systems, magnetic materials, transformers, DC & AC electrical machines, basic converters and Components of LT Switchgear.

Course Objectives:

1. To learn the basics of the D.C. circuit analysis.
2. To have an idea about single-phase and three-phase A.C. electrical circuits.
3. To gain knowledge about basic magnetic material and transformers.
4. To learn the construction and operation of D.C. and A.C. machines.
5. To understand the operation of basic rectifiers and various components of LT Switchgear.

UNIT I DC CIRCUIT ANALYSIS 12 hours

Electrical circuit elements, voltage and current sources, Series and parallel resistive circuits, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits with dc excitation. Source Transformation, Star-Delta Transformation, Superposition Theorem.

UNIT II AC CIRCUIT ANALYSIS 12 hours

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III MAGNETIC MATERIALS AND TRANSFORMERS 12 hours

Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency.

UNIT IV DC AND AC MACHINES 12 hours

Construction, working, emf equation of DC generator, methods of excitation, speed control of dc motor. Introduction to different types of AC motors, Three Phase Induction Motors - Generation of rotating magnetic fields, construction, working and starting methods: D.O.L, Autotransformer starter. Introduction to Alternators.

UNIT V RECTIFIERS AND ELECTRICAL INSTALLATIONS 12 hours

PN junction diode, half wave, full wave and bridge rectifiers. Components of LT Switchgear: switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables – Current carrying capability, Insulation Strength; Earthing.

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Course Outcomes:

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

1. To understand and analyze basic DC electric circuits.
2. To measure and analyze various electrical quantities of single phase and three AC electric circuits.
3. To understand magnetic materials and to analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

Text Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Reference Books:

1. Abhijit Chakrabarti, "Circuit Theory : Analysis and Synthesis", Dhanpat Rai & Co., 2014.
2. J.B. Gupta, "Theory & Performance of Electrical Machines", S. K. Kataria & Sons, 2013.
3. John Bird, "Electrical Circuit Theory and Technology", Fourth edition, Elsevier Ltd., 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year I Semester

20CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	3	3.5

Pre-requisite: None

Course Description:

Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience.

This course provides knowledge on how to implement programs in python language and to solve computational problems using the various programming constructs including data structures, functions, string handling mechanisms and file handling concepts

Course Objectives:

This course enables students to

1. Learn Python programming constructs.
2. Implement Python programs with conditional structures and loops.
3. Use functions for structuring Python programs.
4. Handle compound data using Python lists, tuples, and dictionaries.
5. Manipulate data using files handling in Python.
6. Getting exposed to the basics of Object Oriented Programming using Python

UNIT I: INTRODUCTION 12 hours

Algorithms, building blocks of algorithms (flow chart), History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Data Types - Integers, Strings, Boolean.

a) Develop a flowchart for the various arithmetic operations on numbers.
b) Develop a flowchart to check whether the number is positive or negative.
c) Develop a flowchart for finding whether a given number is even or odd.
d) Develop a flowchart for finding biggest number among three numbers.
e) Develop a flowchart for displaying reversal of a number.
f) Develop a flowchart to print factorial of a number using function.
g) Develop a flowchart to generate prime numbers series up to N using function.
h) Develop a flowchart to check given number is palindrome or not using function.
i) Alexa travelled 150 kms by train. How much distance in miles she actually covered?

UNIT II: OPERATORS AND EXPRESSIONS 12 hours

Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations. Control Flow - if, if-elif else, for, while, break, continue pass.

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a) Swapping of two number with and without using temporary variable.

b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.

c) Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard. The operator codes are as follows:

- For code '+', perform addition.
- For code '-', perform subtraction.
- For code '*', perform multiplication.
- For code '/', perform division.

d) Implement the python program to generate the multiplication table.

e) Implement Python program to find sum of natural numbers

f) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.

g) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the MITS examination policy as shown below.

% OBTAINED GRADE
90 - 100 O (Outstanding)
80 - 89 A+ (Excellent)
70 - 79 A (Very Good)
60 - 69 B+ (Good)
50 - 59 B (Above)
45 - 49 C (Average)
40 - 44 P (Pass)
< 40 F (Fail)

h) Implement Python Script to generate prime numbers series up to N.

i) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371. Write a program to find all Armstrong number in the range of 0 and 999.

UNIT-III: DATA STRUCTURES **12 hours**

Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. Functions - Defining Functions, Calling Functions, Passing Arguments, variable in python-Global and Local Variables.

a) Write a Python script to

- create a list
- access elements from a list
- slice lists
- change or add elements to a list
- delete or remove elements from a list

b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.

c) Write a Python script to compute the similarity between two lists.

d) Write a Python script to read set of values from a Tuple to perform various operations.

e) Write a Python script to perform basic dictionary operations like insert, delete and display.

f) Write a Python program to count the occurrence of each word in a given sentence.

g) Define a dictionary named population that contains the following data.

Keys	Values
Shanghai	17.8
Istanbul	13.3
Karachi	13.0
Mumbai	12.5

h) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.

i) Implement Python script to display power of given numbers using function.

j) Implement a Python program that takes a list of words and returns the length of the longest one using function.

UNIT-IV:

String Handling -Modules: Creating modules, import statement, from import statement, name spacing

Files and Directories:

a) Implement Python program to perform various operations on string using string libraries.

b) Implement Python program to remove punctuations from a given string.

c) Write a Python program to change the case of the given string (convert the string from lower case to upper

case). If the entered string is “computer”, your program should output “COMPUTER” without using library functions.

d) Implement Python program to capitalize each word in a string. For example, the entered sentence “god helps only people who work hard” to be converted as “God Helps Only People Who Work Hard”

e) Write a Python script to display file contents.

f) Write a Python script to copy file contents from one file to another.

g) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.

h) Write a Python commands to perform the following directory operations.

- List Directories and Files
- Making a New Directory
- Renaming a Directory or a File
- Removing Directory or File

UNIT-V:

Python packages: Predefined Packages and User-defined Packages, Package Creation.

Object Oriented Programming using Python: Introduction to OOP, Creating Classes and Objects in Python, Creating Methods in Python

Brief Tour of the Standard Library: Turtle

a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the __init__.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.

b) Create a class by name Student with instance variables such as roll_no, name, year_of_study, branch, section, and marks in any five subjects. The class should also contain one method for calculating the percentage of marks and the other method for printing a report as follows:

Roll No.	Name	Year	Section	Branch	M1	M2	M3	M4	M5	Percentage
101	abc	I	A	CSE	58	68	95	47	56	64.8

b) Write a python script to display following shapes using turtle.

Course Outcomes:

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

1. Understand problem solving techniques and their applications
2. Understand the syntax and semantics of python.
3. Demonstrate the use of Python lists and dictionaries.
4. Demonstrate the use of Python File processing, directories.
5. Describe and apply object-oriented programming methodology and Standard Library.

Text Books:

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

References:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year I Semester

20ENG201 ENGLISH FOR PROFESSIONAL PURPOSES LABORATORY
(Common to all branches)

L	T	P	C
0	0	2	1

Pre-requisite None

Course Description:
English language communication is a social phenomenon and students need to be able to function in the society at large as the communicators before entering the professional world. The present course equips the students with the basic functions of English language communication, which are required not only in their day-to-day lives but also profoundly significant for their future professional, academic training and their careers in the industry. The course mainly focuses on the achievement of communicative proficiency of the students coupled with the necessary linguistic inputs.

Course Objectives:
This course enables the student to –
1. Get aquatinted with the basic communicative functions.
2. Engage effectively in learning various functions of English language communication.
3. Enhance their narration abilities in past experiences and future plans and goals/events.
4. Develop their abilities in expressing opinion.
5. Provide speaking practice in speech.

Course contents:

Greeting and Introductions (L & S)
- Greeting on different occasions and responding to greetings **(L & S)**
- Wishing on various occasions, taking leave and saying goodbye **(L & S)**
- Introducing oneself and others **(L & S)**
- Asking for introduction and responding to introduction **(L & S)**
- Developing a short personal profile **(R &W)**

Describing: (L, S, R & W)
- Using adjectives **(Vocab)**
- Degrees of comparison **(Grammar)**
- Common words, phrases, and expressions used for description **(Vocab)**
- Describing people, places and objects **(L, S, R & W)**
- Reading and writing descriptive paragraphs **(R &W)**

Narrating (L, S, R & W)
- Talking about past experiences and events **(L & S)**
- Talking about memorable incidents or events **(L & S)**
- Techniques of narration and narrative tenses **(Grammar)**
- Composing and narrating a story **(R &W)**

Planning and Predicting (L, S, R & W)
- Talking about future events **(L & S)**
- Making promises and giving assurances **(L & S)**
- Predicting future events **(L & S)**
- Writing and organising a short plan of an event **(R &W)**

Instructions and directions (L, S, R & W)
- Forming imperative sentences (Grammar)

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- Reading and writing short instruction manuals **(R &W)**
- Writing a recipe/ procedure **(R &W)**
- Giving directions

Enquiring: (L, S, R & W)

- Open and closed ended questions **(Grammar)**
- Asking for information and giving information **(L & S)**
- Telephonic enquiry **(L & S)**
- Official enquiries through emails and letters **(R &W)**

Requesting: (L, S, R & W)

- Polite expressions
- Modal verbs and key phrases for requesting **(Grammar and vocab)**
- Official requests through emails and letters **(R &W)**

Comparing and contrasting: (L, S, R & W)

- Words and phrases used for comparison and contrast **(Vocab)**
- Comparing qualities/properties/quantities of people, places and objects **(L & S)**
- Composing comparison and contrast paragraphs **(R &W)**

Expressing opinion: (L, S, R & W)

- Language expressions used for expressing opinions **(Vocab)**
- Developing opinion based paragraphs **(R &W)**
- Discourse markers and linkers used in opinion based paragraphs **(R &W)**

Public Speaking: (L, S, R & W)

- Techniques and strategies required for public speaking **(L & S)**
- Developing and organising a short speech **(R &W)**
- Presentation skills required for public speaking **(L & S)**

Course Outcomes:

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

1. Develop their confidence while giving introduction, describing a place, & giving directions. (3,4,5)
2. Use various functions of English like asking for & giving information**,** inviting people for events/occasions, & requesting people. (3,4,5)
3. Narrate the past experiences and events in speaking and wring (3,4,5)
4. Express their views and opinions logically and appropriately in spoken and written format. (3,4,5,6)
5. Deliver logically organized speeches and present them without hesitations. (3,4,5, 6)

Text Books:

1. Leo Jones; Functions of English, Published by: Cambridge University Press.
2. Leo Jones; Let's Talk Level 1, 2, 3, Published by: Cambridge University Press.
3. Adrian Doff, Craig Thaine, Herbert Puchta, et al; *Empower: Intermediate (B1+)*; Published by: Cambridge University Press.

References:

1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press,2015.
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press 2013.
3. K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006

5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P.HUMPHREY, 2006
6. Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7. Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012
8. www.cambridgeenglish.org/in/
9. https://learnenglish.britishcouncil.org/en/english-grammar
10. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year I Semester

20PHY201 PHYSICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Description:

Physics Practical course is meant for making the students to gain practical knowledge to co relate with the theoretical studies. It covers experiments on Principles of Mechanics and Optics, Measurement of Magnetic field and studying Resonance using LCR Circuit.

Course Objectives:

1. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
2. Illustrate the basics of mechanics, waves and optics to analyze the behavior and characteristics of various materials for its optimum utilization.
3. Develop an ability to apply the knowledge of physics experiments in the later studies.

LIST OF EXPERIMENTS:

{Out of 17 experiments any 12 experiments (minimum 10) must be performed in a semester}

1. Spring constant - Coupled Pendulums.
2. Study of resonance effect in series and parallel LCR circuit.
3. Determination of radius of curvature of a curved surface - Newton's Rings.
4. Wavelength of a laser - Diffraction Grating
5. Wavelength of the spectral lines - Diffraction Grating.
6. Magnetic field along the axis of a current carrying coil - Stewart Gees' Apparatus
7. Thickness of a given wire - Wedge Method.
8. Dispersive power of prism – Spectrometer.
9. Frequency of the tuning fork - Melde's apparatus.
10. Determination of particle size using Laser.
11. Width of single slit - Diffraction due to Single Slit.
12. Torsional Pendulum.
13. Determination of the numerical aperture of a given optical fiber and hence to find its acceptance angle.
14. Measurement of *e/m* of electron (Thomson's method)
15. Energy gap of a material of p-n junction.
16. Determination of Planck's constant.
17. Ferroelectric hysteresis (B-H Curve).

Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Apply the scientific process in the conduct and reporting of experimental investigations.
2. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
3. Verify the theoretical ideas and concepts covered in lecture by doing hands on in the experiments.
4. Know about the characteristics of various materials in a practical manner and gain knowledge about various optical technique methods.
5. Acquire and interpret experimental data to examine the physical laws.

Reference Books:

1. Physics Laboratory Manual
2. Optics, A. Ghatak, 4th Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4th edition, McGraw-Hill Inc., 1981.
4. Engineering Mechanics, 2nd ed. — MK Harbola
5. Introduction to Electrodynamics- David J Griffiths

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year I Semester

20EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: None

Course Description:

The laboratory facilitates the students to deal with electrical instruments, which further strengthen the concepts & operation of various AC & DC circuits, and machines, and their characteristics. The lab also reinforce the concepts discussed in class with a hands-on approach which enable the students to gain significant experience with electrical instruments such as ammeter, voltmeter, digital multimeter, oscilloscopes, tachometer, switches, fuses and power supplies.

Course Objectives:

1. To provide hands on experience in setting up simple electrical circuits (DC and AC).
2. To get exposure to handle different electrical equipment's.
3. To measure various electrical parameters with different measuring instruments.
4. To get hands on experience in operating DC and AC machines.
5. To understand the operation of basic converters and various components of LT Switchgear..

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:

DEMONSTRATIONS:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, oscilloscope. Study of passive components - resistors, capacitors and inductors.
2. Demonstration of voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). In star and delta connections.
3. Demonstration of cut-out sections of transformer and DC & AC machines.
4. Demonstration of induction machine. Motor operation and generator operation of an induction machine driven at super-synchronous speed.
5. Wavelength of the spectral lines - Diffraction Grating.
6. Familiarization of (i) different types of cables/wires and switches and their uses, (ii) different types of fuses & fuse carriers; MCB, ELCB, MCCB their ratings and uses (components of LT switchgear).

EXPERIMENTS:

1. Wiring of a simple circuit for controlling (1) a lamp/fan point, (2) Staircase or Corridor Winding.
2. Wiring of a power circuit for controlling an electrical appliance (16A Socket).
3. Verification of Kirchhoff's current and voltage laws (KCL & KVL).
4. Verification of superposition theorem
5. Sinusoidal steady state response of R-L, and R-C circuits (impedance calculation and verification).
6. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
7. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
8. Open-circuit and short-circuit test on a single-phase transformer.
9. Speed control of separately excited DC motor.
10. Wiring of a power distribution arrangement using single-phase MCB distribution board with ELCB, main switch and energy meter (or residential house wiring).
11. Regulated power supply for generating a constant DC Voltage.
12. Fabrication of a given electronic circuit on a PCB and test the same.

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Course Outcomes:

Upon successful completion of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of various power electronic converters.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

I Year II Semester

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20ENG101 PROFESSIONAL ENGLISH

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –

1. Engage effectively in a professional environment
2. Understand the intricacies and implications of professional communication
3. Use linguistic skills in any given context
4. Conduct self in a learning environment
5. Be better prepared for employment

UNIT I GRAMMAR & VOCABULARY 9 hours

Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms.

UNIT II READING SKILLS & WRITTEN COMMUNICATION 9 hours

Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing- completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence.

UNIT III VERBAL & NON-VERBAL ASPECTS 9 hours

Verbal - Introducing oneself, exchanging personal information, Using 'Wh'- Questions, asking and answering, yes or no questions- asking about routine actions and expressing opinions; Non-Verbal – Use of body language, combating nervousness.

UNIT IV CONVERSATIONS 9 hours

Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, sharing information of a personal kind speaking about one's friend.

UNIT V BUSINESS ENVIRONMENT & ETIQUETTES 9 hours

Greeting & taking leave; Writing e-mails, memos, reports, etc.

Course Outcomes:

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

1. Read articles and understand professional communication
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind and personal letters and emails in English.

Text Books:

1. Guy Brook Hart & Norman Whitby; Cambridge English-Business Benchmark: Pre-Intermediate to Intermediate; Published by: Cambridge University Press.

2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Intermediate (B1+); Published by: Cambridge University Press.

Reference Books

1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press, 2015.
2 Raymond Murphy; English Grammar in Use with CD; Cambridge University Press, 2013.
3 K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4 William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006
5 Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006
6 Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7 Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012.
8 http://www.cambridgeenglish.org/in/
9 https://www.rong-chang.com/
10 https://www.rong-chang.com/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20MAT110 LINEAR ALGEBRA

L	T	P	C
3	0	0	3

Pre-requisite **20MAT101**

Course Description:

Linear algebra has widespread applications in engineering and science. In this course, various methods of solving system of linear equations, as applicable in the information technology and electrical circuits are highlighted. The concept of reduction of number of variables in systems has been introduced and effect of change of basis from the view point of computer graphics has been explained. Finally, basics involved in search engine operations by orthogonalisation and least squares optimization have been explained.

Course Objectives:

1. Understanding basic concepts of linear algebra (systems of linear equations, matrix calculus, vectors and basic vector operations).
2. Learn about vector spaces and subspaces.
3. To become proficient in solving computational problems of linear algebra.
4. To understand the axiomatic structure of modern mathematics and learn to construct simple proof.
5. To gain basic knowledge of search engine operations and optimization path.

UNIT I LINEAR EQUATIONS AND MATRICES 9 hours

System of linear equations, Gaussian elimination, Gauss-Jordan method, LU and LDU factorization, block matrices, inverse of matrices, elementary matrices, permutation matrix, Eigen value and Eigen vectors, Cayley -Hamilton Theorem (without proof), applications to cryptography and electrical network.

UNIT II VECTOR SPACE 9 hours

The n-space $R\ n$ and vector space, subspaces, bases, linear combination, span, linear independence, dimensions, finite dimensional, Row and column spaces, Rank and nullity, Bases for subspace, invertibility, application in interpolation.

UNIT III LINEAR TRANSFORMATIONS 9 hours

Basic Properties of Linear transformations, invertible linear transformation, matrices of linear transformations.

UNIT IV VECTOR SPACE OF LINEAR TRANSFORMATIONS 9 hours

Vector space of linear transformations, change of bases, similarity, application to computer graphics.

UNIT V INNER PRODUCT SPACES 9 hours

Dot Products and Inner products, the lengths and angles of vectors, matrix representations of inner products, Gram-Schmidt orthogonalisation, orthogonal projections, relations of fundamental subspaces, orthogonal matrices and isometrics, singular value decomposition (SVD), applications to least square solutions.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Solve systems of linear equations using Gaussian elimination and matrix inversion.
2. Understand the concepts of vector space and subspace, linear independence and use them in network systems. Apply principles of matrix algebra to linear transformations in solving engineering problems.
3. Use the concepts of similarity of transformations in computer graphics.
4. Demonstrate understanding of inner products, associated norms and interlink to search operations on network.

Text Books:

1. Jin Ho Kwak and Sungpyo Hong, "Linear Algebra", Second edition, Birkhaüser, 2004.

Reference Books:

1. Stephen Andrilli and David Hecher, Elementary Linear Algebra, 3rd Edition, Academic Press (2006)
2. Charles W. Curtis, Linear Algebra, Springer (2004).
3. Howard Anton and Robert C Busby, Contemporary linear algebra, John Wiley (2003).
4. Gilbert Strang, Introduction to Linear Algebra.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:

Deals with the basic principles of various branches of chemistry like physical, organic, inorganic, analytical and nanomaterial chemistry.

Course Objectives:

Students will

1. Understand, analyse and determine the impurities present in the water.
2. Appreciate the synthetic organic reactions used in daily life
3. Learn the principles of spectroscopies to analyse them.
4. Value the basic concepts of thermodynamics and electrochemistry.
5. Be exposed to the importance of nano and engineering materials used in their daily life and industry

UNIT I IMPURITIES PRESENT IN WATER AND WATER TREATMENT **9 hours**

Impurities present in Water: Impurities in water (BIS and WHO standards), Hardness of water-determination of hardness - EDTA Method (numerical problems), Alkalinity of water (numerical problems), Estimation of Dissolved Oxygen by Winkler's method and its importance and Chlorides. Disadvantages (industry level) of using hard water (Boiler corrosion, Caustic embrittlement, Scale and Sludges). Softening of water (Ion exchange method), Treatment of brackish water by Reverse Osmosis method. Water treatment for civic applications: coagulation, sedimentation, filtration, sterilization - chlorination and ozonation. Concept of break point chlorination.

UNIT II PERIODIC PROPERTIES AND ORGANIC REACTIONS **7 hours**

Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, oxidation states, molecular geometries. Organic Reactions: Introduction to substitution (SN^1 and SN^2), elimination (E_1 and E_2) - Addition, Condensation and Free Radical Polymerization Reaction (only the mechanism).

UNIT III SPECTROSCOPY **8 hours**

Basic Principle and Applications of UV-Visible, FT-IR, Raman, Microwave and Nuclear Magnetic Resonance (NMR) Spectroscopy

UNIT IV THERMODYNAMICS AND ELECTROCHEMISTRY **11 hours**

Thermodynamics: Systems, State Functions, Thermodynamic Functions: Work, Energy, Entropy and Free energy. Estimations of Entropy in Isothermal, Isobaric and Isochoric processes. Electrochemistry: Free energy and EMF. Cell potentials, the Nernst equation and applications. Batteries (Lead-Acid and Lithium ion) and Fuel-Cells (H_2-O_2).

UNIT V ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY **10 hours**

Engineering Materials: Cement Materials and Manufacturing Process. Reactions in setting and hardening of Cement. Lubricants – definition, Properties of lubricants – Viscosity, Viscosity Index, Flash Point and Pour Point. Nanomaterials: Introduction, Classes/Types, Chemical synthesis of Nanomaterials: Chemical Vapor Deposition method (Carbon Nanotubes), Characterization by powder XRD (Scherrer's equation). Applications of Nanomaterials: Solar Energy and Photocatalytic Dye Degradation (TiO_2).

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Analyse and determine the impurities in water such as hardness, alkalinity for sustainable development.
2. Prepare organic compounds/polymers for environmental, safety and society need.
3. Comprehend the principles and applications of spectroscopies.
4. Apply the concept of free energy in thermodynamics, electrochemistry for solving the problems evolve in the engineering processes.
5. Acquire spotlight to the nanomaterials and basic engineering materials used in academics, industry, and daily life.

Text Books:

1. P. W. Atkins & Julio de Paula, 'The Elements of Physical Chemistry', Ninth edition (Oxford University Press, Oxford 2010)
2. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
3. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
4. Dr. S. S. Dara and Dr. S. S. Umare, A Textbook of Engineering Chemistry,1 st Edition., (S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1 st Edition, (Tata McGraw-Hill Publishing Company Limited, 2017).

Reference Books

1. 'Physical Chemistry', D. W. Ball, First Edition, India Edition (Thomson, 2007).
2. Perry's Chemical Engineers' Handbook, Don W. Green and Marylee Z. Southard, 9th Edition (McGraw Hill, 2018).
3. Engineering Chemistry, Dr. Suba Ramesh and others, 1st Edition (Wiley India, 2011).
4. Jain and Jain, Engineering Chemistry,16th Edition (Dhanpat Rai Publishing Company (P) Ltd, 2016).
5. Amretashis Sengupta, Chandan Kumar Sarkar (eds.), Introduction to Nano Basics to Nanoscience and Nanotechnology (Springer-Verlag, Berlin, Heidelberg, 2015)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand fundamentals of C programming language and problem solving.
2. To understand the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stack, queue, and linked list.

UNIT I INTRODUCTION TO C PROGRAMMING 9 hours

Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions.
Control Structures: Conditional Statements (Simple if, if-else, Nested -if-else, Switch). Iterative Statements (for, While, Do-While), Jump Statements (break, Continue).

UNIT II FUNCTIONS & ARRAY 9 hours

Functions Introduction, User defined function, Function prototype, Function Definition and Function Call, Storage classes, Recursion **Arrays**: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. Passing array as an argument to function. **Sorting:** Bubble Sort, Insertion Sort, selection sort. **Searching:** Linear and binary search.

UNIT III STRINGS & POINTERS 9 hours

Strings: Declaring and defining a string, Initialization of strings, Strings Library functions.
Pointers: Fundamentals of pointer, Pointer Declarations, Parameter passing: Pass by value, Pass by reference, Dynamic memory allocation.

UNIT IV STRUCTURES & FILES 9 hours

Structures: Defining a structure, processing a structure, Pointer to Structure, Unions.
Files: Opening and closing a data file, Reading and Writing a data file, File I/O Functions.

UNIT V DATA STRUCTURES 12 hours

Stack: stack operations, stack implementations using arrays.
Queue: queue operations, queue implementations using array, Applications of stack and queue.
Linked List: Single linked list operations.

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand fundamentals of C programming language and its constructs.
2. Design and implement applications using functions, arrays, sorting and searching techniques.
3. Design and implement applications using strings and pointers.
4. Design and implement applications using structures and File processing.
5. Choose appropriate linear data structure depending on the problem to be solved.

Text Books:

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd Edition, Prentice Hall, India 1988.
2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.

Reference Books:

1. Let us C, Yashavant Kanetkar, 15th Edition, BPB Publications, 2016.
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education, 5th edition, 2007.
3. K. N. King ,"C Programming ": A Modern Approach, 2nd Edition 2nd Edition.
4. Byron Gottfried , Jitender Chhabra , Programming with C (Schaum's Outlines Series)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: None

Course Description:
Introduction to AutoCAD commands, simple drawings, orthographic projections, projection of points, lines, planes; auxiliary projections; projections and sections of solids; development and intersection of surfaces; isometric projections.

Course Objectives:

1. Engineering Graphics is the primary medium for development and communicating design concepts.
2. Through this course the students are trained in Engineering Graphics concepts with the use of AutoCAD.
3. The latest ISI code of practice is followed while preparing the drawings using AutoCAD.
4. Computerized drawing is an upcoming technology and provides accurate and easily modifiable graphics entities.
5. Storage and Retrieval of Drawings is also very easy and it takes very less time to prepare the drawings. Also enhances the creativity.

UNIT I INTRODUCTION TO AUTO CAD 12 hours

Introduction to AutoCAD commands, simple drawings using AutoCAD, Introduction to orthographic Projections – Theory, techniques, first angle projections and third angle projections.

UNIT II PROJECTIONS OF POINTS & LINES 12 hours

Projections of points: Positions, notation system and projections. Projections of lines: Positions, terms used, different cases, traces of lines and finding true length.

UNIT III PROJECTIONS OF PLANES & SOLIDS 12 hours

Projections of planes: Positions, terms used, different cases and projections procedure.
Projections of Solids: Projections of Regular Solids inclined to one plane (resting only on HP).

UNIT IV SECTIONS AND DEVELOPMENTS OF SOLIDS 12 hours

Section of solids: Sectional view of right regular solids (Prism and cylinder), true shapes of the sections.
Development of Surfaces: Development of surfaces of right regular solids (Prism, Cylinder and their Sectional Parts).

UNIT V INTERSECTIONS & ISOMETRIC PROJECTIONS 12 hours

Intersections of surfaces of solids: Intersection between prism Vs prism, prism Vs cylinder, cylinder Vs cylinder.
Isometric Projections: Theory of isometric drawing and orthographic views, Conversion of isometric view into orthographic views.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

Student will be able to

1. Identify various commands in AutoCAD software and apply AutoCAD skills to develop the new designs.
2. Draw the projections of points, straight lines using AutoCAD.
3. Draw the projections of the planes, solids using AutoCAD
4. Sketch the developments of solids, sections of solids using AutoCAD.
5. Draw the conversion of the isometric views to orthographic views and intersections of surfaces using AutoCAD.

Text Books:

1. D.M. Kulkarni, A.P. Rastogi and A.M. Sarkar., Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi 2009.
2. N D Bhat, Engineering Drawing, Charotar Publishing House, Gujarath,15th Edition, 2010.
3. K.L. Narayana, P. Kanniah, Engineering Drawing, Scitech Publishers, 2nd Edition, 2010.

Reference Books:

1. Dhananjay A Jolhe, Engineering Drawing: with an introduction to AutoCAD, Tata McGraw Hill, 2008.
2. Warren J. Luzadder & Jon M. Duff Fundamentals of Engineering Drawing, 11th edition, Prentice Hall of India, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:

It deals with basic principles of volumetric and instrumental analytical methods.

Course Objectives:

This Engineering Chemistry Laboratory is common to all branches of I Year B Tech. At the end of the course the student is expected to Students will

1. Learn to estimate the chemical impurities present in water such as hardness, alkalinity, chlorine, etc.
2. Understand and experience the formation of inorganic complex and analytical technique for trace metal determination.
3. Be trained to use the instruments to practically understand the concepts of electrochemistry.
4. Bridge theoretical concepts and their practical engineering applications, thus
5. highlighting the role of chemistry in engineering.

LIST OF EXPERIMENTS

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of dissolved oxygen by Winkler's method.
4. Determination of molecular weight of a polymer by using Ostwald's viscometer.
5. Determination of rate constant of an ester hydrolysis (Pseudo First Order reaction).
6. Determination of strength of a Strong acid (conc. H_2SO_4) by conductometric titration (Neutralisation Titration).
7. Conductometric titration of $BaCl_2$ Vs Na_2SO_4 (Precipitation Titration).
8. Dissociation constant of weak electrolyte by Conductometry.
9. Determination of percentage of Iron in Cement sample by colorimetry.
10. Estimation of ferrous ion by Potentiometric titration (Redox Titration).
11. Saponification value of oil.
12. Formation of Iron-1,10-phenanthroline complex and determination of iron by colorimetry.

Course Outcomes:

After the completion of the Engineering Chemistry Laboratory experiments, students will be able to

1. Develop and perform analytical chemistry techniques to address the water related problems (for e.g., hardness, alkalinity present in water) technically.
2. Handle electro-analytical instruments like digital conductivity meter and potentiometer to perform neutralization, precipitation, and redox titrations, respectively.
3. Acquire practical skills to handle spectro-photochemical methods to verify Beer Lambert's Law.
4. Operate various instruments for the analysis of materials and produce accurate results in a given time frame.
5. Think innovatively and improve the creative skills that are essential for solving engineering problems.

Textbook:

1. Engineering Chemistry Lab Manual (2017-18), Dept. of Chemistry, Madanapalle Institute of Technology and Science, Madanapalle – 517325, Chittoor Dist., Andhra Pradesh, India.
2. "Vogel's Textbook of Qualitative Chemical Analysis", Arthur Israel Vogel, Prentice Hall, 2000.
3. Laboratory Manual on Engineering Chemistry, by Dr Sudha Rani, Dhanpat Rai Publishing house, 2009.
4. A Textbook on Experiments and calculations in Engineering Chemistry, by SS Dara, S Chand publications, 2015.
5. Laboratory Manual of Organic Chemistry, by Raj K Bansal, Wiley Eastern Limited, New age international limited, 2009.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: 20CSE101

Course Description:

This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:

1. To make the student understand fundamentals of C programming language and problem solving.
2. To get hands-on practices with the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stacks, queues, and linked lists.

LIST OF EXPERIMENTS

1. a) Write a C program to swap the two numbers.
b) Write a C Program to find the eligibility of admission for a Professional course based on the following criteria:

i. Marks in Maths >=65
ii. Marks in Physics >=55
iii. Marks in Chemistry>=50
OR
iv. Total in all three subject >=180

2. a) Write a C program to compute the factorial of a given number.
b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1. Print the sum of all the integers that you have read before you encountered -1.

3. a) Write a C program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies.
b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by an iterative process of summing digits. Digital sum of 65536 is 7, because 6+5+5+3+6=25 and 2+5 = 7.Write a program that takes an integer as input and prints its digital root.

4. a) Write a C program to find the series of prime numbers in the given range.
b) Write a C program to generate Tribonacci numbers in the given range.

5. a) Write a C program to find sum of digits, Decimal to Binary conversion, reversal of numbers using functions.
b) Write a C program to find Factorial, Greatest Common Divisor, and Fibonacci using recursion.

6. Your program should take as input: dimension of a square matrix N, two matrices of size N x N with integer values, and one operator symbol (+, - ,*). It must perform the corresponding operation given below;
a) Matrix Addition b) Matrix Subtraction c) Matrix Multiplication

7. Implement the following sorting techniques.
a) Bubble sort b) Insertion sort c) Selection sort.

8. Implement the following searching techniques.
a) Linear Search b) Binary Search

9. a) Write a program in C to find the frequency of characters in a string.
b) Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using string library functions.

10. a) Write a C program to get *N* elements in an array and sort it using Pointer.
b) Write a C program to swap two integers using pass by reference.
c) Write a C program to find the largest element using Dynamic Memory Allocation.

11. a) Write a program in C to count the number of vowels, consonants, digits, special symbols, words in a string using a pointer.

b) Write a C program to print all permutations of a given string using pointers.

12. a) Write a C program to add two distances in the inch-feet system using structures.
b) Write a C program to calculate difference between Two Time Periods (in *Hours, Minutes, Seconds* format) using structures.

13. Develop an application to match parenthesis of a given expression using Stack.

14. Develop an application to identify Palindrome string using Stack and Queue.

15. Develop an application to add two Polynomial equations using Linked List.

Course Outcomes:

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

1. Understand fundamentals of C programming language and its constructs.

2. Design applications using functions, arrays, sorting and searching techniques.

3. Design and implement solutions using strings and pointers.

4. Design and develop solutions using structures and File processing.

5. Design and develop applications on stack, queue, and linked list depending on the problems to be solved.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech I Year II Semester

20CSE202 ENGINEERING AND IT WORKSHOP

L	T	P	C
0	0	3	1.5

Prerequisite: None

Course Description:
This course will provide students with a hands-on experience on various basic engineering practices CSE and presenting the final product design.

Course Objectives:
1. Introduction to the use of Tools and Machinery in foundry, forging, tinsmith, carpentry, welding, fitting, working, fabrication of plastic components, fabrication of polymer composite materials, simple machine turning and wood turning, basic electrical connections.
2. Introduction of basic electrical engineering.
3. Fabrication of final product design at end of the semester.

LIST OF EXPERIMENTS

1. Carpentry (Cross half lap Joint and Miter Joint)
2. Fitting (Square and 'V' fit)
3. Sheet Metal - Tin smithy (Square tray)
4. Foundry (Solid and Split pattern)
5. Welding (Arc and Gas welding) – SingleV Butt Joint, T-fillet Joint
6. Plastic fabrication (Pen Stand)
7. Metrology (Internal and External dimension)
8. Introduction of Power Tools and CNC (Demo Only)
9. Introduction to 3D Printing (Demo Only)

Course Outcomes:
On successful completion of this course, the student will be able to
1. Fabricate carpentry components with suitable joint and pipe connections including plumbing works.
2. Practice the welding equipment to join the structures
3. Effective the basic machining operations
4. Create the models using sheet metal and plastic works.
5. Illustrate the operations of foundry, fitting and smithy
6. Fabrication product in composite material and product in plastic material
7. Conduct experiment basic electrical wire connection
8. Design and fabrication of final product design

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – 1" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998. (v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

B. Tech Computer Science & Engineering (Data Science)

IT WORKSHOP

Prerequisite: None

Course Description:

This course helps the students to understand the basic components of a computer, installation of operating systems, working on office productivity tools word-processor, spreadsheet and presentation slides. Also it gives a basic understanding of using Google tools and various email settings in Gmail.

Course Objectives:

1. The course focuses on enhancing student knowledge in computer peripherals and assembling.
2. To install operating system on computers and create new email account.
3. To understand basic software utilities like compression tools, PDF readers and web browser.
4. To provide technical training to the students on software tools like online forms, calendar applications, online drive, online translation tools and image processing applications.
5. To make the students to install software like Integrated Development Environments (IDE),and compliers for different programming languages.

LIST OF EXPERIMENTS

1. Components of Computer & Assembling a Computer: Learning about the different parts of the computer and its advancement
   - Processor
   - Memory – Types
   - Motherboard
   - Peripheral interfaces – I/O devices
   - Learn about the proper connectivity among the devices inside the PC
   - Assembling the different parts of the computer inside the cabinet
2. Install Operating System
   - Partition the disk drive based on the capacity and the OS to be installed.
   - Install ReactOS/Windows
   - Install Ubuntu or any other GNU/Linux
   - Install VirtualBox or VMWare or QEMU
3. Basic PC Troubleshooting
   - Awareness on the possible issues in a computer
   - Troubleshooting the problems using the available tools
   - Removal and repair of existing software
   - Identification of suitable Device driver for Hardware Devices.
4. Learning Basic Software:
   - Installation of simple Productivity tools like file and folder compression utilities and PDF readers.
   - Installation of Image Editor and Web browsers.
   - Basic Software installation in GNU Linux based system.
   - Connect the Printer and Scanner Devices perform printing and scanning operation.
5. Office Productivity Tools:
   - Generate, manipulate, search, aligning content using word processing applications.
   - Creation of spreadsheet with various column and rows applying various formulas on cells.
   - Create Presentation and Visualization – graphs, charts, 2D, 3D.
   - Create a database template using Libreoffice Base, OpenOffice Base or MS Access.
   - Draw flowchart using the Drawing tools – Google Quick draw, sketch up,
6. Introduction to Google Tools

B. Tech Computer Science & Engineering (Data Science)

- Design a Google form and collect a response date among students using Google Form.
- Schedule One day of your activities using Google Calendar.
- Store and Retrieve Date from cloud storage using Google Drive.
- Translate the English language sentence to Telugu sentence using Google Translate
- Organizing photo and editing photo using Google Photos.

7. Exploring Email

- Creation, Composing and Sending the E-mail.
- Use High Priority setting to categories the mail.
- Create a Folder in different Categories and move the received mail to Folder.
- Unsubscribing unwanted emails
- Enable settings for automatic reply

Add_on content:

- Networking Commands: ping, ssh, ifconfig, scp, ipconfig, traceroute, nslookup, getmac

Technical Stack: GNU Linux, Windows/ReactOS-Compression Utilities, PDF reader, Office Package.

Course Outcomes:

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

1. Attain complete knowledge of a computer hardware
2. Install Operating Systems and troubleshooting using Utility software.
3. Able to do document task through office productivity software.
4. Attain technically strong usage of Google Tools and Email handling.
5. Able to install basic computer engineering software.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

II Year I Semester

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20MAT111 PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE

L	T	P	C
3	0	0	3

Pre-requisite **20MAT101**

Course Description:

This course provides an introduction to probability, distributions and statistics with applications. Topics include: Conditional probability, Random variables, Probability distributions, Joint densities, Bayesian inference, descriptive statistics, Correlation and Regression, Estimation, Confidence intervals, Hypothesis testing.

Course Objectives:

1. To extend and formalize knowledge of the theory of probability and random variables.
2. To solve real time problems in engineering and science by using discrete and continuous distributions
3. To analyze and interpret basic summary and modeling techniques for Multi-variate data
4. To analyze the data by using descriptive statistics for decision making
5. To apply the statistical inference involving confidence interval and hypothesis testing in data analysis.

UNIT I Probability **9 hours**

Introduction to Probability, Sample space and events, axioms of probability, theorems on probability, conditional probability, multiplication theorem and independence of events, Baye's theorem.

Random variables (discrete and continuous), probability density functions, distribution function, mathematical expectation, properties. moment generating function.

UNIT II Probability Distributions **9 hours**

Discrete probability distributions - Binomial, Poisson, Geometric and their properties Continuous probability distributions - Uniform, Exponential, Gamma, Normal distributions and their properties, Chebychev's inequality.

UNIT III Joint Distributions **9 hours**

Joint densities and Independence - Marginal distributions (discrete & continuous)- Expectation and Covariance, Correlation, Conditional densities and Regression, Curves of regression, Transformation of random variables.

UNIT IV Statistics for Data Analysis **9 hours**

Data Visualization, Moments, skewness, kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, lines of regression, regression coefficients and their properties.

UNIT V Statistical Inference **9 hours**

Population, sampling, formulation of null hypothesis, alternative hypothesis, level of significance, types of errors and power of the test. Large Sample Tests: Test for single mean, single proportion, difference of means, difference of proportions, Confidence interval for parameters in one sample and two sample problems, t test for single mean, difference of means, test for ratio of variances.

Course Outcomes:

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

1. Understand the probability concepts and their importance in engineering.
2. Apply discrete and continuous probability distributions to solve various engineering problems.
3. Get an idea about joint density functions, distribution functions to the random variables and analyse the multivariate problems in engineering
4. Apply the method of least squares to estimate the parameters of a regression model.
5. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.

Text Book(s)

1 Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

2 Dr.B.S.Grewal, " Higher Engineering Mathematics", Khanna Publications, 42nd Edition.

Reference Books

1 Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

2 Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012

3 Dean G. Duffy., "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.

E BOOKS

1 http://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf

2 https://www.khanacademy.org

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20CSD103 COMPUTER SYSTEM ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

This course deals with basics of digital logic design and computer organization. It provides knowledge to design digital circuits for computer components with high performance. Computer arithmetic, Pipelining and Parallel processing are studied in this course. It also emphasises on CPU, Memory and I/O organization.

Course Objectives:

1. To provide knowledge for designing digital circuits.
2. To understand various data representation methods and arithmetic operations.
3. To learn about Processor, Memory and I/O organization.
4. To learn the basics of pipelined execution and parallel processing

UNIT I DIGITAL LOGIC CIRCUITS AND COMPONENTS 9 hours

Logic Gates – Boolean Algebra – Simplification of Boolean Expression using K – Map, Combinational Circuit - Binary Codes - Error Detection Codes. Encoders – Decoders – Multiplexers & Demultiplexers – Sequential Circuit - Flip Flops – Registers – Shift Registers.

UNIT II DATA REPRESENTATION AND COMPUTER ARITHMETIC 9 hours

Data Representation: Fixed Point, Floating point Representations –. **Computer Arithmetic**: Addition, Subtraction, Multiplication & Division Algorithms - Floating point Arithmetic Operations.

UNIT III CPU AND CONTROL UNIT 9 hours

Processor Structure and Function: - Processor Organization - Register Organization – Instruction Cycle – CISC – RISC Processors – x86 and ARM Addressing Modes – x86 and ARM Instruction Formats. **Control Unit Operation**:– Hardwired Control – Microprogrammed Control – Basic Concepts.

UNIT IV PIPELINE AND PARALLEL PROCESSING 9 hours

Instruction Pipelining: Pipelining Strategy – Pipeline performance – Pipeline Hazards – Dealing with branches – **Parallel processing**: Multi-Processor Organizations – Symmetric Multiprocessors – Multithreading and Chip Multiprocessors – Clusters.

UNIT V MEMORY AND I/O ORGANIZATIONS 9 hours

Memory Hierarchy: Main memory – ROM - RAM– Cache memory: Computer Memory System Overview – Cache memory principles – Elements of Cache design – **Data Transfer Schemes**: - Programmed I/O – Interrupt Driven I/O – Direct Memory Access – Redundant Array of Independent Disks.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Design digital circuits for computer components.
2. Implement fixed-point and floating point arithmetic unit.
3. Understand the basics structure of computers, operations and instructions.
4. Understand pipelined execution and parallel processing architectures.
5. Analyze the various memory systems and I/O communication.

Text Book(s)

1. William Stallings, "Computer Organization and Architecture Designing for Performance", Tenth Edition, Pearson Publications.
2. M.Morris Mano, "Computer System Architecture", Third edition, Pearson Publications.

Reference Books

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill Publications.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20CSD104 DATA STRUCTURES USING PYTHON

L	T	P	C
3	0	0	3

Pre-requisite **20CSE102**

Course Description:

The typical data structures course, which introduces a collection of fundamental data structures. The basic concepts related to abstract data types, data structures, and algorithms. Arrays, Sets and Maps, Searching and Sorting, Linked Structures, Stacks, Queues, Advanced Linked Lists, Recursion, Hash Tables, Advanced Sorting, Binary Trees, Search Trees.

Course Objectives:

1. To develop skills to design and analyze linear and nonlinear data structures.
2. Develop algorithms for manipulating linked lists, stacks, queues, trees and graphs.
3. Develop recursive algorithms as they apply to trees and graphs.
4. To develop skill in advanced linked list.
5. To develop skill in advanced sorting.

UNIT I ABSTRACT DATA TYPES, ARRAYS, SETS AND MAPS 9 hours

Abstract Data Types: Introduction, The Date Abstract Data Type, Bags, Iterators. **Arrays:** The Array Structure, The Python List, Two-Dimensional Arrays, The Matrix Abstract Data Type. **Sets and Maps:** Sets, Maps, Multi-Dimensional Arrays.

UNIT II ALGORITHM ANALYSIS, SEARCHING AND SORTING 9 hours

Algorithm Analysis: Complexity Analysis, Evaluating the Python List, Amortized Cost, Evaluating the Set ADT. **Searching and Sorting:** Searching, Sorting, Working with Sorted Lists, The Set ADT Revisited.

UNIT III LINKED STRUCTURES, QUEUES 9 hours

Linked Structures: The Singly Linked List, The Bag ADT Revisited, The Sparse Matrix Revisited. **Stacks:** The Stack ADT, Implementing the Stack, Stack Applications. **Queues:** The Queue ADT, Implementing the Queue, Priority Queues.

UNIT IV ADVANCED LINKED LISTS, RECURSION, HASH TABLES 9 hours

Advanced Linked Lists: The Doubly Linked List, The Circular Linked List, Multi-Linked Lists, Complex Iterators. **Recursion:** Recursive Functions, Properties of Recursion, How Recursion Works, Recursive Applications. **Hash Tables:** Hashing, Separate Chaining, Hash Functions, The HashMap Abstract Data Type.

UNIT V ADVANCED SORTING, BINARY TREES, SEARCH TREES 9 hours

Advanced Sorting: Merge Sort**,** Quick Sort, Radix Sort, Sorting Linked Lists. **Binary Trees:** The Tree Structure, The Binary Tree, Expression Trees, Heaps, Heapsort. **Search Trees:** The Binary Search Tree, Search Tree Iterators, AVL Trees, The 2-3 Tree.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Describes the Abstract Data Types, Arrays, Sets and Maps
2. Explains the Algorithm Analysis, Searching and Sorting
3. Understand the Linked Structures, Stacks, and Queues
4. Examine the Advanced Linked Lists, Recursion, and Hash Tables
5. Construct of Advanced Sorting, Binary Trees, and Search Trees

Text Book(s)

1. Data Structures and Algorithms Using Python, Rance D. Necaise

Reference Books

1. Fundamentals of Data Structures, Ellis Horowitz, SartajSahni, Dinesh Mehta, Silicon Press, Second Edition. 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20CSD105 OBJECT ORIENTED PROGRAMMING - JAVA

L	T	P	C
2	1	0	3

Pre-requisite **20CSE102**

Course Description:
This course is designed to provide basics of Object-Oriented Programming - objects, classes, polymorphism, inheritance, static and dynamic binding. Object Oriented Programming using Java- classes, interfaces, inheritance, polymorphism, method dispatch, features for encapsulation and modularity.

Course Objectives:

1. Understand object-oriented programming concepts, and apply them in solving problems.
2. Learn the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes.
3. To introduce the implementation of packages and interfaces.
4. Learn the concepts of exception handling and multithreading.
5. Learn the design of Graphical User Interface using applets and swing controls.

UNIT I INTRODUCTION TO OOPS CONCEPTS AND CLASSES 9 hours

Introduction to Object Oriented Programming, Java buzzwords, Java Programming Basics, Sample programs, Data types and operators, Control statements. **Classes:** Classes, Objects, Methods, Constructors, this and static keywords, Method and Constructor Overloading, Access modifiers, Polymorphism **Arrays**: One Dimensional and multi-dimensional arrays.

UNIT II STRINGS, INHERITANCE, INTERFACES, AND PACKAGES 9 hours

Strings: Strings, String Handling **Inheritance:** Basics, Usage of Super, Multi-level hierarchy, Method overriding, Abstract class and Final keyword. **Packages:** Defining, Finding and Importing packages, Member Access. **Interfaces:** Creating, Implementing, Using, Extending, and Nesting of interfaces.

UNIT III EXCEPTION HANDLING &MULTI-THREADING 9 hours

Exception Handling: Fundamentals, Types, Multiple catch clauses, Nested try blocks, Thrown Class, Using Finally and Throws, Built-in exceptions, User-defined exceptions.
Multi-threading: Thread Class, Runnable interface, creating multiple threads, life cycle of thread, thread properties, synchronization, thread communication, suspending, resuming and stopping threads.

UNIT IV I/O STREAMS AND COLLECTION FRAME WORK CLASSES 9 hours

I/O Streams: Byte Stream Classes and Character Stream Classes. **Collection Frame work :** Hierarchy of collection framework, Array List, Linked List, Vector, Stack, Queue, Priority Queue, Hash Set, Linked Hash Set, Tree Set.

UNIT V SWINGS 9 hours

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, Event Handling- Handling mouse and keyboard events, Exploring Swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Course Outcomes:

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

1. Choose object-oriented programming concepts for problem solving.
2. Create and use packages and interfaces.
3. Develop multithreaded applications with synchronization.
4. Provide computed based solutions by using java collection framework and I/O classes
5. Design GUI based applications

Text Book(s)

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9th Edition, 2016.

Reference Books

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.
3. "Thinking in Java", Bruce Eckel, Pearson Education.
4. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.
5. A Programmers Guide to Java SCJP", Third Edition, Mughal, Rasmussen, Pearson.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20CSD106 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course is aimed to provide basic understanding of different intelligent agents in terms of Artificial Intelligence. This Course covers introduction to artificial intelligence, solving problems by various algorithms, Knowledge and Reasoning, Uncertain Knowledge and Reasoning.

Course Objectives:

1. To provide a broad understanding of the basic techniques for building intelligent computer systems and an understanding of how AI is applied to problems.
2. To Gain knowledge in problem formulation and building intelligent agents.
3. To understand the search technique procedures applied to real world problems.
4. To learn the types of logic and knowledge representation schemes.
5. To understand the applications of Al: namely Game Playing, Theorem Proving and Expert systems.

UNIT I FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE 9 hours

Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT II UNINFORMED SEARCH STRATEGIES 9 hours

Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies, Searching with partial information, Sensor-less problems, Contingency problems.

UNIT III INFORMED SEARCH STRATEGIES 9 hours

Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence.

UNIT IV KNOWLEDGE REPRESENTATION 9 hours

Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.

UNIT V PLANNING AND UNCERTAINTY 9 hours

Planning: Planning problem, Planning with State Space Search, Partial Order Planning, Hierarchical Planning, Conditional Planning. Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Justification based Truth Maintenance Systems, Semantic Nets, Statistical Reasoning, Fuzzy logic:

fuzzy set definition and types, membership function, designing a fuzzy set for a given application. Probability and Bayes' theorem, Bayesian Networks.

Course Outcomes:

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

1. Formulate a problem and build intelligent agents.
2. Apply appropriate searching techniques to solve a real world problem.
3. Evaluation of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.
4. Analyze the problem and infer new knowledge using suitable knowledge representation schemes.
5. Formulate and solve given problem using Propositional and first order logic.
6. Apply reasoning for non-monotonic AI problems.

Text Book(s)

1. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
2. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson

Reference Books

1. George F. Luger, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.
2. Robert J. Schalkolf, Artificial Intelligence: An Engineering approach, McGraw Hill, 1990.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.
4. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, PHI.
6. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 1999.
7. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
8. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.David E Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20CSD203 DATA STRUCTURES USING PYTHON LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20CSE201

Course Description:
The typical data structures course, which introduces a collection of fundamental data structures. The basic concepts related to abstract data types, data structures, and algorithms. Arrays, Sets and Maps, Searching and Sorting, Linked Structures, Stacks, Queues, Advanced Linked Lists, Recursion, Hash Tables, Advanced Sorting, Binary Trees, Search Trees.

Course Objectives:
1. To develop skills to design and analyze linear and nonlinear data structures.
2. To develop algorithms for manipulating linked lists, stacks, queues, trees and graphs.
3. To develop recursive algorithms as they apply to trees and graphs.
4. To develop skill in advanced linked list.
5. To develop skill in advanced sorting.

List of Programs:

1. Write a Python program that uses functions to perform the following:
   a) Create a singly linked list of integers.
   b) Delete a given integer from the above linked list.
   c) Display the contents of the above list after deletion.

2. Write a Python program that uses functions to perform the following:
   a) Create a doubly linked list of integers.
   b) Delete a given integer from the above doubly linked list.
   c) Display the contents of the above list after deletion.

3. Write a Python program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.

4. Write Python programs to implement a double ended queue ADT using i) array and ii) doubly linked list respectively.

5. Write a Python program that uses functions to perform the following:
   a) Create a binary search tree of characters.
   b) Traverse the above Binary search tree recursively in Post order.

6. Write a Python program that uses functions to perform the following:
   a) Create a binary search tree of integers.
   b) Traverse the above Binary search tree non-recursively in in order.

7. Write Python programs for implementing the following sorting methods to arrange alist of integers in ascending order:
   a) Insertion sort b) Merge sort

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8. Write Python programs for implementing the following sorting methods to arrange alist of integers in ascending order:
   a) Quick sort b) Selection sort

9. i) Write a Python program to perform the following operation:
   A) Insertion into a B-tree
   ii) Write a Python program for implementing Heap sort algorithm for sorting a given list of integers in ascending order.
10. Write a Python program to implement all the functions of a dictionary (ADT) using hashing.

11. Write a Python program for implementing Knuth-Morris- Pratt pattern matching algorithm.

12. Write Python programs for implementing the following graph traversal algorithms:
   a)Depth first traversal b)Breadth first traversal

Course Outcomes:

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

1. Describes the Abstract Data Types, Arrays, Sets and Maps
2. Explains the Algorithm Analysis, Searching and Sorting
3. Understand the Linked Structures, Stacks, and Queues
4. Examine the Advanced Linked Lists, Recursion, and Hash Tables
5. Construct of Advanced Sorting, Binary Trees, and Search Trees

Text Book(s)

1. Data Structures and Algorithms Using Python, Rance D. Necaise

Reference Books

1. Fundamentals of Data Structures, Ellis Horowitz, SartajSahni, Dinesh Mehta, Silicon Press, Second Edition. 2007.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20CSD204 OBJECT ORIENTED PROGRAMMING - JAVA LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20CSE201

Course Description:

Basics of Object-Oriented Programming - objects, classes, polymorphism, inheritance, static and dynamic binding. Object Oriented Programming using Java-classes, interfaces, inheritance, polymorphism, method dispatch, features for encapsulation and modularity.

Course Objectives:

1. Understand object-oriented programming concepts, and apply them in solving problems.
2. Learn the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
3. To Introduce the implementation of packages and interfaces
4. Learn the concepts of exception handling and multithreading.
5. Learn the design of Graphical User Interface using applets and swing controls.

List of Programs:

1. .a) Write a Java program that prints all real solutions to the quadratic equation ax2 + bx + c =0. Read in a, b, c and use the quadratic formula. If the discriminant b2-4ac is negative, display a message stating that there are no real solutions.
   b) Write a Java program that find prime numbers between 1 to n.
   c) Write a Java Program that find the factorial of a number.
2. a) The Fibonacci sequence is defined by the following rule: The fist two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that print the nth value in the Fibonacci sequence.
   b) Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a Palindrome.
   c) Write a Java program for sorting a given list of names in ascending order.
3. a) Write a java program to split a given text file into n parts. Name each part as the name of the original file followed by .part<n> where n is the sequence number of the part file
   b) Write a java program to convert an ArrayList to an Array.
   c) Write a Java program to make frequency count of vowels, consonants, special symbols, digits, words in a given text..
4. a) Write a Java program that reads a file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
   b) Write a Java program that reads a file and displays the file on the screen, with a line number before each line.

c) Implement Stack using queues.

5. a) Write a java program to make rolling a pair of dice 10,000 times and counts the number of times doubles of are rolled for each different pair of doubles. Hint: Math.random()
   b) Write java program that inputs 5 numbers, each between 10 and 100 inclusive. As each number is read display it only if it‘s not a duplicate of any number already read display the complete set of unique values input after the user enters each new value.

c) Write a java program to read the time intervals (HH:MM) and to compare system time if the system time between your time intervals print correct time and exit else try again to repute the same thing. By using StringToknizer class.

6. a) Write java program to create a super class called Figure that receives the dimensions of two dimensional objects. It also defines a method called area that computes the area of an object. The program derives two subclasses from Figure. The first is Rectangle and second is Triangle. Each of the sub class overridden area() so that it returns the area of a rectangle and a triangle respectively.

   b) Write a Java program that creates three threads. First thread displays ―Good Morning‖ every one second, the second thread displays ―Hello‖ every two seconds and the third thread displays ―Welcome‖ every three seconds

7. a) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.

   b) Use inheritance to create an exception super class called EexceptionA and exception sub class ExceptionB and ExceptionC, where ExceptionB inherits from ExceptionA and ExceptionC inherits from ExceptionB. Write a java program to demonstrate that the catch block for type ExceptionA catches exception of type ExceptionB and ExceptionC

8. Write a Java Program to design login window using AWT components.
9. Develop an application for simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result.
10. Design & Develop an application that creates a user interface to perform integer divisions. The user enters two numbers in the JtextFields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an ArithmeticException Display the exception in a message dialog box.
11. Design a GUI application that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts.
12. Design a GUI application for Cafeteria bill generation.

Project Based Learning : Design and Develop a mini project using OOPS concepts

Course Outcomes:

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

1. Solve real world problems using OOP techniques.
2. Implement string handling and file handling methods.
3. Design multithreaded applications with synchronization.
4. Develop web applications using AWT components.
5. Create GUI based applications

Text Book(s)

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9th Edition, 2016.

Reference Books

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.
3. "Thinking in Java", Bruce Eckel, Pearson Education.
4. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year I Semester

20CSD205 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20CSE101**

Course Description:
The course aims at equipping students to be able to use python programming for solving Artificial Intelligence problems.

Course Objectives:

1. To train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

List of Programs:

1. Study of Numpy and Pandas basic programs.
2. Write a program to implement Breadth First Search using Python.
3. Write a program to implement Depth First Search using Python.
4. Write a program to implement Tic-Tac-Toe game using Python.
5. Write a program to implement 8-Puzzle problem using Python.
6. Write a program to implement Water-Jug problem using Python.
7. Write a program to implement Travelling Salesman Problem using Python.
8. Write a program to implement Tower of Hanoi using Python.
9. Write a program to implement Monkey Banana Problem using Python.
10. Write a program to implement Missionaries-Cannibals Problems using Python.
11. Write a program to implement 8-Queens Problem using Python.

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Formulate a problem and build intelligent agents.
2. Apply appropriate searching techniques to solve a real world problem.
3. Evaluation of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.

Text Book(s)

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

2. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson

B. Tech Computer Science & Engineering (Data Science)

Reference Books

1. George F. Luger, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.
2. Robert J. Schalkolf, Artificial Intelligence: An Engineering approach, McGraw Hill, 1990.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.
4. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, PHI.
6. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 1999.
7. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
8. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.David E Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2013.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Mandatory Course
B. Tech. II Year I Semester

20CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

Pre-requisite Basic knowledge about sciences up to intermediate or equivalent level.

Course Description:
The course deals with basic concepts of environment, its impact on human, universe, consumption of energy sources, effects, controlling methods for pollution and the environmental ethics to be followed by human beings.

Course Objectives:
1. To make the students aware about the environment and its inter-disciplinary nature and to emphasize the importance of the renewable energy sources.
2. To familiarize the concept of Ecosystem and their importance.
3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.
4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
5. To introduce the environmental ethics and emphasize the urgency of rain water harvesting along with water shed management.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES **6 hours**

Definition, Scope and Importance – Need for Public Awareness. Renewable energy Resources: Solar energy - solar cells, wind energy, tidal energy. Non-renewable energy resources: LPG, water gas, producer gas. Overgrazing, effects of modern agriculture – fertilizer and pesticides.

UNIT II ECOSYSTEMS **6 hours**

Concept of an ecosystem. Structure – functions – Producers, Consumers and Decomposers – Ecological succession – Food chains, Food webs and Ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystems: Forest, Desert and Lake.

UNIT III BIODIVERSITY AND ITS CONSERVATION **6 hours**

Introduction, Definition: Value of biodiversity: consumptive use, productive use, social, ethical and aesthetic values. Biogeographical zones of India. Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and Endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION **6 hours**

Definition, Cause, effects and control measures of pollution – Air, Water, Soil and Noise. Solid Waste Management: Effects and control measures of urban and industrial wastes.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT 6 hours

Urban problems related to Water conservation, rain water harvesting and watershed management; Climate changes: global warming, acid rain, ozone layer depletion, nuclear accidents. Case Studies: Population growth, variation among nations and population explosion.

Course Outcomes:

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

1. Ability to understand the natural environment, its relationship with human activities and need of the day to realize the importance of the renewable energy sources.
2. The knowledge of various ecosystems and their importance along with the concepts of food chains, food webs and ecological pyramids.
3. Familiarity with biodiversity, its importance and the measures for the conservation of biodiversity.
4. The knowledge about the causes, effects and controlling methods for environmental pollution, along with disaster management and solid waste management.
5. Awareness about the sustainable development, environmental ethics, social issues arising due to the environmental disorders.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press, 2005.
2. Environmental Studies by R. J. Ranjith Daniels and Jagdish Krishnaswamy, (Wiley Re- print version 2014).
3. Chemistry for Environmental Engineering/C.N. Sawyer, P.L. McCarty, G.F. Parkin (TataMcGraw Hill, Fifth Edition, 2003).
4. Environmental Chemistry by B.K. Sharma, (Goel Publishing House, 2014).
5. Environmental Studies by Benny Joseph (TataMcGraw Hill, Second Edition, 2009).

Reference Books:

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2 Perspectives in Environmental Studies, Second edition, Anubha Koushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.
3 R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

II Year II Semester

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year II Semester

20HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the positions of financial statements are explained to know the analysis of financial matters.

Course Objectives:

1. Describe the nature of engineering economics in dealing with the issues of scarcity;

2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;

3. Explain the performance of firms under different market structures and Price determination in various market conditions.

4. Explain the accounting principles, types of accounting and preparation of final accounts; and

5. Describe the financial statement analysis and investment evaluation through ratios and capital budgeting techniques.

UNIT I DEMAND ANALYSIS 9 hours

Scope and Significance of Economics- Understanding the problem of scarcity and choice - Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

UNIT II PRODUCTION AND COST ANALYSIS 9 hours

Production Function – Short-run and long- run production – Cost Analysis: Cost concepts - Cost Structure of Firms and output decision- Break-Even Analysis (BEA) – Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems).

UNIT III MARKET STRUCTURE AND PRICING 9 hours

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic, Oligopoly, Duopoly – Price determination under various market conditions- Pricing objectives- Methods.

UNIT IV BASICS OF ACCOUNTING 9 hours

Uses of Accounting - Book Keeping Vs Accounting - Double Entry System - Accounting Principles - Classification Of Accounts - Rules Of Debit & Credit- Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems).

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING 9 hours

Ratio Analysis - Liquidity, Leverage, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Understand Engineering economics basic concepts,

2. Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,

3. Compare different market structures and identify suitable market,

4. Demonstrate an understanding and analyzing the accounting statements, and

5. Exhibit the ability to apply knowledge of ratio analysis and capital budgeting techniques in financial statement analysis and investment evaluation respectively.

Text Book(s)

1. Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8th Edition, 2007

2. Financial Accounting, S. N. Maheshwari, Sultan Chand, 2009

3 Financial Statement Analysis, Khan and Jain, PHI, 2009

4 Financial Management, Prasanna Chandra, T.M.H, 2009

Reference Books

1. Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11th Edition, 2007

2 Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18th Edition, 2007

3 Financial Management and Policy, Van Horne, James, C., Pearson, 2009.

4. Financial Management, I. M. Pandey, Vikas Publications

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year II Semester

20MAT112 DISCRETE MATHEMATICAL STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite 20MAT110

Course Description:

This course introduces the concepts of discrete mathematics and their applications in computer science. It covers algebraic structures, combinatory and finite state machines. It also provides insight into the concepts of graph theory and their applications.

Course Objectives:

1. To introduce the concepts of logic, rules of inference and predicates.
2. To discuss the concepts on combinatory.
3. To explain the concepts of algebraic structures.
4. To familiarize the principles of Lattices and Boolean algebra.
5. To illustrate the problems in graph theory.

UNIT I Mathematical Logic and Statement Calculus 9 hours

Introduction -Statements and Notation - Connectives – Tautologies – Two State Devices and Statement logic - Equivalence - Implications - The Theory of Inference for the Statement Calculus –- The Predicate Calculus - Inference Theory of the Predicate Calculus.

UNIT II Combinatory 9 hours

The Basics of Counting- The Pigeonhole Principle -Permutations and Combinations - Binomial Coefficients -Generalized Permutations and Combinations –Generating Permutations and Combinations.

UNIT III Algebraic Structures 9 hours

Semigroups and Monoids - Grammars and Languages –Types of Grammars and Languages – Groups – Subgroups – Lagrange's Theorem –Homomorphism: Introduction –Properties - Group Codes.

UNIT IV Lattices and Boolean algebra 9 hours

Relations - Partially Ordered Relations - Hasse Diagram - Poset - Lattices - Boolean algebra - Boolean Functions - Representation and Minimization of Boolean Functions - Karnaugh map representation.

UNIT V Graph Theory 9 hours

Basic Concepts of Graph Theory - Isomorphic graph - Matrix Representation of Graphs – Trees - Kruskal's and Dijkstra's algorithms - Storage Representation and Manipulation of Graphs - Introduction to Finite State Machines.

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Course Outcomes:

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

1. Evaluate elementary mathematical arguments and identify fallacious reasoning (not just fallacious conclusions) for develop syntax of programming languages.
2. Apply the concepts inclusion/exclusion principle and the pigeonhole methodology in data structure and algorithm.
3. Learn elementary proofs and properties of modular arithmetical results; and explain their applications such as in coding theory and cryptography.
4. Apply proof techniques towards solving problems in Boolean algebra and computer circuit designing.
5. Apply graph theory models and finite state machines concepts to solve critical networking issues, shortest path problems, scheduling, etc.

Text Book(s)

1. J.P. Trembley and R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill – 13th reprint, 2012.
2. Kenneth H. Rosen, Discrete Mathematics and its applications, 6th Edition, Tata McGraw Hill, (2011)

Reference Books

1. Richard Johnsonbaugh, "Discrete Mathematics", 6th Edition, Pearson Education, 2011.
2. S. Lipschutz and M. Lipson, "Discrete Mathematics", Tata McGraw Hill, 3rd Edition, 2010.
3. B.Kolman, R.C.Busby and S.C.Ross, "Discrete Mathematical structures", 6th Ed, PHI, 2010.
4. C.L.Liu, "Elements of Discrete Mathematics", Tata McGraw Hill, 3rd Edition, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year II Semester

20CSD107 OPERATING SYSTEMS FUNDAMENTALS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:
This course will cover the trade-offs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Course Objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To give introduction to shell programming.
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5. To know the components and management aspects of concurrency management

UNIT I INTRODUCTION **9 hours**

Concept of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Case study on UNIX and WINDOWS Operating System. KORN SHELL PROGRAMMING: Basic Script Concepts, Expressions, Decisions: Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts.

UNIT II PROCESS CONCEPTS **9 hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling.

UNIT III PROCESS SYNCHRONIZATION AND DEADLOCKS **9 hours**

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

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UNIT IV MEMORY MANAGEMENT STRATEGIES 9 hours

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT V FILE SYSTEM 9 hours

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Course Outcomes:

At the completion of the course the students will be able to:

1. Write shell scripts using korn shell.
2. Create processes & threads and implement the various process scheduling techniques.
3. Analyse the concurrent processing and deadlock situations.
4. Design algorithmic solutions to solve memory management problems.
5. Implement the different types of file management techniques.

Text Book(s)

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Reference Books

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing.
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley.
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India,
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year II Semester

20CSD108 PYTHON FOR DATA SCIENCE

L	T	P	C
3	0	0	3

Pre-requisite **20CSE101**

Course Description:
This course is designed to provide strong foundation for data science and application area related to it and understand the underlying core concepts and emerging technologies in data science.

Course Objectives:

6. To describe the life cycle of Data Science and computational environments for data scientists using Python.
7. To describe the fundamentals for exploring and managing data with Python.
8. To examine the various data analytics techniques for labeled/columnar data using Python.
9. To demonstrate a flexible range of data visualizations techniques in Python.
10. To describe the various Machine learning algorithms for data modeling with Python.

UNIT I INTRODUCTION TO DATA SCIENCE 9 hours

Introduction to Data Science and its importance - Data Science and Big data-, The life cycle of Data Science- The Art of Data Science - Work with data – data Cleaning, data Managing, data manipulation. Establishing computational environments for data scientists using Python with IPython and Jupyter.

UNIT II INTRODUCTION TO NUMPY 9 hours

NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-SortingUnique and Other Set Logic.

UNIT III DATA MANIPULATION WITH PYTHON 9 hours

Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping EntriesIndexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

UNIT IV DATA CLEANING, PREPARATION AND VISUALIZATION 9 hours

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots

B. Tech Computer Science & Engineering (Data Science)

UNIT V MACHINE LEARNING USING PYTHON 9 hours

Introduction Machine Learning: Categories of Machine Learning algorithms, Dimensionality reduction-Introducing ScikitApplication: Exploring Hand-written Digits. Feature Engineering-Naive Bayes Classification - Linear Regression - kMeans Clustering.

Course Outcomes:

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

1. Identify phases involved in the life cycle of Data Science.
2. Preprocess and manage the data for efficient storage and manipulation in Python.
3. Realize the various data analytics techniques for labeled/columnar Data using Python Pandas.
4. Explore a flexible range of data visualizations approaches in Python.
5. Analyze various Machine learning algorithms for data modeling with Python.

Text Book(s)

1. Python Data Science Handbook-Essential Tools for Working with Data, Jake Vander Plas, O'Reilly Media, 2016.
2. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 2015.

Reference Books

1. Python for Data Analysis, Wes Mckinney, O'Reilly Media, 2013.
2. Field Cady, "Data Science Hand Book", John Wiley & Sons, 2017.
3. Fundamentals of Data Science, Samuel Burns, Amazon KDP printing and Publishing, 2019.
4. Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt. O'Reilly. 2014
5. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook",Packt Publishing Ltd., 2014.
6. Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics", Wiley, 2011.
7. Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year II Semester

20CSD109 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
2	1	0	3

Pre-requisite **20CSD104**

Course Description:
This course emphasis on analysis of various types of algorithms. It provides idea to design the algorithm to solve the problems using divide and conquer, greedy method, dynamic programming, backtracking, branch and bound, approximation.

Course Objectives:
1. To introduce the concepts of Algorithm Analysis, Time Complexity, Space Complexity.
2. To discuss various Algorithm Design Strategies with proper illustrative examples.
3. To introduce Complexity Theory with NP and Approximation.

UNIT I INTRODUCTION & DIVIDE AND CONQUER 9 hours

Introduction: What is an algorithm?, Algorithm specification, Space Complexity, Time Complexity, Orders of Growth, Worst-Case, Best-Case, and Average-Case Efficiencies, Asymptotic notations.
Divide and Conquer: Master's Method, Substitution Method, Recursion Tree Method, Binary Search, Finding the maximum and minimum, Merge sort, Quick Sort, Strassen's matrix multiplication.

UNIT II GREEDY METHOD & DYNAMIC PROGRAMMING 9 hours

Greedy Method: General method, Fractional Knapsack problem, Huffman Code, Job Scheduling with Deadlines, Optimal merge pattern.
Dynamic Programming: General method, String Editing, Longest Common Subsequence, Matrix Chain Multiplication, 0/1 Knapsack problems, The traveling sales person problem.

UNIT III GRAPH ALGORITHMS 9 hours

BFT, DFT, Connected components, Biconnected Components, Spanning Trees, Minimum cost Spanning Trees, Kruskal's and Prim's algorithm, Topological sort, Shortest Path Algorithms: Dijkstra's Single Source Shortest Path Algorithm, Floyd-Warshall's All Pairs Shortest Path Algorithm.

UNIT IV BACK TRACKING & BRANCH AND BOUND 9 hours

Backtracking: General method, N-Queens Problem, Sum of subset problem, Graph Coloring Problem.
Branch and Bound: General method: FIFO, LIFO and LC, Travelling salesperson problem, 0/1 Knapsack problem.

UNIT V NP PROBLEMS &APPROXIMATION ALGORITHMS 9 hours

NP Problems: Complexity Class - P, NP, NP Complete, NP Hard. Reducibility, Cook's Theorem. **Approximation Algorithms:** Introduction, Absolute Approximation, ϵ - Approximation, Polynomial time Approximation.

Course Outcomes:

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

1. Analyze the performance of different algorithms.
2. Identify optimal solution for different problems using greedy method and dynamic programming.
3. Implement various graph based algorithms.
4. Make use of backtracking and branch & Bound methods to solve real world problems.
5. Understand the complexity of NP problems and Approximation algorithms.

Text Book(s)

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2008
2. Jon Kleinberg and Eva Tardos "Algorithm Design", Pearson Education, 2007

Reference Books

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012
2. Micheal T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet examples", Second Edition, Wiley Publication, 2006
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2006

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year II Semester

20CSD206 OPERATING SYSTEMS FUNDAMENTALS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **NIL**

Course Description:

This course will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Course Objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management.

List of Programs:

1. To Study basic concepts in OS with the help of Linux commands.
2. a) Write a shell script that accepts two integers as its arguments and computers the value of first number raised to the power of the second number.
   b) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.
3. a) Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.
   b) Write a shell script that computes the gross salary of a employee according to the following rules:

   i)If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.

   ii)If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic

   The basic salary is entered interactively through the key board.
4. a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
   b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.
5. Simulate the following CPU scheduling algorithms
   a) Round Robin b) SJF c) FCFS d) Priority
6. Program on process creation and Execution
   a. To display Environment variables.
   b. To implement Different types of exec functions.
7. a) Write a program to create a chain of Processes.
   b) Demonstration of Zombie and Orphan process.

8. Write a program for Producer Consumer Problem.

9. Write a program to create pipes.

10. Write a Program to find whether a file is having read, write, execute permissions and also check whether a given name is file or directory.

11. Simulate MVT and MFT.

12. Simulate all page replacement algorithms

13. Simulate all file allocation strategies
    a) Sequential b) Indexed c) Linked

Course Outcomes:

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

1. Understand the use of Linux commands
2. Compare the performance of processor scheduling algorithms
3. Design algorithmic solutions for process synchronization problems
4. Analyze the performance of various file management schemes
5. Implement different page replacement algorithms.

Text Books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India

References:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

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B. Tech II Year II Semester

20CSD207 PYTHON FOR DATA SCIENCE LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20CSE101,Basic Programming Knowledge**

Course Description:
This course is designed to equipping students to be able to use python programming for solving data science problems.

Course Objectives:

1. To train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

List of Programs:

1. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
2. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
3. Computation on NumPy arrays using Universal Functions and Mathematical methods.
4. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
5. Load an image file and do crop and flip operation using NumPy Indexing.
6. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
7. Create Pandas Series and DataFrame from various inputs.
8. Import any CSV file to Pandas DataFrame and perform the following:
   (a) Visualize the first and last 10 records
   (b) Get the shape, index and column details.
   (c) Select/Delete the records(rows)/columns based on conditions.
   (d) Perform ranking and sorting operations.
   (e) Do required statistical operations on the given columns.
   (f) Find the count and uniqueness of the given categorical values.
   (g) Rename single/multiple columns.
9. Import any CSV file to Pandas DataFrame and perform the following:
   (a) Handle missing data by detecting and dropping/ filling missing values.
   (b) Transform data using apply() and map() method.
   (c) Detect and filter outliers.
   (d) Perform Vectorized String operations on Pandas Series.
   (e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
10. Write a program to demonstrate Linear Regression analysis with residual plots on a given data set.
11. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
12. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions using Python ML library classes.

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13. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Course Outcomes:

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

1. Illustrate the use of various data structures.
2. Analyze and manipulate Data using Numpy and Pandas.
3. Creating static, animated, and interactive visualizations using Matplotlib.
4. Understand the implementation procedures for the machine learning algorithms.
5. Identify and apply Machine Learning algorithms to solve real-world problems using appropriate data sets.

Text Book(s)

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.
2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.

Reference Books

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.
2. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017.
3. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition, Available at https://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
4. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016 4. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech II Year II Semester

20CSD208 DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20CSD203**

Course Description:
This course is aimed to provide hands on experience to analyse the time complexity of sorting, graph based, greedy, dynamic programming and backtracking algorithms.

Course Objectives:

1. To learn how to analyse a problem & design the solution for the problem.
2. To Strengthen the ability to identify and apply the suitable algorithm for the given real world problem.
3. To develop the optimal solution, i.e., time complexity & space complexity must be very low.

List of Programs:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements.
2. Implement Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements.
3. Implement Fractional Knapsack problem using Greedy Method
4. Implement Job Scheduling with Deadlines using Greedy Method
5. Implement 0/1 Knapsack problem using Dynamic Programming
6. Implement Traveling Salesperson problem to find the optimal tour using Dynamic Programming
7. Find Minimum Cost Spanning Tree of a given undirected graph using
   (a) Prim's algorithm.
   (b) Kruskal's algorithm
8. Implement the algorithm for Topological ordering of vertices in a DAG.
9. From a given vertex in a weighted connected graph, find shortest paths to all other vertices using Dijkstra's algorithm
10. Implement All-Pairs Shortest Paths Problem using Floyd-Warshall's algorithm
11. Find a subset of a given set $S = \{S_1, S_2, ...S_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if S= {2, 3, 5, 7, 8} and d = 10 there are three solutions {2,3,5}, {3,7}. and {2,8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.
12. Implement N Queen's problem using Back Tracking

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Analyse the performance of different algorithms.
2. Apply various problem solving approaches
3. Identify optimal solution for different problems using greedy method and dynamic programming.
4. Implement various graph based algorithms.
5. Make use of backtracking method to solve real world problems.

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Text Book(s)

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Second Edition, Universities Press, 2008
2. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2012.

Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Third Edition, PHI Learning Private Limited, 2012.
2. S. Sridhar, “Design and Analysis of Algorithms”, Oxford university press, 2014.
3. Web reference: http://nptel.ac.in/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Mandatory Course
B. Tech. II Year II Semester

20HUM901 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Pre-requisite NIL

Course Description:

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state.

Course Objectives:

The course is intended to:

To know about Indian constitution;
To know about central and state government functionalities in India; and
To know about Indian society.

UNIT I INTRODUCTION 6 hours

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 6 hours

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 6 hours

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS 6 hours

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY 6 hours

Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

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Course Outcomes:

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

1. Understand the functions of the Indian government; and

2. Understand and abide the rules of the Indian constitution.

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi..
2. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
3 Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
4 K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

Reference Books:

1. **S**harma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2 U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
3 R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

III Year I Semester

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year I Semester

20CSD110 DATABASE MANAGEMENT SYSTEM

L	T	P	C
2	1	0	3

Pre-requisite NIL

Course Description:

This course is designed to provide a basic understanding of database systems and their design. The course material is further used for developing any web-based applications in which the database is back end. The course covers all basic and advanced queries of SQL, PL/SQL programs, Relational algebra and calculus, normal forms, low-level details such as representing data elements of the database and indexed structures, transaction management, and data recovery.

Course Objectives:

1. To understand the concept of DBMS and ER Modelling.
2. To comprehend the structure of SQL Queries and commands to manage data from the databases
3. To learn PL/SQL concepts that help in seamless processing of SQL
4. To explain the normalization, Query optimization, and relational algebra
5. To apply Transaction processing, concurrency control, recovery, security, and indexing for the real-time data
6. To gain knowledge on Database Attacks, Recovery, and Recent Trends

UNIT I INTRODUCTION 9 hours

Database Systems Concepts and Architecture: History and motivation for database systems-characteristics of database approach Advantages of using DBMS approach- Architectures for DBMS– Classification of database management systems. **Database Modelling**: Types of Attributes, Entities, Relationships, ER Model. **Introduction to Relational Model**: Introduction, Logical database design, Introduction to views

UNIT II RELATIONAL MODEL 9 hours

Relational Data Model: Concept of relations, schema-instance distinction, keys, referential integrity, foreign keys, relational algebra operators, SQL - Introduction, data definition in SQL, table, key, and foreign key definitions. Querying in SQL, notion of aggregation, Integrity constraints, aggregation functions group by and having clauses.

PL/SQL concepts: Embedded SQL, Dynamic SQL, triggers and active databases, Cursors, Introduction to JDBC, Stored Procedures.

Relational Algebra and Calculus: Preliminaries, Relational algebra- Selection and Projection, Set Operations, Renaming, Joins, Division. Relational Calculus

UNIT III DATABASE DESIGN & SCHEMA REFINEMENT 9 hours

Database Design: Dependencies and Normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FDs.

Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, and 5NF decompositions and desirable properties

UNIT IV TRANSACTION PROCESSING & INDEXING 9 hours

Transaction processing - Concepts of transaction processing, ACID properties, concurrency control, Time-stamp based and lock-based protocols for concurrency control. Serializability of scheduling Index Structures – Indexes on Sequential Files – Secondary Indexes – B-Trees – Hash Tables

UNIT V DATABASE ATTACKS, RECOVERY, AND RECENT TRENDS 9 hours

Database Attacks and Recovery: SQL Injection, Recovery based on deferred update – Recovery techniques based on immediate update - Shadow Paging

Recent Trends: Need of NoSQL, CAP Theorem, different NoSQL data models

Course Outcomes:

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

1. Apply design principles for database design, ER model
2. Demonstrate the basics of query evaluation and heuristic query optimization techniques
3. Access normalization relations of the relational model using normal forms
4. Implement transaction processing techniques in the database.
5. Design database security plan for database

Text Book(s)

1. Database Management Systems, Raghu RamaKrishnan, Johannes Gehrke, 3rd Edition, 2003,McGraw Hill.
2. Database Systems, The Complete Book, Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, 3rd impression, 2009, Pearson.

Reference Books

1. Silberschatz, H. F. Korth S. Sudershan, Database System Concepts, McGraw Hill, 6th Edition 2010.
2. R. Elmasri S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2015
3. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation, and Management,6th Edition,2012.
4. Pramod J. Sadalage and Marin Fowler, NoSQL Distilled: A brief guide to merging world of Polyglot persistence, Addison Wesley, 2012

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year I Semester

20CSD111 DATA VISUALIZATION

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

This course aims to provide a strong understanding of fundamental concepts of data visualization. It explains the most popular data visualizations tools such as Tableau, Microsoft Power Bi. It envisions the students to best present the data using storytelling and dashboards.

Course Objectives:

1. To understand the fundamental design principles and different types of data visualization.
2. To identify both positive and negative impacts of data-informed decision across a variety of domains.
3. To apply the fundamental concepts of data visualization to define a project in your field of study.
4. Practice the core principles using widely available tools (e.g. Tableau, Power Bi).
5. Demonstrate the best practice that presents your story in the process of creating data visualization including connecting to different data sources, assessing to the quality of the data, and converting raw data into data visualizations that provide actionable information.

UNIT I INTRODUCTION **9 hours**

Introduction to data visualization, mapping data onto aesthetics, coordinate systems and axes. Introduction to Tableau, Installation, Data types in Tableau, Data Analytics in Tableau, saving tableau works - Create a simple bar chart on sales forecasts using Tableau.

UNIT II VISUALIZING DISTRIBUTIONS **9 hours**

Color scales, Directory of visualizations, visualizing amounts, visualization distributions: Histograms & density plots, empirical cumulative distributions and q-q plots - Introduction to Microsoft Power Bi, Installation - Infer the accurate trends for flight prices using the flight information dataset - Plot a histogram for the California housing dataset using Tableau and Power Bi.

UNIT III VISUALIZING PROPORTIONS **9 hours**

Visualizing many distributions at once, visualizing proportions, visualizing associations, visualizing time series, visualizing trends, visualizing uncertainty.

Draw box plot, violin plot and ridgeline plot for the temperature dataset.

UNIT IV COLOR AND CODING **9 hours**

The principle of proportional link, common pitfalls of color use, redundant coding, multi-panel figures, titles, captions and tables, Balance the data and the context, Avoid line drawings.

Predict the higher number of crime cases for the crime information dataset using Tableau and Power Bi.

UNIT V STORYTELLING **9 hours**

Introduction to most used image formats, choosing the right visualization software, telling a story and making a point.

Create a dashboard for the COVID-19 dataset using Tableau and Power Bi.

Practice story telling for adult income dataset and explore Q & A in Power Bi.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Employ best practices in data visualization to develop charts, maps, tables, and other visual representations of data.
2. Use visualization tools such as Tableau, Power Bi to conduct data analysis, especially exploration of an unfamiliar dataset.
3. Create compelling, interactive dashboards to combine several visualizations into a cohesive and functional whole.
4. Utilize advanced Tableau features including parameters, data blending, custom SQL, very large datasets, custom date hierarchies, and others.
5. Use data visualizations, dashboards, and Tableau Stories to support relevant communication for diverse audiences.

Text Book(s)

1. Fundamentals of Data Visualization by Claus O. Wilke
2. Visual Analytics with Tableau by Alexander Loth

Reference Books

1. Visual Data Storytelling With Tableau, Lindy Ryan, Pearson India
2. A Step by Step Guide for Data Visualization using Tableau by Gourav Singh
3. https://www.projectpro.io/article/-tableau-projects-ideas/479
4. https://docs.microsoft.com/en-us/power-bi/fundamentals/service-get-started
5. Best Tableau Dashboard Examples
6. https://rigorousthemes.com/blog/15-best-tableau-dashboard-examples/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year I Semester

20CSD112 MACHINE LEARNING

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

This course aims to gives a basic knowledge on machine learning, classification techniques and the various algorithms in machine learning. It helps the students to explores Scikit-learn, Tensorflow and the various datasets used for machine learning. It enlightens the students with the knowledge of need for cloud computing in machine learning and GPU computing using CUDA.

Course Objectives:

1. To understand the principles and concepts of machine learning
2. To learn the clustering techniques and their utilization in machine learning
3. To study the neural network systems for machine learning
4. To understand the role of cloud computing and GPU computing in machine learning
5. To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance

UNIT I INTRODUCTION **9 hours**

Introduction to Machine Learning, Need for Machine Learning, Types of Machine learning systems - Challenges in Machine learning system. End-to-End Machine learning project - Practice a python code for training and running a linear model using Scikit-learn in California Housing Dataset.

UNIT II CLASSIFICATION **9 hours**

Binary Classification, Multiclass classification, Multilabel classification, Multioutput classification, SVM classification

Compute the Performance Metrics Precision and Recall for MNIST dataset using Scikit-learn.

Train a linear SVM model using Scikit-learn to detect Iris-Virginica flowers in Iris Dataset

UNIT III ALGORITHMS **9 hours**

Decision Tress, CART algorithm, Ensemble Algorithm and Regression Trees, Unsupervised learning: clustering. Introduction to Artificial Neural Networks.

Use Adult income dataset to predict income level based on the individual's personal information.

UNIT IV INTELLIGENT CLOUD **9 hours**

Tensor Flow: Introduction, Installation, Architecture, Functions and graphs. Intelligent cloud: introduction, need for cloud computing in machine learning, key characteristics of cloud computing, various stakeholders, Examples of Cloud based Machine Learning, Case studies on Healthcare in the cloud using machine learning.

Explore Salesforce IoT cloud, Azure cognitive services.

UNIT V AN INTRODUCTION TO GPU COMPUTING WITH CUDA **9 hours**

Introduction: Parallel Processing, Rise of GPU computing, CUDA – Architecture, Applications, CUDA development environment, Parallel programming with CUDA, CUDA C on multiple GPUs, CUDA tools.

Explore tensorflow-gpu to classify MNIST dataset using GPU.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

1. Upon successful completion of the course, students will be able to
2. Appreciate the underlying mathematical relationships within and across machine learning algorithms and the paradigms of supervised and un-supervised learning
3. Appreciate machine learning challenges and suggest solutions for the same
4. Design and implement various machine learning algorithms in a range of real-world applications
5. Have an understanding of how cloud computing helps machine learning.
6. Design parallel programming with CUDA.

Text Book(s)

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Geron Aurelien
2. CUDA by example: an introduction to general-purpose gpu programming, Edward Kandrot and Jason Sanders

Reference Books

1. Introduction to Machine Learning in the Cloud with Python, Pramod Gupta • Naresh K. Sehgal, Springer
2. Machine Learning: A multistrategy approach, Tom M. Mitchell
3. E. Alpaydin, “Introduction to Machine Learning”, Second Edition, Prentice-Hall of India, 2010.
4. Simon Haykin, “Neural Networks and Learning Machines”, Pearson, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year I Semester

20CSD209 DATA VISUALIZATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **NIL**

Course Description:

This course helps the students to learn the various data visualization tools such as Tableau and Power Bi. It also enlightens the students to visualize their data using the libraries available in python. It helps the students to create dashboards and storytelling for the numeric data.

Course Objectives:

1. To explore the various data visualization tools.
2. To understand the various libraries in python for data visualization.
3. To practice drawing various representations such as charts and graphs using Power Bi and Tableau.
4. To understand matplot, geoplot to visualize the data.
5. To explore gnuplot and tensorflow for data visualization.

LIST OF PROGRAMS:

1. What is data visualization? List and discuss the various tools for data visualization.

   Explain the various libraries available in python for data visualization.

   Write the syntax and describe the parameters used for the following:
   - Box Plot
   - Scatter Plot
   - Histogram
   - Pie Chart
   - Facet Plot
   - Pair Plot
   - Area Chart
   - Violin Plot
   - Bar Chart
2. Explore the following using Air quality & Pollution dataset.
   - Filters
   - Tree Map
   - Trend Line
   - Drawing quick report
3. Use Tableau and Power Bi

   For the Canada immigration dataset that contains immigration details to Canada from 1980 to 2013,

   i. Create an area plot for top 6 immigrant countries from 1990 to 2013

   ii. Create an year-wise immigrant bar chart from India to Canada during the period of 1980 to 2013.

   iii. Create a boxplot for Indian, Phillipine and China immigrants.

iv. Show the total no. of immigrants from India and France countries using AreaChart and Pie chart.

v. creates a scatter Histogram for the immigrants from Fiji and Singapore in the year 2013

4. Display the dashboard for titanic dataset.

5. Display storytelling for adult income dataset.

6. Generate the following for the tip's dataset using matplot
    a. Bar chart
    b. Scatter plot
    c. Line chart
    d. Heat map
    e. Line plot
    f. Histogram
    g. Box plot
    h. Error Chart
7. For the flight information data set that contains the data of flights that were on time in January for the years 2019 and 2020. Using the two data sets visualize the data using matplot and plotly libraries to depict the following:
    - Show the difference in statistics for distance for both the years using the appropriate plotting technique.
    - Visualize the no. of flights whose destination airport id is 11778 and 11267using a bar plot or bar chart.
    - Create a Sunburst Plot for both the years depicting the difference among them
8. Draw scatter plot, histogram, bar chart, heat map, box plot for wine_reviews dataset using Seaborn.

9. Using Geoplotlib create dot-density map, symbol map for US census demographic dataset.

10. Create dot density map, spatial graph, 2D histogram, heat map for the geospatial data using geoplotlib.

11. Explore gnuplot.

12. Create scatter plot for the MNIST dataset using tensorflow.

Course Outcomes:

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

1. Differentiate the various tools for data visualization.
2. Analyses and use the python libraries for visualizing the data.
3. Understand dashboard creation and storytelling.
4. Differentiate the different types of data and the type of visualization that best suits the data.
5. Analyse gnuplot for drawing various graphs and charts.

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Text Book(s)

1. Fundamentals of Data Visualization by Claus O. Wilke
2. Visual Analytics with Tableau by Alexander Loth

Reference Books

1. Visual Data Storytelling with Tableau, Lindy Ryan, Pearson India
2. A Step-by-Step Guide for Data Visualization using Tableau by Gourav Singh
3. https://www.projectpro.io/article/-tableau-projects-ideas/479
4. https://docs.microsoft.com/en-us/power-bi/fundamentals/service-get-started
5. 15 Best Tableau Dashboard Examples
6. https://rigorousthemes.com/blog/15-best-tableau-dashboard-examples/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year I Semester

20CSD210 MACHINE LEARNING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite

Course Description:

This course helps the students to learn various machine learning algorithms. It makes the students to explore the machine learning algorithms using various dataset. It also helps the students to analyse the data and find interesting patterns.

Course Objectives:

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice
3. To apply various supervised learning methods to different problems.
4. To evaluate the performance of the machine learning algorithms.
5. To skill in various languages to analyse the machine learning algorithms.

List of Programs:

1. Implement Linear Regression
2. Implement Logistic Regression
3. Implement Decision Tress
4. Implement SVM algorithm
5. Implement Naïve Bayes Algorithm
6. Implement KNN algorithm
7. Implement K-Means algorithm
8. Implement Random forest algorithm
9. Implement Gradient boosting and Adaboosting algorithm
10. Implement Neural Networks
11. Implement DBSCAN Clustering
12. Implement Hierarchical clustering
13. Implement Grid search algorithm
14. Implement Voting classifier

Course Outcomes:

1. Design and implement various machine learning algorithms in a range of real-world applications
2. Appreciate the underlying mathematical relationships within and across machine learning algorithms
3. Analyse the paradigms of supervised and un-supervised learning
4. Apply suitable machine learning techniques for data handling
5. Evaluate the performance of algorithms.

B. Tech Computer Science & Engineering (Data Science)

Text Book(s)

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Geron Aurelien
2. Machine Learning: A multi strategy approach, Tom M. Mitchell

Reference Books

1. Introduction to Machine Learning in the Cloud with Python, Pramod Gupta • Naresh K. Sehgal, Springer.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Mandatory Course

20CE901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Pre-requisite: None

Course Description:

The goal of this course is to expose the under graduate students regarding different types of disasters and preparedness needed to mitigate their effects. The course matrix will cover various natural, biological, chemical and emerging hazards and risks that may cause property, loss of lives, and livestock's. Thus, the future engineers will understand the social responsibility for the preparedness and mitigation of the damages caused by the disasters.

Course Objectives:

1. To make aware the students about disasters and their impact on living beings.
2. 2. To ensure the students for the understanding on vulnerability, disasters, disaster prevention
3. and risk reduction.
4. To gain a preliminary understanding of approaches for the Disaster Risk Reduction (DRR)
5. To enhance awareness of institutional processes available in the country for the disaster risk mitigation.

UNIT I INTRODUCTION 6 hours

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention and mitigation.

UNIT II TYPES OF DISASTERS 6 hours

Types of Disaster; natural disasters (earthquakes, volcanoes, forest fires and explosions, heat and cold waves, floods, draught, cyclones, tsunami, landslides, soil erosion); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.), hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III DISASTER IMPACTS 6 hours

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV DISASTER RISK MITIGATION MEASURES 6 hours

Disaster Risk Reduction (DRR) - Disaster management- four phase approach; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications), DRR programmers in India and the activities of National Disaster Management Authority. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction.

UNIT V IMPACT OF DEVELOPMENTAL ACTIVITIES 6 hours

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

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Course Outcomes:

The students after completing the course will be able to:

1. Explain various disaster concepts
2. Differentiate between categories of disasters
3. Analyze impact of various types of disasters
4. Select disaster risk mitigation measures
5. Identify the impact of development activities

Text Books:

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Data Books:

1. C P Kothandaraman & S Subramanyan, Heat and Mass Transfer data book, New Age International Publishers, Eight Edition.

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
6. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments, Mid Term Tests

B. Tech Computer Science & Engineering (Data Science)

III Year II Semester

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year II Semester

20CSD113 BIG DATA ANALYTICS

L	T	P	C
2	1	0	3

Pre-requisite NIL

Course Description:

This course introduces the students the concept of big data, characteristics, and its importance. It helps the students to explore Hadoop, how to set up a Hadoop cluster, spark, and its applications. It also discusses the MapReduce functions and NoSQL database.

Course Objectives:

1. To understand the Big Data Platform and its Use cases
2. To Provide an overview of Apache Hadoop
3. To understand the various MapReduce functions
4. To Provide HDFS Concepts and Interfacing with HDFS
5. To understand NoSQL database

UNIT I INTRODUCTION TO BIG DATA **9 hours**

Introduction: Big Data - Characteristics of Big Data - Big data management architecture - Examining Big Data Types - Big Data Technology Components - Big data analytics - Big data analytics examples - Web Data Overview - Web Data in Action.

UNIT II HADOOP **9 hours**

Introduction: History of Hadoop - Hadoop Ecosystem - Analyzing data with Hadoop - Hadoop Distributed File System - Design - HDFS concepts - Hadoop filesystem - Data flow - Hadoop I / O - Data integrity - Serialization - Setting up a Hadoop cluster - Cluster specification - cluster setup and installation - YARN.

UNIT III MAPREDUCE **9 hours**

Introduction: Understanding MapReduce functions - Scaling out - Anatomy of a MapReduce Job Run - Failures - Shuffle and sort - MapReduce types and formats - features - counters - sorting - MapReduce Applications –Configuring and setting the environment - Unit test with MR unit - local test.

UNIT IV SPARK **9 hours**

Installing spark - Spark applications - Jobs - Stages and Tasks - Resilient Distributed databases - Anatomy of a Spark Job Run - Spark on YARN - SCALA: Introduction - Classes and objects - Basic types and operators - built-in control structures - functions and closures - inheritance.

UNIT V NoSQL DATABASE **9 hours**

Introduction to NoSQL - MongoDB: Introduction - Data types - Creating - Updating and deleing documents - Querying - Introduction to indexing - Capped collections - Hbase: Concepts - Hbase Vs RDBMS - Creating records - Accessing data - Updating and deleting data - Modifying data - exporting and importing data. USE CASES: Call detail log analysis - Credit fraud alert - Weather forecast.

Course Outcomes:

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

1. Understand the characteristics of big data and concepts of Hadoop ecosystem
2. Understand the concepts of Scala programming
3. Apply Mapreduce programming model to process big data
4. Analyze Spark and its uses for big data processing
5. Design programs for big data applications using Hadoop components

B. Tech Computer Science & Engineering (Data Science)

Text Book(s)

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley Publishers, 2015.
2. Simon Walkowiak, “Big Data Analytics with R”, PackT Publishers, 2016.

Reference Books

1. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, No SQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013.
2. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.
3. Kim H. Pries, Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers”, CRC Press, 2015.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year II Semester

20CSD114 DEEP LEARNING

L	T	P	C
3	0	0	3

Pre-requisite: Probability and Statistics, Introduction to Machine Learning

Course Description:
This course is designed to present the core fundamentals behind the much talked about field of Deep Learning. We will delve into selected topics of Deep Learning, from discussing basics of neural networks, to understanding how CNN and NN works with common examples and publicly available datasets. Special highlight of the course is the lecture on Interpretability of Neural Networks which will help students to understand how to trust a neural network's recommendation.

Course Objectives:

To introduce the fundamentals of deep learning and the main research activities in this field.

To learn architectures and optimization methods for deep neural network training

UNIT 1 LINEAR ALGEBRA REVIEW AND OPTIMIZATION 9 hours

Brief review of concepts from Linear Algebra, Types of errors, bias-variance trade-off, overfitting-under fitting, brief review of concepts from Vector Calculus and optimization, variants of gradient descent, momentum.

UNIT 2 LOGISTIC REGRESSION 9 hours

Basic concepts of regression and classification problems, linear models addressing regression and classification, maximum likelihood, logistic regression classifiers.

UNIT 3 NEURAL NETWORKS 9 hours

Basic concepts of artificial neurons, single and multi-layer perceptron, perceptron learning algorithm, its convergence proof, different activation functions, SoftMax cross entropy loss function.

UNIT 4 CONVNETS 9 hours

Basic concepts of Convolutional Neural Networks starting from filtering. Convolution and pooling operation and arithmetic of these, Discussions on famous convent architectures - AlexNet, ZFNet, VGG, GoogLeNet, ResNet, MobileNet-v1

REGULARIZATION, BATCHNORM

Discussion on regularization, Dropout, Batchnorm, Discussion on detection as classification, region proposals, RCNN architectures

UNIT 5 RECURRENT NEURAL NETWORKS 9 hours

Basic concepts of Recurrent Neural Networks (RNNs), backpropagation through time, Long-Short Term Memory (LSTM) architectures, the problem of exploding and vanishing gradients, and basics of word embedding.

AUTOENCODERS

Autoencoders, Denoising autoencoders, sparse autoencoders, contractive Autoencoders

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Course Outcomes:

After completion of course, students would be able to:

1. Understand the fundamentals of deep learning
2. Compare various deep neural network architectures
3. Apply various deep learning algorithms based on real-world applications.

Text Book(s)

1. Ian Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning, the MIT press, 2016
2. Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now Publishers, 2009.

Reference Books

1. B. Vegnanarayana, Artificial Neural Networks, Prentice Hall of India, 2005.
2. Simon Haykin, Neural Networks a Comprehensive Foundations, PHI Edition, 2005.
3. Chao Pan, Deep Learning Fundamentals: An Introduction for Beginners, AI Sciences Publisher.

Online Resources:

1. https://www.coursera.org/learn/neural-networks-deep-learning
2. https://www.deeplearning.ai/program/deep-learning-specialization/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year I Semester

20CSD115 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

The main emphasis of this course is to understand the basic concepts of Computer Networks, Introducing the layered approach for design of computer networks, introduce to computer communication, TCP/IP layers functionalities, and operations of network protocols in the TCP/IP suite, and elucidating the design issues for a computer network.

Course Objectives:

1. To study the evolution of computer networks, foundational principles, architectures, and techniques employed in computer networks.
2. To study the concepts of communication networks from layered perspective
3. To provide students with a theoretical and practical base in computer networks issues
4. Student will be able purse his study in advanced networking courses
5. To Prepare students for easy transfer from academia into future directions of research.

UNIT I INTRODUCTION **9 hours**

NETWORK FUNDAMENTALS:

Introduction, Advantages and Applications, Network Types, Topologies, Internet History, Standards and Administration. Protocols and Standards Network Models: Protocol Layering, The ISO Model, Layers in the OSI Model, TCP/IP Protocol Suite, Cross-layering, Addressing.

THE PHYSICAL LAYER

Data and Signals, Transmission impairment, Data rate limits, Performance. Transmission media: Introduction, Guided Media, Unguided Media. switching: Structure of Circuit Switched Networks, Packet switched networks.

UNIT II THE DATA LINK LAYER **9 hours**

Introduction, Link layer addressing. Error detection and Correction: Cyclic codes, Checksum, Forward error correction. Data link control: DLC Services, Data link layer protocols, Frames, Flow & Error Control, Protocols, HDLC, Point to Point Protocol. Media Access control: Random Access, Controlled Access, Channelization, and connecting devices.

UNIT III THE NETWORK LAYER **9 hours**

Network layer design issues, Routing algorithms, (Optimal, Shortest path, Distance Vector routing, Link State routing, Hierarchical routing, Routing in adhoc networks), Congestion control algorithms, Quality of service, Internetworking, The network layer in the Internet: IP Classes, IPV4 and IPV6, IP Addressing, NAT, IP support protocols, OSPF, BGP, RIP, IGMP.

UNIT IV THE TRANSPORT LAYER **9 hours**

The Transport Service, Elements of Transport Protocols, Flow control, Congestion Control, The internet transport protocols: UDP, TCP, SCTP. Performance problems in computer networks, Network performance measurement. Performance Issues.

UNIT V THE APPLICATION LAYER 9 hours

Introduction, Client Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP. DNS, TELNET, e-mail, File Transfer, WWW and HTTP, SNMP, Streaming Audio & Video, Content delivery.Case study- Computer Networks in health care.

Course Outcomes:

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

1. Understand and choose the transmission media and topologies depending on the requirements.
2. Apply error detection and error correction wherever required.
3. Analyze the concepts of routing, and congestion control
4. Evaluate the computer network logically, by enumerating the layers of the TCP/IP.
5. Create and make use of application-level protocols for file communication, and file transfer.

Text Book(s)

1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education,5th edition, 2012.
2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson,6th edition, 2021.

Reference Books

1. "Internetworking with TCP/IP – Principles, protocols, and architecture", Volume 1, Douglas E. Comer, 5th edition, PHI
2. Peterson, Larry L., and Bruce S. Davie. Computer networks: a systems approach. Elsevier, 2007.
3. "Data communications & networking with TCP/IP protocol suite", Behrouz A. Forouzan, Mc Graw Hill Education, 2021.
4. Droms, R. (2001). Computer networks and internets: with internet applications. Prentice Hall.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year II Semester

20CSD211 BIG DATA ANALYTICS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Data Structure & Algorithms, Computer Architecture, Operating System, Database Management Systems

Course Description:
This course is designed an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques that underlie today's big data computing technologies. It provides an introduction to some of the most common frameworks such as Apache Spark, Hadoop, MapReduce, Large scale data storage technologies such as in-memory key/value storage systems, NoSQL distributed databases

Course Objectives:

1. Optimize business decisions and create competitive advantage with Big Data analytics
2. Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
3. Introducing Java concepts required for developing map reduce programs
4. Derive business benefit from unstructured data
5. Introduce programming tools PIG & HIVE in Hadoop echo system.
6. Developing Big Data applications for streaming data using Apache Spark

List of Programs:

1. (i) Perform Setting Up And Installing Hadoop In Its Two Operating Modes:

Pseudo Distributed, And Fully Distributed.

(ii) Use Web Based Tools To Monitor Your Hadoop Setup.

2. (i) Implement the following file management tasks in Hadoop:

    1. Adding files and directories
    2. Retrieving files
    3. Deleting files

ii) Benchmark and stress test an Apache Hadoop cluster

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

    1. Find the number of occurrence of each word appearing in the input file(s)
    2. Performing a MapReduce Job for word search count (look for specific keywords in a file)

4. Stop word elimination problem:

a. Input:

    i. A large textual file containing one sentence per line

    ii. A small file containing a set of stop words (One stop word per line)

b. Output:

i. A textual file containing the same sentences of the large input file without thewords appearing in the small file.

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: https://github.com/tomwhite/hadoop- book/tree/master/input/ncdc/all.

1. Find average, max and min temperature for each year in NCDC data set?

2. Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

6. Purchases.txt Dataset

a. Instead of breaking the sales down by store, give us a sales breakdown by product category across all of our stores

i. What is the value of total sales for the following categories?

1. Toys

2. Consumer Electronics

b. Find the monetary value for the highest individual sale for each separate store

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

8. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)

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

10. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.

Course Outcomes:

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

1. Preparing for data summarization, query, and analysis.
2. Applying data modelling techniques to large data sets
3. Creating applications for Big Data analytics
4. Building a complete business data analytic solution

Text Book(s)

1. Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A Hands-On Approach “,VPT, 2016
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge DataStreams with Advanced Analytics”, John Wiley& sons, 2012

Reference Books

1. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, “Harness the Power of Big Data The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012
2. Bart Baesens “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons,2014

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year II Semester

20CSD212 DEEP LEARNING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Data Structures using Python Programming Lab

Course Description

This course is designed to provide a basic understanding of working principle of perceptron model. Expert knowledge in solving real world problems using state of art deep learning techniques the course covers all basic and advanced concepts to solve real world problems by using neural network and deep learning techniques.

Course Objectives

Understand the working principle of perceptron model.

1. Learn different activation functions and optimization techniques used in neural networks.
2. Know the applications of deep learning models for binary and multiclass classification.
3. Understand the architectures of CNN, RNN, LSTM and GRU.
4. Explore various types of Categorical Data Encoding Schemes

List of Programs:

1. Basic image processing operations: Histogram equalization, thresholding, edge detection, data augmentation, morphological operations
2. Implement Perceptron training algorithm to classify flowers in IRIS dataset.
3. Implement Activation Functions in Neural Networks and analyse their usage.
4. Build a three-layer Artificial Neural Network by implementing the Back propagation algorithm.
5. Design a GRU-based deep learning model for IMDB dataset. Compare the performance of GRU based model with LSTM based model
6. Build a Deep Neural Network for multi class text classification using Reuters dataset
7. Design a model for MNIST handwritten digit classification using Deep Convolution Neural networks.
8. Train a simple Recurrent Neural Network using an Embedding layer and a Simple RNN layer for movie review classification problem.
9. Build a Deep learning model using LSTM layer in Keras for IMDB dataset.
10. Design a Neural network with various optimization algorithms and analyse their performance using Keras.
11. Design a Deep Learning Model to classify the movie reviews as Positive or Negative based on the text content of reviews using IMDB dataset.

12. Apply One Hot Encoding for categorical sequence data.
13. Design a Deep Learning framework for Object Detection.
14. Image segmentation using Mask RCNN,SegNet
15. Familiarisation of cloud based computing like Google colab

COURSE OUTCOMES:

1. Illustrate Perceptron training algorithm and apply various activation functions.
2. Design multi-layer neural network with Back propagation algorithm and evaluate the performance of various optimization techniques.
3. Build Deep Learning models for binary and multiclass classification problems.
4. Compare the application of Deep learning models CNN, RNN, LSTM and GRU
5. Use data encoding schemes and develop Deep learning models for real world applications.

TEXTBOOKS:

1. Deep Learning with Python, Francois Chollet, Manning Publications Co.
2. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms with contributions by Nikhil Buduma , O'Reilly publications
3. Francois Chollet, "Deep learning with Python" – Manning Publications.

REFERENCE BOOKS:

1. Deep Learning, Ian Good fellow,Yoshua Bengio and Aaron Courville, MIT Press, London, England
2. Deep Learning: A Practitioner's Approach by Josh Patterson, Adam Gibs, O'Reilly publications

Mode of Evaluation: Continuous Internal Evaluation of the Lab Experiments, Record, Viva-voce, and External Lab Examination

B. Tech Computer Science & Engineering (Data Science)

B. Tech III Year II Semester

20CSD213 COMPUTER NETWORKS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Nil

Course Description:

This course helps the students to understand and implement OSI layers, simulation of various protocols, Error detection techniques, Routing and Congestion Algorithms simulation using NS, and protocol analysis, packet analysis, and traffic analysis using Wireshark.

Course Objectives:

1. To provide students with a theoretical and practical base in computer networks issues
2. Student will be able purse his study in advanced networking courses
3. Prepare students for easy transfer from academia into practical life

List of Programs:

1. Study of Basic Network Commands and Network Configuration commands.
2. Implement a program for OSI functionality to transmit data from client to server.
3. Implement a program for the following Encoding Techniques: NRZ, NRZ-I, Manchester
4. Implement a program for framing Techniques
   a) Character Count b) Bit Stuffing and Destuffing c) Byte Stuffing and Destuffing
5. Implement a program for Flow control based on Sliding Window protocol
   a) Go Back N ARQ b) Selective repeat ARQ
6. Implement a program for CRC polynomials.
7. Simulation of Transferring data between two nodes using NS.
8. Simulation of data transfer and packet loss using NS.
9. Simulation of Congestion Control Algorithm using NS.
10. Simulate a 3 nodes point-to-point network with duplex links between them. Set the queue size vary the bandwidth and find the number of packets dropped.
11. Simulate a 4 nodes point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP n1-n3. Apply relevant Applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
12. Simulate an Ethernet LAN using N-nodes (6-10), change error rate and data rate and compare the throughput.
13. Protocol analysis with Wireshark.
14. Packet Capture & Traffic Analysis with Wireshark.

Course Outcomes:

After completing this course, the students should be able to

1. Understand and Implement OSI layers functionality.
2. Implement of Encoding and framing techniques
3. Implement error detection and correction techniques.
4. Simulate the various congestion control protocols using NS and learn NS tool.
5. Analyze packets and traffic using packet analyzer tool such as Wireshark.

Text Book(s)

1. Data Communications and Networking, Behrouz A. Forouzan, 6th , Tata McGraw Hill, 2021.

Reference Books

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kurose, K.W.Ross, Third Edition, Pearson Education
2. Understanding Communications and Networks, Third Edition, W.A.Shay, Cengage Learning. Implementation and Management,6th Edition,2012.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Mandatory Course

20HUM902** / 20HUM102# UNIVERSAL HUMAN VALUES

L	T	P	C
2/3*	0	0	0/3*

Pre-requisite None.

Course Description:

This course discusses students' role in their family and briefly touches issues related to their role in the society and the nature.

Course Objectives:

This course enables students to

1. Understand Happiness and Prosperity correctly and basic Human Aspirations
2. Able to self-verify the Harmony in the Human Being
3. Visualize a universal harmonious order in society which leads to Undivided Society at Universal Order- from family to world family.
4. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
5. Implicate the UHV in professional ethics.

UNIT I The Process for Value Education - Basic Human Aspirations

L1: Purpose and motivation for the course, recapitulation from Universal Human Values-I

L2: Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration

L3: Continuous Happiness and Prosperity- A look at basic Human Aspirations

L4: Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

L5: Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

L6: Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

T1 & T2: Discussion on natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II Understanding Harmony in the Human Being - Harmony in Myself!

L7: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

L8: Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

L9: Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

L10: Understanding the characteristics and activities of 'I' and harmony in 'I'

L11: Understanding the harmony of I with the Body: Self-regulation and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

L12: Programs to ensure Self-regulation and Health.

T3 & T4: Discussion on the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

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UNIT III Understanding Harmony in the Family and Society

L13: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

L14: Understanding the meaning of Trust; Difference between intention and competence

L15: Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

L16: Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

L17: Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

T5 & T6: Reflection on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT IV Understanding Harmony in the Nature and Existence

L18: Understanding the harmony in the Nature

L19: Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature

L20: Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

L21: Holistic perception of harmony at all levels of existence.

T7 & T8: Discussion on human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V Implications of Holistic Understanding of Harmony on Professional Ethics

L22: Natural acceptance of human values

L23: Definitiveness of Ethical Human Conduct

L24: Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

L25; Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

L26: Case studies of typical holistic technologies, management models and production systems

L27: Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

L28: Sum up.

T9-T14: Exercises and Case Studies For e.g. Individual discussion on the conduct as an engineer or scientist etc.

Course Outcomes:

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

1. Understood the natural acceptance in human being as the innate acceptance,
2. More aware of themselves,
3. Maintain harmony with family and society by recognizing Harmony in Human-Human Relationship,
4. Try to get Harmony in the Nature and Existence by realizing existence as Coexistence
5. More responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind with better critical ability.

Text Book(s)

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

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

Mode of Evaluation: Assignment / Quiz, Classroom participation, Mini project / Report, Internal Mid Examination and external semester end examination.

Open Elective - II

B. Tech Computer Science & Engineering (Data Science)

Open Elective - II

20MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre-requisite: 20MAT101, 20MAT107, 20MAT110

Course Description:
This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis. The students use MATLAB as the computer language to obtain solutions to a few assigned problems.

Course Objectives:

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To avail the basics of numerical techniques for solving the system of linear equations
3. To familiarize the knowledge of interpolation and numerical calculus.
4. To use numerical calculus for solving ordinary differential equations.
5. To introduce the computational techniques for solving partial differential equations.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9 hours

Introduction to MATLAB, errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial - Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.
Exercises of Bisection method and Newton's method through MATLAB

UNIT II SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS 9 hours

Gaussian Elimination, LU decomposition, Thomas algorithm for the tridiagonal systems, Norms-Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.Exercises of Gaussian Elimination and Gauss-Seidel method through MATLAB

UNIT III INTERPOLATION & NUMERICAL CALCULUS 9 hours

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature - Exercises of Divided differences and Simpson's rule through MATLAB

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.
Exercises of Runge-Kutta method and Shooting method through MATLAB.

UNIT V NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS 9 hours

Finite difference methods for one-dimensional Wave and Heat equations; Laplace and Poisson equations (five-point formula) - Exercises of Finite difference method (forward, central and backward differentiation) and Crank-Nicolson method through MATLAB

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Course Outcomes:

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

1. Solve the system of algebraic and transcendental equations.
2. Apply the numerical techniques to find the solution to system of equations.
3. Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.
4. Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.
5. Compute the solutions for engineering problems represented by partial differential equations.

Text Books:

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.
2. Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.
3. Advanced Engineering Mathematics by E. Kreyszig, 10th ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - II

20MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite: 20MAT101, 20MAT106, 20MAT104, 20MAT108, 20MAT109, 20MAT110.

Course Description:
Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course Objectives:
1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to solve dynamic programming problem using recursive relations.
5. Analyze the techniques of project management and queuing models.

UNIT I CLASSICAL OPTIMIZATION **9 hours**

Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

UNIT II LINEAR PROGRAMMING PROBLEM **9 hours**

Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method. Duality, dual Simplex method.

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM **9 hours**

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

UNIT IV DYNAMIC PROGRAMMING **9 hours**

Introduction, developing optimal decision policy, Dynamic Programming Problem (DPP) under certainty, DPP approach for solving LPP.

UNIT V PROJECT MANAGEMENT AND QUEUING MODELS **9 hours**

Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT). Introduction to queuing system, single server queuing models (M/M/1) :(∞/FCFS), (M/M/1): (N/FCFS).

Course Outcomes:
At the end of the course, students will be able to:
1. Understood the importance of unconstrained and constrained optimization to solve engineering problems.
2. Get an idea about the linear programming techniques.
3. Solve transportation and assignment problems in engineering situations.
4. Apply the Bellman principle of optimality to solve dynamic programming problem.
5. Analyze the problems of network analysis for project management and Queuing systems engineering & industry.

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Text Books:

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.
2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

Reference Books

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.
2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.
3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.
4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2nd edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - II

20PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course will cover Geometrical optics, Aberrations, Physical Optics, Diffraction and Optical fibers.

Course Objectives:
Students will

1. Knowledge of basic principles and concepts in optics and the techniques used to deal with them.
2. Explain the limitations associated with spherical and chromatic aberration
3. Describe optical systems such as microscopes and telescopes with reference to parameters such as angular magnification and depth of field
4. Provide students with a working knowledge of optical physics, including interference, diffraction and physical optics.
5. Introduce construction and concepts of basic fiber optic communication system and to make the students learn about its important applications for societal needs.

UNIT I INTRODUCTION 9 hours

Corpuscular and wave theory, Fermat's principle, Matrices for translation, refraction and reflection, Unit and nodal planes, Eigenvalues and Eigenvectors.

UNIT II ABERRATIONS AND OPTICAL INSTRUMENTS 9 hours

Types of aberrations, Chromatic and monochromatic aberrations. Different types of monochromatic aberrations. Simple and Compound microscopes, Astronomical and Terrestrial telescopes. Ramsden's and Huygens' eye pieces.

UNIT III WAVE OPTICS & INTERFERENCE 9 hours

Huygens's principle, Superposition of waves, Fourier transforms, representation of slits and apertures, Two beam interference by Division of wave front. Applications of Interference, Nonlinear interaction of light with matter (self-study).

UNIT IV DIFFRACTION & POLARISATION 9 hours

Fraunhoffer diffraction, Diffraction from single slit, double slit & multiple slits, Fresnel half-period zones, Zone plate, Applications of diffraction, Polarization, Malus' law, double refraction. Applications of polarization.

UNIT V FIBER OPTICS 9 hours

Construction and working principle of optical fibers, Numerical aperture and acceptance angle, Types of optical fibers. Attenuation and losses in optical fibers, Analog and Digital optical fiber communication system. Applications of optical fibers in communications, sensors and medicine.

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

1. Recollect the fundamental characteristics of light and their mathematical principles.
2. Learn the principles of superposition, Interference and Diffraction
3. Understand nonlinear optics and photonics phenomena.
4. Be exposed to the application of optical techniques in cutting edge research areas.
5. Describe the basic laser physics, working of lasers and principle of propagation of light in optical fibers.

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Text Books:

1. Optics by Ghatak, 4th Edition, Tata McGraw Hill (2011).

Reference Books

1. Optics by Lipson, Lipson & Lipson, 4th Edition, Cambridge Univ Press (2010).
2. Optics by Hecht, 4th Edition, Addison-Wesley (2002).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:

Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:

1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I INTRODUCTION TO LASER TECHNOLOGY 9 hours

Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours

Energy levels & Radiative properties of Atoms and molecules; Atomic lasers: He-Ne laser, Argon Ion laser; Molecular Lasers: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

UNIT III SOLID STATE LASERS 9 hours

Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)

Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only);

UNIT IV PULSED OPERATION OF LASERS 9 hours

Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.

Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

UNIT V LASER APPLICATIONS 9 hours

Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology- Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering.

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Course Outcomes:

Upon completion of this course the students shall be able to:

1. Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.
2. Estimate stability requirements in producing laser light by different types of sources
3. Differentiate or list the various types of lasers and their means of excitation.
4. Assess (Identify) which laser would best meet the need for a particular industrial or research task.
5. Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Text Books:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.
2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer
3. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
4. Principles of Laser: O. Svelto
5. Laser Physics: Peter W Miloni, Joseph H Eberly.

Reference Books

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.
2. Ultrafast Optics, Andrew M. Weiner
3. Laser spectroscopy: Demtroder
4. Laser Applications: Monte Ross

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - II

20CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:
It deals with basic principles of petroleum engineering and the processes involved in petroleum industry.

Course Objectives:
Students will

1. To understand the basic concepts of crude oil, distillation process, internals, petroleum products and their properties, Instruments used for fuel testing.
2. To understand the type of chemicals and their application in petroleum industry.
3. To introduce the basic principles of hydroprocessing and fluid catalytic cracking and familiarize the processes involved there.
4. To familiarize the basic concepts of catalysis, bioprocesses in the refinery.
5. Health, environment, process safety and management in petroleum companies.

UNIT I BASIC PROCESSES IN PETROLEUM REFINING AND FUEL TESTING **9 hours**

Source of Crude oils and types, Overview of refinery process, Atmospheric Distillation, Vacuum distillation, Desalter, Desulphurization, Cracking, catalysis, Effluent treatment plant. Density, viscosity, pour point, flashpoint, octane number, cetane number, Fire point, Chromatography, Ductility, Water content, Sulphur analysis, MCRT, SARA, HFRR, calorific value etc.

UNIT II CHEMICALS AND THEIR IMPORTANCE IN PETROLEUM INDUSTRY **9 hours**

Types of products in the refinery and their structural properties, Netralizing amines, Corrosion inhibitors, Multifunctional additives, viscosity improvers, drag reducing agents, antioxidants, Lubricity improvers, Antifoam additives, Oil spill absorbers, Dispersants and their applications, Types of Catalysts used in the refinery, Chemicals for ETP plant.

UNIT III ROLE OF HYDROPROCESSING AND FLUID CATALYTIC CRACKING IN PETROLEUM INDUSTRY **9 hours**

Objectives, Hydrocracking Reactions, Hydrocracking feedstocks, Modes of Hydrocracking, Effects of process variables, Hydro treating process and catalysts Resid hydro processing, FCC Cracking, Catalyst coking and regeneration, Design concepts, New Designs for Fluidized-Bed Catalytic Cracking Units

UNIT IV ROLE OF CATALYSTS, BIOPROCESSES IN PETROLEUM INDUSTRY **9 hours**

Types of catalyst and their importance, Design of catalyst, selection of catalyst, Catalytic processes. Introduction to biotechnology, oil recovery from reservoirs, refining of petroleum using biodesulphurisation, Bioremediation, commercial processes for bioethanol, propanol.

UNIT V HEALTH, ENVIRONMENT, PROCESS SAFETY AND MANAGEMENT IN PETROLEUM INDUSTRY **9 hours**

Safety policy, Personal protective equipment, Different type of extinguishers, Types of gloves and their application, Hydrants and their role, Safety indicators, Safety contact, Environmental pollution, precaution and first aid, precautions safety, Occupational safety and management, different elements and their role.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Be able to understand the overview of petroleum industry
2. Be able to understand the concepts of crude oil, types of crude oils, properties of fuels such as octane number, cetane number, viscosity, density etc. Instruments.
3. Be familiarized with importance and their use of chemicals involved in the petroleum industry.
4. Be familiarized with the processes involved in hydroprocessing and fluid catalytic cracking.
5. Be familiarized the types of catalysts and bioprocesses in the petroleum industry.
6. Understanding the PPE, different types of extinguishers, First aid, process safety and management in the petroleum industry.

Text Books:

1. Mohamed A. Fahim, Taher A. Al-Sahhaf, Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier,2009
2. David T Day, Handbook of the Petroleum Industry, Volume 1, ISBN: 137595962X, CHIZINE PUBN, 2017
3. S. P. Srivastava Jenő Hancsók, *Fuels and fuel additives*, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
4. Robert O. Anderson, *Fundamentals of the Petroleum Industry*–University of Oklahoma Pres, 1987.
5. James G.Speight, *Handbook of Petroleum Product Analysis,* John Wiley & Sons, Inc, 2015
6. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company)

Reference Books

1. Sankara Papavinasam, Corrosion Control in the Oil and Gas Industry, Elsevier, 2013
2. Petroleum Engineering Handbook (Vol. 1 through VIII). Editor in Chief: Larry W. Lake, Society of Petroleum Engineers.
3. Srinivasan Chandrasekaran. Health, safety and Environmental Management for offshore and Petroleum Engineers, John Wiley and Sons, U.K., ISBN: 978-11-192-2184-5, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:

This course aims to introduce the interdisciplinary concept for engineering's to enhance their knowledge that they need to contribute with relevance and confidence in developing green technologies. This course covers feedstocks, green metrics and the design of safer, more efficient processes, as well as the role catalysts and solvents and green processes for Nanoscience.

Course Objectives:

Students will

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing Nanoscience.

UNIT I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY 9 hours

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide.

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

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Course Outcomes:

Upon completion of this course the students should:

1. Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
2. Understand and apply catalysis for developing eco-friendly processes.
3. Be in a position to use environmental benign solvents where ever possible.
4. Have knowledge of current trends in alternative energy sources.
5. Apply green chemistry principles in practicing green Nanoscience.

Text Books:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.

2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20CE301 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geo-synthetics; improvement of expansive soils.

Course Objectives:
Students will
1. To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques.
2. To bring out concepts of reinforced earth.
3. Applications of geotextiles in various civil engineering projects.

UNIT I DEWATERING & GROUTINHG 9 hours

Introduction- Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique.
Methods of de-watering- sumps and interceptor ditches- wells- drains- Electro- osmosis. Objectives of grouting- grouts and their properties-grouting methods.

UNIT II DENSIFICATION 9 hours

In - situ densification methods in cohesionless Soils: - Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth. In - situ densification methods in cohesive soils: - preloading or dewatering, Vertical drains - Sand Drains- Sand wick geo-drains
- Stone and lime columns - thermal methods.

UNIT III STABILIZATION 9 hours

Methods of stabilization-mechanical-cement- lime-bituminous-chemical stabilization with calcium chloride- sodium silicate and gypsum.

UNIT IV REINFORCED EARTH & GEOSYNTHETICS 9 hours

Principles - Components of reinforced earth - factors governing design of reinforced earth walls design principles of reinforced earth walls. Geotextiles- Types, Functions and applications - geo- grids and geo-membranes - functions and applications.

UNIT V EXPANSIVE SOILS 9 hours

Problems of expansive soils - tests for identification - methods of determination of swell pressure. Improvement of expansive soils - Foundation techniques in expansive soils - under reamedpiles.

Course Outcomes:
After successful completion of the course, student will be able to
1. Evaluate basic deficiencies of various soil deposits and able to decide various dewatering methods to improve the soil.
2. Implement different techniques of soil densification.
3. Choose the best method for stabilizing the soil for a given soil condition.

4. Choose-the best geosynthetic materials in different engineering applications.
5. Assessing various types of foundation techniques and methods to control swelling of soil

Text Books:

1. Dr. Purushotham Raj, P., Ground Improvement Techniques, Laxmi Publications, New Delhi.

2. Dr. Sivakumar Babu, GL, An Introduction to Soil Reinforcement & Geosynthetics, Universities Press

Reference Books

1. Hausmann M.R., Engineering Principles of Ground Modification, McGraw-Hill International Edition, 1990.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20CE302 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course will focus on Basic concept of Environmental Impact Assessment (EIA), EIA Methodologies, Impact of Developmental Activities and Land use in soil, water, and vegetation, Environmental Audit, Post Audit activities, The Environmental pollution Acts.

Course Objectives:
Students will
1. To impart knowledge on Environmental management and Environmental Impact Assessment.
2. To give the student the brief knowledge about various legislations and audit protocols.
3. To give student knowledge about the framing of environmental audit through case studies.

UNIT I CONCEPTS AND METHODOLOGIES IN EIA 9 hours

Introduction - Elements of EIA - Factor affecting EIA -Impact evaluation and analysis - Preparation of Environmental Base map - Classification of environmental parameters. Criteria for the selection of EIA Methodology - EIA methods: Ad-hoc methods - matrix methods - Network method - Environmental Media Quality Index Method -overlay methods - cost/benefit Analysis.

UNIT II IMPACT OF DEVELOPMENTAL ACTIVITIES 9 hours

Introduction and Methodology for the assessment of soil and ground water - Delineation of study area - Identification of actives. Procurement of relevant soil quality - Impact prediction - Assessment of Impact significance -Identification and Incorporation of mitigation measures. EIA in surface water - Air and Biological environment.

UNIT III IMPACT ON VEGETATION AND WILD LIFE 9 hours

Assessment of Impact of development Activities on Vegetation and wildlife - environmental Impact of Deforestation - Causes and effects of deforestation.

UNIT IV ENVIRONMENTAL AUDIT 9 hours

Environmental Audit & Environmental legislation objectives of Environmental Audit - Types of environmental Audit - Audit protocol - stages of Environmental Audit - onsite activities - evaluation of audit data and preparation of audit report - Post Audit activities.

UNIT V ENVIRONMENTAL POLLUTION ACTS 9 hours

The water Act-1974 - The Air Act-1981 (Prevention & Control of pollution Act.) - Wild life Act- 1972 - Indian Forest Conservation Act-1980 -National Green Tribunal Act –2010 - Biological Diversity Act-2002.

Course Outcomes:
The students after completing the course will be able to:
1. Apply the various methods used in predicting environmental impacts.
2. Apply site information to interpret impacts on land and groundwater.
3. Evaluate environmental impacts of various development activities on existing ecosystem.
4. Apply the procedures and various protocols involved in preparation of environmental audit report.
5. Apply the implications of environmental prevention and protection acts in relation to environmental impact assessment.

Text Books:

1. Anjaneyulu, Y., Environmental Impact Assessment Methodologies, B.S. Publication, Sultan Bazar, Kakinada.

Reference Books

1. Glynn, J. and Gary W. Hein Ke., Environmental Science and Engineering, Prentice Hall Publishers

2. Suresh K. Dhaneja Environmental Science and Engineering, S.K., Katania& Sons Publication, New Delhi.

3. Dr. Bhatia, H.S., Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20CE303 WATERSHED MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Topic covers basic concepts of watershed, sustainable watershed management approached and practices, integrated watershed management and modelling, social aspect in watershed management, quantification of water quality and quantity at the catchment outlet using modern techniques, drought, flood and storm management at catchment scale.

Course Objectives:
1. To discuss various aspects of water resources development and management on watershed basis.
2. To proliferate the sustainable use and development of natural resources.
3. To enrich the students for change in the hydrological fluxes due altered physiographic condition (land use or elevation) on a watershed scale.
4. To improve the quantitative problem solving skills of the students for natural resources management.

UNIT I CONCEPT OF WATERSHED 9 hours

Concept of watershed - classification of watershed - introduction to watershed management - objective of watershed development - Hydrological cycle - water balance equation - different stakeholders and their relative importance - watershed management policies and decision making. Factor Affecting Watershed Development**:** Morphological characteristics: linear - Arial and Relief aspect - land use - vegetation - soil and geological characteristics - Hydrology and geology and socio-economic characteristics.

UNIT II WATERSHED MODELING 9 hours

Watershed delineation - modelling of rainfall - runoff process - Concept of integrated watershed management conjunctive use of water resources - Integrated water resources management. PRA - Private sector participation - Institutional issues - Socio- economy issues - Integrated development - Water legislation and implementations - Tools and emerging technologies for watershed management and planning.

UNIT III EROSION AND SEDIMENTATION 9 hours

Types of erosion - factor affecting erosion - effect of erosion on land fertility and capacity - estimation of soil loss due to erosion: universal soil loss equation - Prevention And Control To Erosion: contour techniques - ploughing - furrowing- trenching - bunding - terracing - gully control - rockfill dams - check dams - brushwood dam - Gabion structure.

UNIT IV WATER HARVESTING 9 hours

Rain water harvesting - catchment harvesting - harvesting structures - soil moisture conservation - check dams - artificial recharge from pond - percolation tanks - Flood And Drought Management: Definition of flood - Flood frequency analysis: Weibul - Gumbel - and log Pearson methods - Definition and classification of drought - drought analysis techniques - drought mitigation planning - Management Of Water Quality: Water quality and pollution - types and Sources of pollution - water quality modelling- environmental guidelines for water quality.

UNIT V COVER MANAGEMENT 9 hours

Land use land cover change estimation through satellite imageries - land capability classification - management of forest - agricultural - grassland and wild land - Reclamation of saline and alkaline soil. Classification of columns based on slenderness ratio - reinforcement & loading - Design of rectangular and circular columns subjected to axial load - (axial load + uni-axial bending) and (axial load + bi-axial bending). Different Types of Footings - Design of isolated - square - rectangular and circular footings. Integrated Cropping System For Watersheds: Intercropping - mix cropping strip and terrace cropping - sustainable agriculture - cover cropping (biomass conservation) - horticulture - dryland agriculture and afforestation.

Course Outcomes:

The students after completing the course will be able to:

1. Classify watershed and Identify factors to consider for watershed Development.
2. Apply the concepts of watershed development and planning
3. Evaluate the erosion rate and total amount of soil loss from a watershed
4. Select the flood and drought mitigation measures
5. Quantify the change in land use land/cover and its impact on hydrological processes.

Text Books:

1. Kenneth N. Brooks Peter F. Ffolliott Joseph A. Magner. Hydrology and the Management of Watersheds. A John Wiley & Sons, Inc., Publication (4th Edition)
2. VVN, Murthy. Land and Water Management- Kalyani Pblication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20ME301 MATERIAL SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

1. To understand the relation between structure and properties of metallic materials.
2. To understand the strengthening mechanism of metals
3. To comprehend the various electrical and electronic properties of materials.
4. To understand origins and various types of magnetism and its applications.
5. To comprehend the transmission of light in various solids and study of photonic behavior.

UNIT I STRUCTURE OF MATERIALS 9 hours

Introduction: Historical prospective - importance of materials - Classification of Materials and its Properties. Bonding in solids: bonding forces and energies - primary and secondary bonding. Crystallography and Metallic structures: Unit cell - Crystallographic directions and planes, FCC, BCC, HCP, SC and other structure – miller indices, Linear and planar densities - close- packed crystal structures. Packing of atoms in solids. Packing factor

UNIT II CRYSTAL IMPERFECTIONS AND DIFFUSION 9 hours

Crystal Imperfections: Types, Vacancies and interstitials, Dislocations, and grain boundaries. Diffusion: Fick's Law of diffusion – Diffusion mechanism – Steady state and non-steady state, factors affecting diffusion.

UNIT III ELECTRICAL PROPERTIES OF MATERIALS 9 hours

Introduction and Electrical Conduction: Ohm's Law, Electrical Conductivity, Electronic and Ionic Conduction - Energy Band Structures in Solids, Electron Mobility - Electrical Resistivity of Metals Semi conductivity: Intrinsic and Extrinsic Semiconduction - Temperature Dependence of Carrier Concentration, Factors that Affect Carrier Mobility, The Hall Effect, Semiconductor Devices. Conduction in Ionic Materials, Electrical Properties of Polymers. Dielectric Materials: Capacitance, Ferroelectric Materials, Piezoelectric Materials.

UNIT IV MAGNETIC PROPERTIES OF MATERIALS 9 hours

Introduction and Basic Concepts, Diamagnetism, Paramagnetism, Ferromagnetism, Anti ferromagnetism, Ferrimagnetism, Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Magnetic Anisotropy, Soft and Hard Magnetic Materials, Magnetic Storage, Superconductivity.

UNIT V PHOTONIC MATERIALS 9 hours

Introduction, Electronic Radiation in Vacuum; Reflection, Refraction, and absorption in materials; Absorption and Chemical Bonding: Color, X-Ray absorption, Photon absorption Devices - Photon Emission: X-Ray Emission, Emission of electromagnetic radiation and devices: LED's, OLEDs and LASERs. Optical Fibers in communication

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

At the end of the course students will be able:

1. To develop deep knowledge of crystal structure and effect of structure on the properties of the materials
2. To demonstrate knowledge of various imperfections in crystal, and diffusion mechanism in materials
3. To explain the origins of various electronic and electrical properties in the materials
4. To understand the concept of magnetism, its origin and types, while choosing the right material for the given application
5. To summarize various optical properties of the material and light's transmission behavior

Text Books:

1. W. Callister, "Materials Science and Engineering", Wiley, 7th Edition, 2007.
2. Charles M. Gilmore, "Materials Science and Engineering Properties", Cengage Learning, SI Edition, 2016

Reference Books

1. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", Cengage Learning, 5th Edition, 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

Students belonging to all branches of Engineering are made to learn following fundamental topics related to mechanical engineering:

1. To teach students the basic concepts of Thermodynamics.
2. To teach students the basic Classification and working principles of boilers and turbines.
3. To teach students about IC engines, Refrigeration, and Air-Conditioning systems.
4. To teach students about engineering materials and casting manufacturing processes.
5. To teach students and machines tools and manufacturing systems.

UNIT I THERMODYNAMICS 9 hours

Basic concepts of Thermodynamics: Introduction, Important terminologies used in thermodynamics, Specific heat capacity, First law of thermodynamics, Second law of thermodynamics, Reversible and irreversible processes, the Carnot cycle and the Clausius inequality.

UNIT II BOILERS, TURBINES AND PUMPS 9 hours

Boilers: Introduction to boilers, Classification of boilers, requirements of a good boiler, Cochran, Babcock, Locomotive, and Lancashire boilers.

Turbines: Hydraulic Turbines-Classification and specification, Principles, and operation of Pelton wheel turbine, Francis turbine, and Kaplan turbine (elementary treatment only).

Hydraulic Pumps: Introduction, Classification, and specification of pumps, reciprocating pump, and centrifugal pump.

UNIT III IC ENGINES AND REFRIGERATION SYSTEMS 9 hours

Internal Combustion Engines: Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines, Working principle of IC engines, Valve timing diagrams, Otto cycle, Diesel cycle, and Dual cycle. Refrigeration and Air conditioning Refrigeration – Introduction, Refrigerator, and Heat pump, Components of refrigeration system, Types of refrigeration system, and Type of refrigerants.

UNIT IV MATERIALS, CASTING AND TRANSMISSION 9 hours

Engineering Materials: Introduction, mechanical properties of engineering materials, mechanical testing of engineering materials, Impact test, and Classification of engineering materials.

Casting: Introduction to casting processes, Classification of casting processes, Sand casting, and special casting methods.

Power Transmission Devices: Introduction, belt drive, rope drive, Chain drive, Gear drive, Classification of gears.

UNIT V TOOLS AND MANUFACTURING SYSTEMS 9 hours

Machine Tools: Introduction, Mechanism of metal cutting, Geometry of single point cutting tool, Orthogonal and oblique metal cutting, Lathe, and Milling machines.

Manufacturing Systems Introduction, Computer Integrated Manufacturing, CAD/CAM, Numerical Control (NC), Computer Numerical Control, and Dynamics Numerical Control.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. State first, second and third law of thermodynamics.
2. Sketch components of boilers and turbines.
3. State working principle of IC engines and R& AC systems.
4. Fair understanding of application and usage of various engineering materials, Casting process, and different types of drives with applications.
5. Explain the role of Computers in manufacturing systems.

Text Books:

1. "Basic Mechanical Engineering" by Pravin Kumar, Pearson Edition ISBN: 9789332505759, 9789332505759.

Reference Books

1. George E Dieter, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 2017
2. S. Kalpakjian and S. R. Schmid, "Manufacturing Engg, and Technology", 7th Edition, Pearson, 2018
3. P K Nag, "Engineering Thermodynamics", 6th Edition, McGraw Hill, 2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

220EEE301 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course deals with basics of electrical wiring systems for residential, commercial and industrial consumers, and its representation with standard symbols and drawings, various components of industrial electrical systems and its sizing and control aspects of industrial electrical system using PLC and SCADA.

Course Objectives:
1. To understand the electrical wiring systems for residential, commercial and industrial consumers.
2. To learn the representation of systems with standard symbols and drawings.
3. To understand the various components of industrial electrical systems.
4. To analyze and select the proper size of several electrical system components.
5. To study the control aspects of industrial electrical system using PLC and SCADA

UNIT I ELECTRICAL SYSTEM COMPONENTS 9 hours

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT II RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS 9 hours

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT III ILLUMINATION SYSTEMS 9 hours

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

UNIT IV INDUSTRIAL SUBSTATION SYSTEMS 9 hours

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT V INDUSTRIAL SYSTEM AUTOMATION 9 hours

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

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Course Outcomes:

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

1. Discuss the various component representation involved in the design of electrical wiring for Low Tension.
2. Understand the guidelines for wiring of household and commercial buildings.
3. Understand the various components of illumination in industrial electrical systems.
4. Select the proper size of various electrical system components required for designing different electrical wiring systems.
5. Understand the control aspects of industrial electrical system using PLC and SCADA.

Text Books:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

Reference Books

1. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.
3. https://www.bis.gov.in/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course describes about manufacturing, modeling and applications of MEMS.

Course Objectives:

1. To know the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. To know various MEMS microfabrication technologies.
3. To provide various MEMS technology for mechanical, optical, and chemical sensors and actuator

UNIT I INTRODUCTION **9 hours**

Overview – History and industry perspectives – Working principles – Mechanics and dynamics — Scaling law

UNIT II MICRO SENSORS & ACTUATORS **9 hours**

Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING **9 hours**

Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS **9 hours**

Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS **9 hours**

Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

Course Outcomes:

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

1. Explain the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. Analyze the Micro sensors and actuators and its fabrication.
3. Explain the materials for MEMS and Microsystems.
4. Design MEMS using microfabrication techniques.
5. Explain the advantages of MEMS technology for mechanical, optical, and chemical sensors and actuator

Text Books:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006

2. G.K. Ananthsuresh et al ,'Micro and Smart Systems', Wiley, India, 2010

Reference Books

1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.
3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005
4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:
This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids

UNIT I HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS 9 hours

Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects

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

1. Understand the applications of biological transducers in medical field.
2. Analyze the design of bio-electrodes and bio-amplifiers.
3. Apply suitable measuring instruments to measure various medical parameters.
4. Understand and test various imaging techniques used in bio-medical diagnosis.
5. Analyze the applications of artificial medical aids.

Text Books:

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.

2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014
2. R.S.Khandpur,"Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw - Hill, New Delhi, 2005
3. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – II

20ECE302 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET models, CMOS design rules, Design of VLSI Systems, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives:
This course enables students to

1. Study the fundamentals of CMOS circuits and its characteristics
2. Learn the design and realization of combinational digital circuits.
3. Learn the design and realization of sequential digital circuits.
4. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
5. Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Realize the concepts of digital building blocks using MOS transistor.
2. Design combinational MOS circuits and power strategies
3. Design and construct Sequential Circuits and Timing systems.
4. Design arithmetic building blocks and memory subsystems.
5. Apply and implement FPGA design flow and testing.

Text Books:

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson , 2017.
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

B. Tech Computer Science & Engineering (Data Science)

Open Elective - IV

20PHY303 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:

1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I PHYSICS OF THIN FILMS 8 hours

Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation.

UNIT II THIN FILM DEPOSITION TECHNIQUES 10 hours

Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating.

UNIT III PROPERTIES OF THIN FILMS 8 hours

Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films.

UNIT IV CHARACTERIZATION OF THIN FILMS 10 hours

Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry).

UNIT V APPLICATIONS OF THIN FILMS 9 hours

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.
2. Asses the relation between deposition technique, film structure, and film properties.
3. Know the typical thin film applications.
4. Motivate selection of deposition techniques for various applications.

Text Books:

1. Thin Film Deposition: Principles and Practice, Donald L. Smith, McGraw Hill, Singapore, 2001.
2. Maissel, L.I and Glang. R, "Handbook of thin film technology", McGraw Hill, 1970.

Reference Books:

1. Thin film phenomena / Kasturi L. Chopra, New York: McGraw-Hill, c1969.
2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
3. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
4. Thin film processes, John L Vossen, Werner Kehn editors, Academic Press, New York, 1978.
5. Thin film physics / O.S. Heavens, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - IV

20CHE303 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This is primarily a lecture course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology.

Course Objectives:

1. To understand the emergence of nanoscience and technology through history.
2. The various process techniques available for nanostructured materials.
3. The role of nanotechnology in electronics how basic nano-systems work
4. To use physical reasoning to develop simple nanoscale models to interpret the behaviour of such physical systems

UNIT I MOLECULE TO MATERIALS: BASICS OF NANOTECHNOLOGY **8 hours**

History & emergence (Feynman to present) of Nanoscience and Nanotechnology, Challenges in Nanotechnology. Atomic Structures: Rutherford and Bohr's model of atom. Bohr's model to Quantum: Wave function, Uncertainty principle, Orbital quantum numbers, Shape of the orbitals. Types of simple crystal structures, defects in crystals.

UNIT II TYPES AND SYNTHESIS OF NANOSTRUCTURES **10 hours**

Definition of a Nano system - Zero Dimensional (OD), One Dimensional (1D) - Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials. Nanoscale building blocks, Top-down and Bottom-up approaches. Synthesis of Nanomaterials – Physical & Chemical methods: Chemical Vapour Deposition (CVD), Atomic Layer Deposition (ALD), Chemical Reduction, Co-precipitation, Emulsion Polymerization (Polymer and Organic NPs), Sol-Gel, Green synthesis of Nanoparticle (NP).

UNIT III PROPERTIES OF NANOMATERIAL **8 hours**

Thermal, Mechanical, Optical, Electrical and Magnetic properties of nanomaterials (Metal oxides, Ceramics, Nanocomposites, Semiconductors). Carbon age materials: CNTs, and other Carbon-based materials). Effect of size and shape on the properties of nanomaterials.

UNIT IV CHARACTERIZATION OF NANOMATERIALS **10 hours**

Structure: Powder XRD (SAXS); Composition: XPS; Thermal: TG-DTA; Optical & Electron microscopes: Atomic force microscopes (AFM), Scanning electron microscope (SEM), Transmission electron microscope (TEM); Magnetic characterization (SQUID).

UNIT V APPLICATIONS OF NANOMATERIALS **9 hours**

Molecular electronics and nano-electronics – LED applications, Quantum electronic devices - CNT based transistor and Field Emission Display – Biological (anti-bacterial, anti-fungal, anti-microbial) applications - Biochemical sensor - Membrane based water purification, Target based drug delivery system.

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Course Outcomes:

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

1. Understand the correlation between atomic, molecular structures and nanomaterials
2. Classify the types and synthesis the nanomaterials based on the needs of the society and environment.
3. Infer and interpret the properties of nanomaterials
4. Apply the knowledge of characterization tools towards making the sustainable engineering products.
5. Illustrate the application of various nanomaterials in daily life, industry towards the sustainable development.

Text Books:

1. M. Wilson, K. Kannangara, G. Smith, M. Simmons, and B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C. N. R. Rao, A. Muller, and A. K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
3. Kenneth J. Klabunde (Eds), Nanoscale Materials Science, John Wiley & Sons, InC, 2001.
4. C. S. S. R. Kumar, J. Hormes, and C. Leuschner, Nanofabrication towards biomedical applications, Wiley - VCH Verlag GmbH & Co, Weinheim, 2004.
5. T. Pradeep, Nano: The Essentials, Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

Reference Books

1. W. Rainer, Nano Electronics and information Technology, Wiley, 2003.
2. K. E. Drexler, Nano systems, Wiley, 1992.
3. G. Cao, Nanostructures and Nanomaterials: Synthesis, properties and applications, Imperical College Press, 2004.
4. P. Yang, Chemistry of Nanostructured Materials, World Scientific Publishers, 2005.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - IV

20CHE304 COMPUTATIONAL METHODS IN MATERIALS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: Exposure to Introductory engineering mathematics, introductory materials science and introductory programming courses is preferred.

Course Description:

This course deals with various computational approach and mathematical methods to understanding and apply different concepts in materials science and engineering.

Course Objectives:

1. To get exposed to the basic concepts in Materials Science and Engineering.
2. To understand the basic concepts of Programming and Graphical plotting.
3. To introduce the basic concepts of Data types and handling of various data.
4. To familiarize the basic concepts of modelling and simulation.
5. To acquire and apply the current knowledge and trends in the field of Computational Materials Science.

UNIT I INTRODUCTION TO COMPUTATIONAL MATERIALS SCIENCE AND ENGINEERING **9 hours**

Concepts in materials science and engineering; use of computers and freely available open source software to: data handling; understand concepts and solve problems of engineering interest.

UNIT II PROGRAMMING AND PLOTTING **9 hours**

Introductions to the advanced concept C programming language; open source software for numerical computations and visualization (gnuplot, GNU Octave, Scilab); introduction to the LaTeX software for report preparation along with other miscellaneous software and programs.

UNIT III DATA TYPES AND HANDLING TECHNIQUES **9 hours**

Classification, and understanding of data properties, data handling - plotting, fitting, functional forms, interpolation, and integration.

UNIT IV COMPUTATIONAL MODELING AND SIMULATIONS **9 hours**

Understanding the materials properties; atomistic and electronic modelling of materials; concepts in molecular dynamics and its application using Quantum ESPRESSO.

UNIT V CURRENT TRENDS IN COMPUTATIONAL MATERIALS SCIENCE **9 hours**

Applied materials for various engineering field; research literature exploration; real-time application of computational methods in materials science and engineering, mini-project.

Course Outcomes:

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

1. Understand the importance and applications of computational methods in Materials Science and Engineering.
2. Be familiarized with the tools of the trade, namely programming and graphical plotting.
3. Be able to understand and access the various types of data sets and appropriately handle it to productively work with it.
4. Get the knowledge about handling various open source computational tools and their effective usage to do computational modeling and simulations.
5. Be familiarized with up to date trends in computational materials science by taking up real time research problems and provide solutions.

Text Books:

1. Computational Materials Science: An Introduction, Second Edition 2nd Edition, by June Gunn Lee, 2014
2. Materials science and engineering: an introduction, William D Callister, Sixth edition, John Wiley & Sons, 2013.
3. The C programming language, Brian W Kernighan and Dennis M Ritchie, Second edition, PHI Learning Private Limited, 2010.
4. Materials science and engineering: a first course, V Raghavan, Fifth edition, PHI Private Limited, 2008.
5. Physical metallurgy principles, Robert E. Reed-Hill, Second edition, Affiliated East-West Press Pvt. Limited, 2008.
6. An introduction to materials science and engineering, Kenneth M Ralls, Thomas H Courtney, and John Wulff, Wiley India Pvt. Ltd., 2011.

Reference Books

1. Materials Science and Engineering,V Raghavan,Prentice-Hall India, 2004
2. Advanced Engineering Mathematics, E Kreyzig, Wiley-India,1999.
3. A Review of Computational Methods in Materials Science, International Journal of Molecular Sciences 10(12):5135-216

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - IV

20CE304 GREEN BUILDINGS AND ENERGY CONSERVATION

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course covers various aspects of bioclimatic architecture like climate sensitive design, passive solar architecture, Water management, green building materials and construction techniques.

Course Objectives:

1. The course introduces concepts of sustainability and bioclimatic design in planning, construction and life of buildings.
2. This course intends to equip students with technical knowledge of energy-efficient green buildings
3. This course guide students, through projects, to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.
4. This course also initiates students in basics of functional design and drawing of the various buildings using the above concepts.

UNIT I GREEN BUILDING CONCEPTS 9 hours

Introduction to bioclimatic architecture - Sustainability in building science and Functional planning - Orientation - Elements of building design and drawing - Building regulations and bylaws - Traditional and VernacularArchitecture - Climate zones - Design Charts - sun path diagram - Solar angles - Indices of thermal comfort - Vernacular buildings in different climate zones.

UNIT II CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN 9 hours

Introduction - various steps in Site planning - Plan form Building envelope Land form -Topography - vegetation - water bodies; Orientation - S/V ratio - P/A ratio - Walls, Fenestration - Roof and floors - Active and passive solar strategies - Passive solar architecture.

UNIT III THERMAL FLOW IN BUILDINGS 9 hours

Calculation of thermal conductance - Heat flow through different building elements - Ventilation and day lighting- Design and placement of openings- Water management in buildings- Techniques to recycle, reuse and harvest water.

UNIT IV GREEN BUILDING MATERIALS AND CONSTRUCTION 9 hours

Material properties - Energy efficiency using various materials - emerging new materials Construction techniques- Techniques for roof, wall and foundations.

UNIT V ECONOMY OF GREEN BUILDING 9 hours

Cost of building - operation and maintenance - Green building rating system - Evaluation criteria of LEED - TERI GRIHA case studies - Case studies in different climate zones.

Course Outcomes:

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

1. Use various regulations and by laws for green building construction0.
2. Do site planning for Green Building.
3. Compute thermal flow through different building elements
4. Identify energy efficient building materials
5. Compute cost of building/operation and maintenance

Text Books:

1. Krishnan, A., Baker, N., Yannas, S., & Szokolay, S. (Eds.). (2001). Climate responsive architecture, a design handbook for energy efficient buildings. New Delhi: Tata McGraw- Hill Publishing Company.
2. TERI & ICAEN (InstitutCatalad'Energia). (2004). Sustainable building design manual (Vol. II). New Delhi: The Energy and Resources Institute(TERI) Press.

Reference Books

1. Bureau of Indian Standards. (1995). SP:41, Handbook on functional requirements of buildings (other than industrial buildings) (First reprint ed.). New Delhi: Bureau of Indian Standards.
2. Indian Green Building Council, LEED-India. (2011). LEED 2011 for India- Green building rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council.
3. Koenigsberger, O., ingersoll, T. G., Mayhew, A., & Skozolay, S. V. (2011). Manual of Tropical Housing and Building. Hyderabad: Universities Press.
4. Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan. Building Design and Drawing. Calicut: Spades Publishers, 2008.
5. Szokolay, S. V. (2008). Introduction to Architectural Science - The Basis of sustainable Design (Second ed.). Architectural Press/Elsevier.
6. The Energy and Resources Institute (TERI). (2011). Green Rating for Integrated Habitat Assessment (GRIHA) manual. New Delhi: TERI press.
7. Journals: Energy and Buildings, Building and Environment, Other relevant publications.
8. National Building Code, Bureau of Indian Standards: New Delhi. 2005; Building Bye laws and building rules of selected Indian urban and rural areas
9. Swamy, N. K., & Rao, A. K. (2013). Building planning and Drawing,New Delhi, CharotharPublishing House

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - IV

20CE305 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

The course covers demand, quality and treatment of water along with characterization, water and wastewater treatment plant units and design , low cost treatment of wastewater and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included. Further the course also covers basic laboratory

Course Objectives:

1. To explain different sources of water, water quality standards, water demands, distribution of water, population forecast, characteristics of water.
2. To analyze various water treatment plant units and their design considerations, advanced water treatment systems.
3. To explain the generation and collection of wastewater; wastewater treatment plant design, various wastewater treatment units and sludge treatment.
4. To explain various impacts of air and noise pollution and various methods to control them air and noise pollution
5. To describe about solid waste generation, characterization, impacts and various management techniques

UNIT I WATER SUPPLY ENGINEERING 9 hours

Water- Sources of Water, Water quality standards, Quantity of water: water demands, percapita demand, design period, population forecast, fluctuation in demand. General requirement for water supply: Sources, Types of intakes, Pumping and distribution of water; Quality of water: Physical, chemical, and biological characteristics of water and significance, necessity of treatment, water quality standards for various water uses.

UNIT II WATER TREATMENT 9 hours

Engineering system for water purification: Aeration, Screening, Coagulation and Flocculation, Sedimentation, Softening, Filtration, Disinfection; Methods of treatment: Removal of color, tastes and odor control, removal of iron and manganese, fluoridation and defluorination. Advanced water treatment: Ion exchange, electro-dialysis, RO (principles only.

UNIT III WASTEWATER TREATMENT 9 hours

Generation and collection of wastewaters- sanitary, storm and combined sewerage systems, quantities of sanitary wastes and storm water, design of sewerage system. Engineered system for wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation. Secondary treatment: Basis of microbiology, Growth and food utilization, Suspended growth systems, Attached growth systems, Secondary clarification, Disinfections of effluents; Sludge treatment and disposal: Sludge characteristics, thickening, disposal.

UNIT IV AIR AND NOISE POLLUTION 9 hours

Air - Composition and properties of air, urban air pollution, Air quality standards, Measures and major equipment for air pollution control, Noise - Basic concept, measurement, and various noise control methods.

UNIT V SOLID WASTE MANAGEMENT 9 hours

Solid waste management-Municipal solid waste, Composition, and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment, and disposal of MSW. Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle, Disposal methods.

Course Outcomes:

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

1. Estimate water demand and population forecasting and characteristics of water
2. Estimate water generation and perform basic design of the unit operations that are used in water treatment plants.
3. Explain various wastewater generation sources and different units of wastewater treatment and sludge treatment techniques
4. Describe the impacts of air and noise pollution and review various air and noise pollution control methods
5. Discuss about the impacts of solid waste and various solid waste management techniques

Text Books:

1. Environmenatal Engineering (Volume I & II) by S. K. Garg-Khanna Publishers.
2. Rao M and Rao H. V. N. Air Pollution, McGraw Hill Education, 2017.
3. Jagbir Singh and Ramanathan A. L., Solid Waste Management: Present and Future Challenges, I K International Publishing House Pvt. Ltd., 2009
4. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.

Reference Books

1. Birdie, G.S, Birdie, J.S., Water supply and sanitary Engineering, Including Environmental Engineering, Water and Air Pollution Laws and Ecology, Dhanpat Rai Publications, 1996.
2. Punmia, B.C, Ashok Kr Jain, Arun Kr Jain., Waste Water Engineering, Laxmi Publications, 1998.
3. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
4. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective - IV

20ME303 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees for the improvement of processes and products. TQM encompasses various principles, techniques, and tools for identifying and solving problems, fostering a culture of quality, promoting teamwork, and striving for excellence in all areas of the organization. The goal of TQM is to achieve sustainable and long-term success by consistently delivering high-quality products and services that meet or exceed customer expectations while improving overall organizational performance.

Course Objectives:

Students will

1. Study comprehensive knowledge about the principles, practices, tools and techniques of total quality management.
2. Gain knowledge on leadership, customer satisfaction, addressing customer complaints, team work, employee involvement, related to customer and supplier partnership.
3. Gather information on various tools and techniques, concept on Six Sigma, bench marking and Failure Mode Effective Analysis (FMEA).
4. Know the importance of Quality circle, Quality Function Deployment, Taguchi design and case studies related to TQM.
5. Facilitate the understanding of standards of quality.

UNIT I INTRODUCTION 9 hours

Introduction - Evolution of Quality - Historical Perspective, Basic Concepts of Quality – Quality control, Quality management and Quality Assurance - Definition of TQM – Basic concepts of TQM - TQM Framework - Contributions by Deming, Juran, Crosby and Feigenbaum – Dimensions of product and service quality

UNIT II TQM PRINCIPLES 9 hours

TQM principles - Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Role of Leadership and Commitment in Quality Deployment, Team Building, Motivation and Rewards, Total Employee Empowerment, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection,

UNIT III TOOLS OF TQM 9 hours

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – KAIZEN, 5S, JIT, Documentation – Failure mode and Effect Analysis (FMEA)

UNIT IV TQM TECHNIQUES 9 hours

Quality circles – Quality Function Deployment (QFD) – House of Quality – Design of Experiments – Taguchi quality engineering – Orthogonal Arrays – Signal to Noise Ratio – TPM – Concepts, improvement needs – Cost of Quality – Performance measures

UNIT V IMPELMENTATION OF TQM 9 hours

Introduction – Benefits of ISO Registration – ISO 9000 Series of Standards –Implementation – Environmental Management System: Introduction – ISO 14000 Series Standards – Concepts of ISO 14001 – Requirements of ISO 14001, Case studies on TQM principles followed by Indian Industries.

Course Outcomes:

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

1. Understand the various principles and practices of TQM to achieve quality.
2. Identify the various statistical approaches for Total Quality Control.
3. Demonstrate the TQM tools for continuous process improvement.
4. Adopt the importance of ISO and Quality systems.
5. Make use of the concepts of TQM to solve case studies

Text Books:

1. Dale H. Besterfield, et al., Total Quality Management, Pearson Education Asia, Third Edition, Indian Reprint (2003).

Reference Books

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, (6th Edition), South-Western (Thomson Learning), 2005.

2. Oakland, J.S. TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).

3. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd. (2006) Model.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – IV

20ME304 ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course is designed to ignite the entrepreneurship idea into the young minds of engineers. This course gives the complete details to setup an enterprise which includes the generating business ideas, writing business plan and executing the plan successfully.

Course Objectives:
1. Understand the requirements of entrepreneurship as a profession.
2. Understand and develop the business plan.
3. Identify the various financial terms and conditions of new business venture.
4. Selection of plant location and choosing layout.
5. Analyse the market research for new ventures and small businesses.

UNIT I INTRODUCTION 9 hours

Introduction to Entrepreneurship, history of entrepreneurship development, social Entrepreneurship, Intrapreneurship, Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision processes. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. Realities & Case studies about successful Entrepreneur

UNIT II CREATING AND STARTING THE VENTURE 9 hours

Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, implementation of business plans. Case studies of successful business plan, Marketing plan, financial plan, and organizational plan, Launching formalities. Developing business plan and evaluation with team.

UNIT III FINANCING AND MANAGING THE NEW VENTURE 9 hours

Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. Ecommerce and Entrepreneurship, Internet advertising. New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Case studies about entrepreneur who success or failure in their business based on the financial control

UNIT IV PLANT LAYOUT 9 hours

Definition of plant layout and its types, Issues related to Selection of layout. Production and Marketing Management, Selection of production Techniques, plant utilization and maintenance. Case study about selection of site and plant layout for new business venture.

UNIT V MARKET ANALYSIS AND PROJECT MANAGEMENT 9 hours

Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Case studies on market analysis on entrepreneur perspective. Project Organization- Project Planning, Monitoring, Control and Learning. Detailed life cycle and post-mortem analysis, Resource allocation, Risk and uncertainty, Budget constraints, Project feasibility.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

Upon completion of this course the students shall be able to:

1. Describe the sources of new business ideas, methods to develop new ideas and use the problem-solving techniques.
2. Write a business plan which includes financial plan, organizational plan and marketing plan.
3. Identify the financial sources for new business ventures.
4. Select a plant layout and draw a plant layout.
5. Design a workplace and analyse the market research for new business.

Text Books:

1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

Reference Books

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publ. House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech Computer Science & Engineering (Data Science)

Open Elective – IV

20EEE303 ROBOTICS

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:

Robotics is an interdisciplinary area ranging from mechanical & electrical component design to advanced sensor technology, incorporating computer systems and Artificial Intelligence (AI). With advances in AI-techniques & computational power in recent years, it has become one of the most interesting areas for multidisciplinary research, with lots of commercial applications already in market.

Course Objectives:

This course enables students to

1. To know the fundamentals of Robotics & its applications.
2. To make students capable of handling robot manipulator tasks in real, as well as in simulation environment.
3. To know about kinetic and Jacobian modeling.
4. To know about sensors and actuators.

UNIT I INTRODUCTION, TRANSFORMATION AND MAPPING 9 hours

Evolution of Robots and Robotics, Laws of Robotics, Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Robotic Programming and Future Prospects.

Coordinate Frames, Object Description in Space, Transformation of Vectors, Inverting a homogenous transform, Fundamental Rotation Matrices.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9 hours

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers.

Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9 hours

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors, binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS 9 hours

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems.

UNIT V ROBOT PROGRAMMING, IMPLEMENTATION AND ECONOMICS **9 hours**

Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs. RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Course Outcomes:

After completing this Unit, students will be able to

- **1**. Understand the fundamentals of Robotics.
- **2.** Analyze the mechanical structure and notations kinematic model.
- **3**. Analyze the jacobian and dynamic modeling.
- **4**. Explain the robot manipulator control and path planning.
- **5**. Describe the various sensors and actuators.

Text Book(s)

1. Mittal, R. K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.

2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547

Reference Books

1. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, 1988.

2. Craig, J.J., Introduction to Robotics: Mechanism & Control. Addison Wesley, 1986.

3. Paul, R.P., Robot Manipulator: Mathematics Programming & Control. MIT Press, 1981.

4. Pugh, A., Robot Sensors, Vision Vol.-I. Springer Verlag, 1986.

5. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill,

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Open Elective – IV

20EEE304 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Pre-requisite Nil 20EEE101

Course Description:

To provide a comprehensive exposure to electrical hazards, various grounding techniques, safety procedures and various electrical maintenance techniques.

Course Objectives:

This course enables students to

1. To impart knowledge on electrical hazards and safety equipment.
2. To analyze and apply various grounding and bonding techniques.
3. To select appropriate safety method for low, medium and high voltage equipment.
4. To understand how to participate in a safety team.
5. To carry out proper maintenance of electrical equipment by understanding various standards.

UNIT I ELECTRICAL HAZARDS 9 hours

Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, Classification of insulating materials, locking devices- voltage measuring instruments- proximity and contact testers-safety electrical one-line diagram-electrician's safety kit.

UNIT II GROUNDING AND BONDING 9 hours

General requirements for grounding and bonding- definitions- grounding of electrical equipment-bonding of electrically conducting materials and other equipment- connection of grounding and bonding equipment- system grounding- purpose of system grounding- grounding electrode system-grounding conductor connection to electrodes-use of grounded circuit conductor for grounding equipment- grounding of low voltage and high voltage systems Ground resistance measurement using megger.

UNIT III SAFETY METHODS 9 hours

The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system- lockout-tag out- flash hazard calculation and approach distances- calculating the required level of arc protection-safety equipment, procedure for low, medium and high voltage systems- the one minute safety audit.

UNIT IV SAFETY TEAM 9 hours

Electrical safety programme structure, development- company safety team- safety policy-programme implementation- employee electrical safety teams- safety meetings- safety audit-accident prevention-first aid- rescue techniques-accident investigation.

UNIT V MAINTENANCE OF ELECTRICAL EQUIPMENT 9 hours

Safety related case for electrical maintenance- reliability centred maintenance (RCM) - eight-step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- Indian standard for electrical safety in work place- occupational safety and health administration standards.

Course Outcomes:

After completing this Unit, students will be able to

1. Understand various types of dielectric materials, their properties in various conditions.
2. Analyze and apply various grounding and bonding techniques.
3. Select appropriate safety method for low, medium and high voltage equipment.
4. Participate in a safety team.
5. Carry out proper maintenance of electrical equipment by understanding various standards**.**

Text Book(s)

1. Dennis Neitzel, Al Winfield, 'Electrical Safety Handbook', McGraw-Hill Education, 4th Edition,2012.

Reference Books

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.

2. The Institution of Electric Engineers, 1994.

3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.

4. Tareev, 'Electrical Engineering Materials', Verlag Technik, Berlin

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Open Elective – IV

20ECE303 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
The course will provide strong foundation on embedded system design. The course covers theory and logic to develop programming expertise. Student will understand application of embedded microcontrollers ARM.

Course Objectives:
This course enables students to

1. To provide knowledge on the basics, building blocks of Embedded System.
2. To provide basic of operating system and Real time programming languages
3. To teach automation using scheduling algorithms and Real time operating system.
4. To understand firmware design and Architectural Support for Operating Systems for various applications
5. To discuss on different Phases & Modeling of a new embedded product.

UNIT I THE CONCEPT OF EMBEDDED SYSTEMS 9 hours

Embedded System Design, Introduction to Embedded Hardware Elements, Sensors and Actuators, Embedded Processors, Memory Architectures. Embedded System vs. General Purpose computing systems, Examples of embedded systems, Embedded memories, Embedded microcontroller cores

UNIT II SOFTWARE ASPECTS OF EMBEDDED SYSTEMS – I 9 hours

Operating System Basics, types of Operating Systems, Task and Task States, Semaphores and shared Data, RTOS services and design using RTOS, Tasks, Process and Threads, Multiprocessing and Multitasking, Real time programming languages.

UNIT III SOFTWARE ASPECTS OF EMBEDDED SYSTEMS- II 9 hours

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication Synchronization Issues, Task Synchronization Techniques, Device Drivers, how to Choose an RTOS, Integrated Development Environment (IDE).

UNIT IV FIRMWARE AND ARCHITECTURAL SUPPORT FOR OPERATING SYSTEMS 9 hours

Firmware and Bootloader, an introduction to operating systems, The ARM system control coprocessor Embedded ARM Applications, CP15 protection unit registers, CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/Output, Example and exercises, The ARM7500 and ARM7500FE.

UNIT V MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES 9 hours

Modelling embedded systems- embedded software development approach -Overview of UML modelling with UML, UML Diagrams-Hardware/Software Partitioning, Co-Design Approaches for System Specification and modelling- Co-Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures-design approach on parallelism in uniprocessors & Multiprocessors.

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Course Outcomes:

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

1. To understand the functionalities of processor internal blocks, with their requirement
2. Understand the basics of operating systems and then to learn the programming language used for real time operating system.
3. systems and related terms.
4. Understand the role and features of RT operating system, that makes multitask execution possible by processors.
5. Understand that using multiple CPU based on either hard-core or softcore helps data overhead management with processing.

Text Book(s)

1. M.A. Mazdi & J.G. Mazdi, The 8051 Microcontroller and Embedded System, Pearson Education India , 2013
2. Andrew N. Sloss & Dominic Symes, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaufmann Publisher, 2004.

Reference Books

1. Steve Furber, Arm System-On-Chip Architecture, 2000.
2. J.K. Peckol, Embedded Systems A contemporary Design Tool, Wiley Student Edition , 2008
3. K J Ayala, The 8051 Microcontroller Architecture, Programming and Application, Penram International Publishing (India)
4. S. Heath, Embedded Systems Design, Elsevier, 2009

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Open Elective – IV

20ECE304 DSP ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite 20ECE110

Course Description:

The course will provide an insight into the architectures of DSP processors for handling the bottlenecks in executing DSP algorithms. On the application side the students can develop FPGA based DSP Systems and can understand the concept of multicore DSP as HPC infrastructure

Course Objectives:

This course enables students to

1. Understand the programmable digital signal processing hardware.
2. study the architecture of TMS320CX processor and block diagram
3. Know syntax and write the assembly language programming for digital signal processors.
4. Study the architecture of FPGA based DSP for various applications.
5. Study about High-Performance Computing using P-DSP.

UNIT I PROGRAMMABLE DSP HARDWARE 9 hours

Introduction: Digital signal-processing system, discrete Fourier Transform (DFT) and fast Fourier transform (FFT), differences between DSP and other microprocessor architectures. Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating-Point Computations, Special Architectures, Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

UNIT II STRUCTURAL AND ARCHITECTURAL CONSIDERATIONS 9 hours

Parallelism in DSP processing, Commercial digital Signal-processing Devices, Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, Data Addressing Modes of TMS32OC54xx., TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

UNIT III VLIW ARCHITECTURE 9 hours

Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Optimizations, Heuristics. Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple application developments as an embedded environment.

UNIT IV FPGA BASED DSP SYSTEMS 9 hours

Limitations of P-DSPs, FPGA based signal processing design-case study of a complete design of DSP processor.

UNIT V HIGH PERFORMANCE COMPUTING USING P-DSP 9 hours

Modified bus structures and memory access in PDSPs, special addressing modes in PDSPs, Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

After completing this Unit, students will be able to
1. Identify and formalize architectural level characterization of DSP hardware.
2. Design and test various digital signal processors.
3. Write assembly language programming for various digital signal processors.
4. Utilize FPGA based DSP hardware for Control, Audio and Video Signal processing applications.
5. Understand the High-Performance Computing using P-DSP.

Text Book(s)

1. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Applications", Tata McGraw-Hill Education Private Limited, 2011.

2. Phil Lapsley; Jeff Bier; Amit Shoham; Edward A. Lee, "DSP Processor Fundamentals: Architectures and Features", Wiley-IEEE Press, 1997.

Reference Books

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A practical approach", Pearson-Education, PHI, 2002.

2. Sen M. Kuo, Woon-Seng S. Gan, "Digital Signal Processors: Architectures, Implementations, And Applications", Pearson/Prentice Hall, 2005.

3. Peter Pirsch, "Architectures for Digital Signal Processing", John Wiley & Sons, 2009

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Open Elective – IV

20ECE305 COMMUNITY RADIO TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite

Course Description:

This course offers a comprehensive exploration of Community Radio, from foundational concepts to practical implementation. It begins with an introduction to the principles of Community Radio and guides students through the process of establishing a Community Radio Station (CRS). Key topics include Studio Technology, Operations and Management along with detailed instruction in Audio Pre-Production and Post-production techniques. Students will also gain essential knowledge of Radio Transmission technology, including the setup of an FM transmitter. By the end of the course, students will have a thorough understanding of Community Radio principles and the Practical skills required to effectively operate a Community Radio station.

Course Objectives:

This course enables students to

1. Associate the concept of fundamentals in Community Radio in Local Communication and development.
2. Gain knowledge of Studio technology and operations including Soundboards, Microphones, Recording, scheduling, content creation, and team coordination.
3. Develop skills in Audio Pre-production and post-production such as recording, editing, and mixing audio content.
4. Categorize the Radio Transmission Technology comprising signal requirements aligning with factors affecting Coverage and Shadow Areas.
5. Explore Radio Transmission technology essentials and understand the technical aspects of setting up and maintaining an FM transmitter.

UNIT I COMMUNITY RADIO FUNDAMENTALS AND SETUP 9 hours

Introduction to Radio Broadcasting in India - Community Radio: Evolution - Community Radio Policy – Technical principles; Components of a CR Station - Radio Waves and Spectrum - Basics of Electricity - Power Backup and Voltage Stabilization

UNIT II STUDIO TECHNOLOGY & OPERATIONAL PRACTICES 9 hours

Basics of Sound - Analog and Digital Audio - Components of the Audio Chain - Studio Acoustics; Good Engineering Practices for Studio Setup - Studio Equipment: Preventive & Corrective Maintenance - Content Distribution: Alternative Mechanisms

UNIT III AUDIO PRE & POST PRODUCTION 9 hours

Audio Hardware and Field Recording – Microphones - Audio Cables and Connectors - Free and Open-Source Software - Telephony for Radio - Landline Systems - GSM/CDMA - Voice Over Internet Protocol (VoIP); Sound Recording and Editing - Mixing and Mastering - File Formats and Compression Transmission - Storing and Retrieval

UNIT IV RADIO TRANSMISSION TECHNOLOGY 9 hours

Transmission Chain Overview – Live and Pre-recorded Transmission - Principles of FM Transmission – FM Transmitter console- Antenna System - Types of Mast/Towers - Layers of Atmosphere and Radio Wave Propagation - Factors Affecting Coverage and Shadow Areas - Signal Requirements and Coverage Planning Parameters

UNIT V FM TRANSMITTER SETUP 9 hours

Connecting Audio Feed to the Transmitter - Back Panel Connectors - Mounting and Connecting the Transmitter - Probable Causes of Failure of Transmitters - Fault Diagnostics and Corrective Maintenance - Transmitter Operation and Upkeep Issues

Course Outcomes:

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

1. Interpret the evolution with a framework of Community Radio with Technical Principles and essential Radio Spectrums.
2. Apply Studio Technology and Operational practices with the components of the Audio Chain including Acoustics and Equipment maintenance.
3. Conduct Comprehensive Audio Pre & Post-production to operate field Recordings with Hardware and Open-source software to manage sound recording, editing, mixing, mastering, and file compression.
4. Infer the principles of FM transmission, Antenna systems, Radio wave propagation and factors affecting coverage.
5. Demonstrate knowledge of the connecting audio feeds for Transmitter setup by resolving operational Issues with corrective maintenance.

Text Book(s)

1. Pooja Murada R. Sreedher, “Community Radio in India”, Aakar Books, 2019.
2. Prof. Raj Misra , “Community Radio By the people, For the People”, Orange Books Publication, 2022
   Fraser, Colin, and Sonia Restrepo Estrada, “Community radio handbook”. Paris: Unesco, 2001.

Reference Books

1. Juliet Fox, “Community Radio’s Amplification of Communication for Social Change”, 7th Edition, Palgrave Macmillan (Springer International Publishing.), 2019.
2. Kanchan K. Malik, Vinod Pavarala, “Community Radio in South Asia: Reclaiming the Airwaves”, Routledge India, 2020.
3. Vinod Pavarala and Kanchan K. Malik, “Other voices: the struggle for community radio in India”,Sage Publications India Pvt Ltd, 2007.
4. Michael C. Keith, “The Radio Station: Broadcast, Satellite & Internet”, 7th Edition, Focal Press (Elsevier Inc.), 2007.
5. “Certificate in Community Radio Technology (CCRT)” https://www.cemca.org/resources/certificate-community-radio-technology-ccrt-0

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - V

B. Tech Computer Science & Engineering (Data Science)

Open Elective - V

20HUM301 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

The course provides students with a practical and concrete explanation of management concepts and techniques they will need to manage today's and tomorrow's organizations. The course will follow the "planning, organizing, leading, controlling" format of managerial functions while putting together many small pictures presented by individual modules into one bigger meaningful picture in which managerial knowledge would apply. At the end of the course students are expected to understand role of components of bigger picture and interactions between and among components.

Course Objectives:

The course is intended to:

1. Describe the concepts of Management theories, approaches and their application with organizations around us;

2. Know the concepts of planning and management;

3. Explain the basic concepts of organization, types and structure of organization;

4. Make the students know leading, good communication, theories of motivation; and

5. Explain controlling, operations management, value chain management and management audit.

UNIT I INTRODUCTION 9 hours

Introduction to Management and Organizations- Management definition, skills, roles, goals and functions of a manager, organization, value of studying management - Managing in a Global Environment- Global Perspective, Understanding global environment, - Social Responsibility and Managerial Ethics.

UNIT II PLANNING 9 hours

Decision-making process, Types of decisions and decision making conditions, styles, biases and errors, Planning: Meaning of planning, establishing goals and developing plans, contemporary issues in planning - Strategic Management-Importance of strategic management, strategic management process, types of organizational strategies, current issues in strategic management.

UNIT III ORGANIZING 9 hours

Organizational structures - HRM process, Contemporary issues in HRM – Departmentation – decentralization – delegation of Authority - Managing Change and Innovations.

UNIT IV COMMUNICATION, MOTIVATION AND LEADING 9 hours

Functions of communication, Inter-personal communication, Barriers of Communication – Understanding Information Technology- Motivation**:** Theories of motivation and current issues in motivation. Leading: Leaders and Leadership, Leadership theories - Leadership issues in twenty first century

UNIT V CONTROLLING 9 hours

Process of Control – Problems of Control Process-Types of Control – Techniques of Control-Essential conditions for effective control- Contemporary issues in control – Strategic role of Operations Management - Value Chain Management.

Management Audit: Objectives-Importance-Activities of Management Auditor.

Course Outcomes:

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

1. Understand the various concepts, approaches and theories of management in the real situation,

2. Analyze the concept of planning and apply on the decisions in strategic management,

3. Compare organization structure designs and chart diligently with theoretical learning concepts,

4. Apply communication and theories of motivation in an organization, and

5. Understand various tools for controlling organizational performance, management audit and apply to achieve the corporate objectives.

Text Book(s)

1. Stephen P. Robbins, Mary Coulter "Management", Pearson Education, 2010, 10th edition.

2. P. Subba Rao "Management and Organizational Behavior", Himalaya Publishing House.

Reference Books

1. Gary Dessler, "Management", Prentice Hall, Inc., 1998, 1st edition.

2 Daft Richard L. 'Management' Thomson South Western, 5th edition.

3 Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int. ed., 2004, 6th edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Open Elective - V

20HUM302 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:
The course content includes: Introduction to HRM, strategic human resource challenges, work flows, job analysis, managing diversity, concepts, goals, mechanism and system of HRD, recruitment and selection, downsizing and outplacement, appraising and managing employee performance, training, career development, managing compensation, rewarding performance, designing benefit plans, employee relation and employee discipline, and workplace safety and health.

Course Objectives:
The course is intended to:
1. Explain the nature and scope of HRM, its functions, policies and strategies;
2. Describe the human resource planning, work analysis and importance in designing jobs;
3. Know the recruitment, selection and the process of performance appraisal;
4. Make the student to learn about training and development, compensation management and
5. Explain the trade unions, industrial relations and grievance.

UNIT I INTRODUCTION 9 hours

Understanding the nature and scope of Human Resource Management- Definition, Evolution of HRD, Functions - objectives, organization of department. Human Resource Management v/s Personnel Management, Role and responsibility of HRM.

UNIT II HUMAN RESOURCE PLANNING 9 hours

Human Resource Planning- Factors affecting HRP, the planning process, managerial succession planning. Job Analysis, Methods of collecting job data, Competency based Job Analysis, Job design approach, contemporary issues in Job Description.

UNIT III RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL 9 hours

Recruiting and selecting employees-, Selection process, Barriers, selection in India. Performance Management, Process of Performance Appraisal, Methods of Performance Appraisal - Errors in Performance Appraisal.

UNIT IV TRAINING AND DEVELOPMENT 9 hours

Meaning – importance and benefits of Training and Development, Training v/s Development – Training Methods - challenges in training - Career development: Definition-objectives—importance of career development – Reward Management – Compensation Management: Nature-Objectives-Components of Compensation- Theories of Compensation-Factors influencing employee compensation.

UNIT V INDUSTRIAL RELATIONS, TRADE UNIONS 9 hours

Trade Unions: Importance-Objectives- Functions and Structure of the Trade Unions- Trade Union movement in India- Industrial Relations: Nature--Importance- Approaches-essential conditions for sound IR. Industrial Disputes: Meaning – Types- Causes-Industrial disputes settlement machinery. Grievance: Sources and Process of Redressal,

Course Outcomes:

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

1. Understand the concept of HRM, its nature, scope, functions, policies and strategies;
2. Analyse human resource planning and apply in designing jobs;
3. Evaluate the recruitment, selection and the process of performance appraisal;
4. Understand the importance of training and development activities, compensation management and
5. Examine the trade unions, industrial relations and grievance.

Text Book(s)

1. Aswathappa K., Human Resource Management- Text and Cases, Tata McGraw Hill, 6th Edition, 2010
2. Gomez-Mejia, L.R., Balkin, D.B., & Cardy, R.L. Managing Human Resource Management 6th edition, Pearson Edu. 2007.
3 VSP Rao, Human Resource Management-Text & Cases, Excel Books.

Reference Books

1. Garry Dessler, BijuVarkkey , Human Resource Management ,11th Edition, Pearson Education, 2009.
2 R. Wayne Mondy, Human Resource Management, 10th Edition, 2010
Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Open Elective - V

20HUM303 SOFT SKILLS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

Soft skills are the personal attributes that make a student a valuable employee and a wholesome personality. They include aspects like communication, teamwork, problem-solving, and time management. Employers are increasingly looking for employees with strong soft skills, as they are essential for success in the workplace. This course will help students analyze themselves and build soft skills needed for their personal and career success.

Course Objectives:

The course is intended to:

1. Analyze their strengths and skills, and build confidence in presenting themselves
2. Work seamlessly as a team and negotiate for solutions
3. Think laterally and critically to evaluate a situation and present it with clarity
4. Write business emails effectively
5. Prepare holistically for a job interview

UNIT I SELF ANALYSIS AND DEVELOPMENT 10 hours

Personal ethics (politeness, empathy, and honesty); self-motivation / building confidence and assertiveness; identifying one's unique selling points (USPs) through skills introspection and recognizing strengths and weaknesses; nurturing strengths and fixing weaknesses; self-introduction.

UNIT II TEAM WORKING AND DYNAMICS 12 hours

Brainstorming techniques, team building, collaboration, and negotiation skills; team role plays (involving negotiation and decision making); group discussion etiquette (greetings and body language), idea generation, and common GD phrases; group discussion practice

UNIT III THINKING AND REASONING SKILLS 6 hours

Lateral thinking, critical thinking and logical reasoning through texts, images, and videos; Speaking activities (e.g. JAM) involving lateral thinking and reasoning through thought-provoking pictures, videos, cartoons, comic strips or articles.

UNIT IV PRESENTATION SKILLS 7 hours

Presentation etiquette; slides design; and presentation practice.

UNIT V INTERVIEW SKILLS 10 hours

Preparing resume and cover letter for job interviews; interview etiquette: dress code, body language, tone, and greeting; HR interviews: answering common interview questions, practice for HR interviews.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Understand and express themselves with confidence
2. Work as an active team member
3. Think and express their views logically and speak on varied topics without hesitations.
4. Prepare business presentations and emails effectively
5. Attend job interviews with confidence

Text Book(s)

1. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.

2. Archana Ram, PlaceMentor, 2018, Oxford University Press

Reference Books

1. Karen Kindrachuk, Introspection, 2010, 1st Edition

2 Karen Hough, The Improvisation Edge: Secrets to Building Trust and Radical Collaboration at work, 2011, Berrett-Koehler Publishers

3. Colin Swatridge, Oxford Guide to Effective Argument and Critical Thinking 1st Edition, Oxford University Press

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Open Elective - V

20HUM304 NATIONAL CADET CORPS

L	T	P	C
3	0	0	3

Pre-requisite: NCC B-Certificate

Course Description:

The main aim of this course is to mould the youth into responsible citizens of the nation. It helps to improve character and leadership qualities towards nation building. This course also motivates the youth to offer Selfless service to the society and nation. The course comprises Common subjects, Service subjects of NCC, societal aspects and basic organization of Indian Armed Forces.

Course Objectives:

This course enables the student to –

1. Get aware of NCC organization and general structure of Defence Forces.
2. Learn leadership and national integration.
3. Motivate towards to maintain Health and hygiene, personality development.
4. Learn elementary characteristics of disaster management, Field craft and Battle craft.
5. Acknowledge the Social activities, Communication and Military History.

UNIT I **10 hours**

INTRODUCTION TO NCC

Introduction, History of NCC , NCC Motto, NCC Flag, Aims of NCC, Cardinal points of NCC, Organization of defence forces in general, Organizational structure of Indian Army(Armed forces), Organizational structure of NCC, NCC Song, Incentives of NCC, Ranks in Army, Navy and Air Force, current representatives – Certificate Examination in NCC– Honours and Awards.

FOOT DRILL BASICS

Aims of Drill, Word of Commands, Attention, Stand at Ease, Turning Left, Right and Inclining at the Halt. Sizing, Forming up in three Ranks and Numbering, Open and Close March Order, Dressing the Squad, Saluting at the Halt, Getting on Parade, Falling Out and Dismissing, Marching, Guard of Honour.

UNIT II **10 hours**

LEADERSHIP

Meaning, Leadership Traits, Types of Leadership, Discipline & Duty of an Indian Citizen, Motivation, Code of Ethics, Perception, Communication, Customs of Services, Importance of Team Work, leaders(swami Vivekananda).

NATIONAL INTEGRATION

Meaning and Importance, Unity in Diversity, Indian History and Culture, Religion and Customs of India, India and its Neighbours, Contribution of Youth in Nation Building, Contribution of leaders in nation unification .

UNIT III **12 hours**

HEALTH AND HYGIENE

Structure and Function of Human Body, Hygiene and Sanitation, Preventable Diseases, First Aid, Yoga: Introduction and Exercises, Physical and Mental Health, Fractures: Types and Treatment.

PERSONALITY DEVELOPMENT

Introduction to personality development, Physical and social factors influencing / shaping personality, psychological and philosophical factors influencing / shaping personality, Self-awareness, SWOT analysis, mind set, interpersonal relationship and communication, effective communication, barriers of communication.

B. Tech Computer Science & Engineering (Data Science)

ENVIRONMENT AND ECOLOGY

Environment: Meaning, Global Warming, Acid Rain, Depletion of Ozone Layer, Conservation of Environment. Ecology: Introduction, Component of Ecological System, Forest Ecology, Wild Life, Pollution Control.

UNIT IV **10 hours**

DEFENCE AND DISASTER MANAGEMENT

Civil Defence: Meaning, Organization and its Duties, Civil Defence Services, Fire Fighting : Meaning, Mode of Fire, Fire Fighting Parties, Fire Fighting Equipment. Introduction, Classification of Disaster: Natural Disaster & Man Made Disaster, Disaster Management During Flood, Cyclone and Earth Quake, Assistance in Removal of Debris, Collection and Distribution of Aid Material, Message Services.

SOCIAL SERVICE ACTIVITIES (Social Service And Community Development)

Basics of Social Service, Weaker Sections in the Society and its Identification, Contribution of Youth towards Social Welfare, NGOs and their Role and Contribution , Social Evils, Drug Abuse, Family Planning, Corruption, Counter Terrorism, Eradication of Illiteracy – Aids Awareness programme – Cancer Awareness Programme.

UNIT V **10 hours**

COMMUNICATION

Types of communication, characteristics of wireless technology, Walkie/talkie, Basic RT procedure, Latest trends and development(Multimedia, video conferencing, IT)

MILITARY HISTORY

Biography of Indian Historical Leaders: Chatrapati Shivaji, Maharana Pratap, Akbar Famous Battles / Wars of India: Indo – Pak War 1971(all wars), Kargil War.(Categorise: before/ After independence)
Biography of Successful Leaders: General Patton, General Mac. Arthur, Field Marshal Sam Maneksha.

Course Outcomes:

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

1. Analyse the NCC structure and different ranks in Indian Armed Forces along with foot drill.
2. Notify the leadership traits and the need of national integrity towards nation building.
3. Instill respect and responsibility towards personal health and hygiene, develop dynamic personality with adequate qualities.
4. Identify different disasters and judging measurements on the ground.
5. Recognise various communication devices, analyse the Military Organization.

Text Books:

1. HAND BOOK OF NCC – "SANJAY KUMAR MISHRA, MAJOR RC MISHRA", published by Kanti prakashan-2020.
2. NCC HAND BOOK - "SHASHI RANJAN & ASHISH KUMAR", published by Goodwin Publications-2021.

Reference Books:

1. NCC Hand book – "R.Gupta's", Ramesh Publishing House-2021.
2 NCC (ARMY WING)- "R.Guptas's",RPH Editorial Board-2021
3 Hand Book Of N.C.C. – "Ashok Pandey", Kanti Publications-2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Professional Elective - I

B. Tech Computer Science & Engineering (Data Science)

Professional Elective - I

20CSD401 TIME SERIES ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:
This course helps the students to gain basic knowledge on time series analysis and forecasting. It aims to provide a detailed explanation on the statistical background of time series analysis. It also enlightens the students about the time series regression analysis and ARIMA models.

Course Objectives:

1. To understand the basic concepts in time series analysis
2. Understand the use of time series models for forecasting and the limitations of the methods.
3. Ability to criticize and judge time series regression models.
4. To distinguish the ARIMA modelling of stationary and nonstationary time series
5. To compare with multivariate times series and other methods of applications

UNIT I INTRODUCTION 9 hours

Introduction: Examples of Time series, Objectives, Time series Analysis models, Stationary models and the autocorrelation functions, Estimation and Elimination of Trend and Seasonal components, Testing the estimated noise sequence.

Introduction to Forecasting: nature and uses, forecasting process, data for forecasting, data warehouse, data cleaning, resources for forecasting.

Practice Time Series Data Cleaning, Loading and handling time series

UNIT II STATISTICS BACKGROUND 9 hours

Introduction: Graphical Displays, 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.

Practice Estimating & Eliminating Trend: Aggregation, Smoothing, Polynomial fitting

UNIT III TIME SERIES REGRESSION ANALYSIS 9 hours

Introduction: Least squares Estimation in Linear Regression Models, Statistical Inference in Linear Regression, Model Adequacy checking, Generalized and weighted least squares, Regression models for general time series data, Econometric models.

Exponential smoothing methods: First-order, second order.

Practice smoothing the time analysis data. Practice modelling

UNIT IV ARIMA MODELS 9 hours

Introduction: Linear models for stationary Time series, Finite order moving average processes, Finite order Autoregressive processes, Mixed Autoregressive-Moving Average Processes, Nonstationary Processes, Time series Model Building, Forecasting Arima Processes, Seasonal Processes, Arima Modeling of Bio surveillance Data, Final comments. Transfer functions and Intervention models

Practice SARIMA

UNIT V MULTIVARIATE TIME SERIES MODELS 9 hours

Multivariate Time series Models and Forecasting, State space models, Arch and Garch Models, Direct Forecasting of percentiles, neural networks and forecasting, spectral analysis, Bayesian methods in forecasting.

Practice canonical correlation analysis

Course Outcomes:

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

1. Understand time series model and stationary models.
2. Understand and analyse the approaches to time series and forecasting
3. Comprehend and differentiate the various regression model
4. Differentiate ARIMA modeling
5. Understand multivariate time series models.

Text Book(s)

1. Introduction To Time Series Analysis And Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015)
2. Peter J. Brockwell Richard A. Davis Introduction To Time Series And Forecasting

   Third Edition.(2016).

Reference Books

1. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek Pal Dr. Prakash (2017)
2. Time Series Analysis And Forecasting By Example Kulahci Technical University Of Denmark Copyright c 2011 By John Wiley & Sons, Inc. All Rights Reserved.
3. Multivariate Time Series Analysis and ApplicationsWilliam W.S. Wei Department of Statistical Science Temple University, Philadelphia, PA, SA

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective - I

20CSD402 CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

Pre-requisite 20MAT112, 20CSE111

Course Description:

This course covers the principles and practices of cryptography and network security. The fundamental topics of attacks, attack model, and few classical techniques are introduced. Symmetric and Asymmetric ciphers are illustrated. Message authentication and Hash functions are exemplified. Email, IP, and Web security techniques are described. Firewalls and intrusion detection techniques are discussed. Also, few case studies on cryptography and security are explored.

Course Objectives:

To understand the basic categories of threats to computers and networks
To learn the Symmetric and Asymmetric cryptographic algorithms.
To have knowledge about the message authentication and cryptographic Hash Functions
To learn in depth about Email and IP security.
To explore Web security threats and protection mechanisms

UNIT I INTRODUCTION TO CRYPTOGRAPHY 9 hours

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security

Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT II SYMMETRIC & ASYMMETRIC KEY CIPHERS 9 hours

Symmetric key Ciphers: Block Cipher principles &Algorithms (DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function, Traffic Confidentiality, Key distribution

Asymmetric key Ciphers: Principles of public key cryptosystems, Algorithms (RSA, Diffie-Hellman, ECC), Key Distribution

UNIT III MESSAGE AUTHENTICATION ALGORITHMS AND HASH FUNCTIONS 9 hours

Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures (Elgamal), knapsack algorithm. and Authentication Protocols.

UNIT IV EMAIL & IP-SECURITY 9 hours

Authentication Applications : Kerberos, X.509 Authentication Security, Public Key Infrastructure
E-Mail Security: Pretty Good Privacy, S/MIME
IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, combining security associations, key management.

UNIT V NETWORK SECURITY & CASE STUDIES 9 hours

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction

Intruders, Virus, and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, DDoS, Firewall design principles, Types of firewalls

Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections.

Course Outcomes:

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

1. Understand various underlying cryptography techniques and its fundamentals
2. Apply basic symmetric and asymmetric cipher techniques
3. Analyze about message, web authentication and security algorithms
4. Evaluate and construct secure network using PGP, S/MIME and key management techniques
5. Explore the threats and identify the solutions for threats by adapting intrusion detection mechanisms.

Text Book(s)

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

Reference Books

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley, India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – I

20CSD403 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

The course covers the topics include process models, software requirements, software design, software testing, software process/product metrics, quality management and UML diagrams. This course presents software engineering techniques and explains the software development life cycle, including software specification, requirement analysis, design implementation, testing and maintenance. This course covers on past and current trends in software development practices. This course is designed to cover fundamentals of Software Engineering concepts, requirement analysis, process models, design issues, modelling, testing strategies, risk strategy and quality management. The main goal of this course is to help student to build their ability to do useful applications that could be released for real-world use.

Course Objectives:

1. To make students to learn Different life cycle models.
2. To make students to learn different phases in software engineering.
3. To learn design concepts and various design models.
4. To make students to learn about testing strategies.
5. To provide better understanding of software quality and assurance techniques

UNIT I BASIC CONCEPTS OF SOFTWARE ENGINEERING & PROCESS MODEL — 9 hours

Introduction to Software Engineering: Ethics of Software engineering, Type of software, Software characteristics, Software lifecycle model, Capability Maturity Model Integration (CMMI), **Process models:** The waterfall model, Incremental process models, Spiral model, **Agile Development:** Agile Process, Other Agile process Models-Adaptive process models, Scrum, Dynamic systems development Method and Crystal.

UNIT II SOFTWARE REQUIREMENT ENGINEERING AND SYSTEM MODELS — 9 hours

Software Requirements: Functional and Non-functional requirements, User requirements, System requirements, Interface specification, and Software requirements specification (SRS). **Requirements engineering process:** Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. **System models:** Context models, Behavioral models, Data models and Object models.

UNIT III SOFTWARE DESIGN AND ENGINEERING — 9 hours

Design Engineering: Design process, Design concepts, Design model, Pattern based software design, **Object oriented analysis and design (using UML):** Class diagrams, Use case diagrams, Interaction diagrams, Activity diagrams. **Modeling component-level design:** Designing class-based components, conducting component-level design, Object constraint language, Designing conventional components. **Performing User interface design:** Golden rules, User interface analysis and design, Interface analysis.

UNIT IV SOFTWARE TESTING AND METRIC PROCESS 9 hours

Testing Strategies: A strategic approach to software testing, Test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing.

Product metrics: Software Quality, Framework for Product metrics, Metrics for analysis model, Metrics for design model, Metrics for source code, Metrics for testing, Metrics for maintenance.

Metrics for Process and Products: Software Measurement, Metrics for software quality.

UNIT V SOFTWARE QUALITY ASSUARANCE 9 hours

Software Quality: Quality concepts, Software quality assurance, Software reviews, Formal technical reviews. **Software Quality Assurance:** Statistical software quality assurance, Software reliability, The ISO 9000 quality standards, Principles of Software Process Change.

Course Outcomes:

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

1. Describe principles, concepts, and practice of software engineering.
2. Explain the methods and processes of constructing the different types of software systems.
3. Describe software design and engineering process.
4. Explain testing strategies of software projects and quality of software systems.
5. Understand project planning and quality management process.

Text Book(s)

1. C Roger S Pressman, Software Engineering: A practitioner's Approach, McGraw Hill, 9th Edition 2020.
2. Ian Sommerville, Engineering Software Products: An Introduction to Modern Software Engineering, Pearson Education, 1 st Edition 2019.

Reference Books

1. Rajib Mall, Fundamentals of Software Engineering, PHI Learning Private Limited, 4th Edition, 2014.
2. Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.
3. Waman S Jawadekar , Software Engineering: A Primer, Tata McGraw-Hill, 1 st Edition, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective I

20CSD404 WEB TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course will expose students to the techniques used in programming web pages for interactive content. The course begins by reviewing basic web technologies (HTML5, CSS3 style sheets) and exploring the use of event-driven programming in JavaScript to add interactive elements such as buttons and text fields to web pages. Next, students will use AJAX tools to build web pages that connect to servers like Google to dynamically access data (maps, search results, videos, images, etc.). Finally, the course will show students how to write their own xml code to provide access to a custom database.

Course Objectives:

1. To introduce Markup Languages for client side scripting
2. To introduce JavaScript and DOM and Java Servlets with Java
3. To introduce XML and processing of XML Data with Java
4. To introduce Server side programming with Java Servlets and JSP
5. To introduce various java web services and SOAP

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 — 9 hours

Web Essentials: Clients, Servers, and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, Embedded, and External style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT-SIDE PROGRAMMING — 9 hours

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects, - Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III SERVER-SIDE PROGRAMMING — 9 hours

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example — JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code
.

UNIT IV PHP and XML — 9 hours

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions — File handling — Cookies — Connecting to Database. XML: Basic

XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V INTRODUCTION TO AJAX and WEB SERVICES 9 hours

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics — Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

Course Outcomes:

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

1. Gain knowledge of client-side scripting, validation of forms and AJAX programming
2. Understand server-side scripting with JSP language
3. Understand what XML is and how to parse and use XML Data with Java
4. To introduce Server-side programming with Java Servlets and JSP
5. Design and implement the various Web services concepts of JAX-RPC

Text Book(s)

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

Reference Books

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, PearsonEducation,2011 .
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Fouth Edition,Pearson Education, 2008.
3. Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II,Pearson Education, 2001.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – I

20CSD405 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides the fundamental knowledge on processing images and their application areas. In this course, different image processing operations such as enhancement, filtering, segmentation and compression are presented.

Course Objectives:

1. To become familiar with digital image fundamentals
2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
3. To learn concepts of degradation function and restoration techniques.
4. To study the image segmentation and representation techniques.
5. To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS 9 hours

Image Processing Fundamentals Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT AND FILTERING 9 hours

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION 9 hours

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.

UNIT IV IMAGE SEGMENTATION 9 hours

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION 9 hours

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

Course Outcomes:

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

1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Understand the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

Text Book(s)

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson, 4th edition, 2018

2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 2nd edition, 2004.

Reference Books

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2. Murat Tekalp, Digital Video Processing, Prentice Hall, 2ndedition, 2015.
3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective - III

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – III

20CSD406 SOCIAL MEDIA ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:

The social media analytics course will enable students to grasp the analytics tools to leverage social media data. The course will introduce tools such as engagement analytics, sentiment analysis, topic modelling, and social network analysis, identification of influencers and evaluation of social media strategy.

Course Objectives:

This course enables students to

1. Describe the concept of social media.
2. Familiarize the learners with the concept of social media analytics and understand its significance.
3. Enable the learners to develop skills required for analyzing the effectiveness of social media.
4. Illustrate different tools of social media analytics.
5. Familiarize the learner with different visualization techniques for Social media analytics.

UNIT I Social Media Analytics: An Overview 9 hours

Core Characteristics of Social Media, Types of Social Media, Social media landscape, Need for Social Media Analytics (SMA), SMA in small & large organizations. Purpose of Social Media Analytics, Social Media vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Social Media Analytics Tools

UNIT II Social Network Structure, Measures & Visualization 9 hours

Basics of Social Network Structure - Nodes, Edges & Tie Describing the Networks Measures - Degree Distribution, Density, Connectivity, Centralization, Tie Strength & Trust Network Visualization - Graph Layout, Visualizing Network features, Scale Issues. Social Media Network Analytics - Common Network Terms, Common Social Media Network Types, Types of Networks, Common Network Terminologies, Network Analytics Tools

UNIT III Social Media Text, Action & Hyperlink Analytics 9 hours

Social Media Text Analytics - Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools Social Media Action Analytics - Introduction to action Analytics - Common Social Media Actions, Actions Analytics Tools Social Media Hyperlink Analytics - Types of Hyperlinks, Types of Hyperlink Analytics, Hyperlink Analytics Tools

UNIT IV Social Media Location & Search Engine Analytics 9 hours

Location Analytics - Sources of Location Data, Categories of Location Analytics, Location Analytics and Privacy Concerns, Location Analytics Tools Search Engine Analytics - Types of Search Engines, Search Engine Analytics, Search Engine Analytics Tools

UNIT V Social Information Filtering 9 hours

Social Information Filtering - Social Sharing and filtering, Automated Recommendation systems, Traditional Vs social Recommendation Systems Understanding Social Media and Business Alignment, Social Media KPI, Formulating a Social Media Strategy, Managing Social Media Risks.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Understand the concept of Social media
2. Use effective Visualization techniques to represent social media analytics.
3. Analyze the Social Media Text and hyperlinks.
4. Use different location and search engine analytics tools effectively and efficiently.
5. Devise appropriate information filtering techniques.

Text Book(s)

1. "Seven Layers of Social Media Analytics Mining" by Gohar F. Khan, Amazon Digital Services, 2015.
2. "Analyzing the Social Web" by Jennifer Golbeck, Morgan Kaufmann Publishers, 2013.
3. "Mining the Social Web" by Matthew A Russell, O'Reilly Media, 2011.

Reference Books

1. "Social Media Analytics: Techniques and Insights for Extracting Business Value Out of social media" by Matthew Ganis and Avinash Kohirkar, IBM Press, 2015.
2. "Social Media Analytics Strategy: Using Data to Optimize Business Performance" by Alex Gonçalves, APress, 1st Edition, 2017.
3. "Social Media Data Mining and Analytics" by Gabor Szabo, Gungor Polatkan, P. Oscar Boykin, Antonios Chalkiopoulos, Wiley, 1st Edition, 2018.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – III

20CSD407 INFORMATION RETRIEVAL SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite : Database Management System and Data structures and algorithms

Course Description:

This course describes the fundamental relationship between information retrieval, hypermedia architectures, and semantic models, thus deploying and testing several important retrieval models such as vector space, Boolean and query expansion. It discusses the implementation and evaluation issues of new algorithms.

Course Objectives:

This course enables students to

1. Demonstrate genesis and diversity of information retrieval situations for text and hypermedia.
2. Describe how to store, and retrieve information from www using semantic approaches.
3. Demonstrate the usage of different data/file structures in building a computational search engine.
4. Analyse the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia.
5. Analyse ranked retrieval of a very large number of documents with hyperlinks between them.

UNIT I INTRODUCTION TO INFORMATION RETRIEVAL 9 hours

Introduction: Basic concepts: The retrieval process, logical view of documents, IR: Past, present, and future. Text encoding: tokenization, stemming, stop words, phrases, index optimization, Vector space model, TF-IDF weight. Retrieval strategies: vector space model, Probabilistic retrieval strategies: Simple term weights, Non-binary independence model, Language models, Zipf's Law.

UNIT II IR MODELING 9 hours

Modeling: A Taxonomy of IR models, ad-hoc retrieval and filtering. Classic IR models: Set theoretic, algebraic, probabilistic IR models, models for browsing.

UNIT III RETRIEVAL UTILITIES 9 hours

Retrieval utilities: Relevance feedback, clustering, N-grams, Regression analysis, Thesauri. Semantic networks, parsing. Cross – Language Information Retrieval: Introduction, Crossing the Language barrier.

UNIT IV EVALUATION AND EFFICIENCY 9 hours

Evaluation**:** Performance Evaluation, Retrieval Evaluation, Evaluation measurements : Precision, Recall

Efficiency: Inverted Index, Query processing, Signature files, Duplicate document detection.

UNIT V SEARCH ENGINES 9 hours

Characterising the web, measuring and modelling the web, search engines: Centralized architecture and distributed architecture. Ranking, Crawling the web, Semantic Web

Course Outcomes:

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

1. Understand various information retrieval concepts and retrieval strategies.
2. Describe different models of IR and how to evaluate the performance.
3. Analyze various retrieval utilities.
4. Evaluate different IR models and identify the efficiency
5. Explore different search engines and its architectures

Text Book(s)

1. "Information Retrieval – Algorithms and Heuristics" by David A. Grossman, Ophir Frieder, Springer, 2nd Edition, 2004.
2. "Modern Information Retrieval: The Concepts and Technology behind Search" by R. Baeza-Yates and B. R. Neto, Addison-Wesley Educational Publishers Inc, 2nd Edition, 2010.

Reference Books

1. "Information Storage and Retrieval Systems: Theory and Implementation" by Gerald J Kowalski, Mark T Maybury, Springer, 2nd Edition, 2005.
2. "An Introduction to Information Retrieval" by Christopher D Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – III

20CSD408 NATURE INSPIRED COMPUTING FOR DATA SCIENCE

L	T	P	C
3	0	0	3

Pre-requisite: Fundamentals of AI and Machine Learning

Course Description:

Nature Computing is an interdisciplinary field that draws inspiration from natural systems to develop innovative computational techniques. This course offers an introduction to the fundamental concepts and principles of Nature Computing, exploring how nature-inspired algorithms and computational models can solve complex problems.

Course Objectives:

This course enables students to

1. Understand the philosophical foundations of Nature Computing
2. Gain knowledge of evolutionary computing techniques
3. Explore the principles of Swarm Intelligence
4. Understand the concepts of Immuno Computing
5. Discover the principles and potential applications of DNA Computing

UNIT I Introduction 9 hours

From Nature to Nature Computing, Philosophy, Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity, Adaptation Feedback-Self-Organization-Complexity, Emergence and Bottom-up Vs Top-Down- Determination, Chaos and Fractals

UNIT II Computing Inspired by Nature 9 hours

Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

UNIT III Swarm Intelligence 9 hours

Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

UNIT IV Immuno Computing 9 hours

Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding, Immune Network Theory- Danger Theory, Evaluation Interaction Immune Algorithms, Introduction – Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks

UNIT V Computing With New Natural Materials 9 hours

DNA Computing: Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing

Course Outcomes:

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

1. Understand the foundational concepts of Nature Computing
2. Apply evolutionary computing techniques to solve complex optimization problems
3. Design and implement swarm intelligence algorithms
4. Analyze and apply immuno computing algorithms for pattern recognition and optimization tasks
5. Evaluate the potential of DNA computing and understand its applications

Text Book(s)

1. "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications" by Leandro Nunes de Castro, Chapman & Hall/ CRC, Taylor and Francis Group, 1st Edition, 2006.

Reference Books

1. "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies" by Floreano D. and Mattiussi C., MIT Press, Cambridge, MA, 2008.
2. "Handbook of Nature-Inspired and Innovative Computing" by Albert Y.Zomaya, Springer, 2006.
3. “Ant Colony Optimization” by Marco Dorrigo and Thomas Stutzle, PHI,2005

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – III

20CSD409 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: Software Engineering

Course Description:

The Software Project Management course provides an overview of essential principles, processes, and techniques for effectively managing software projects. Topics covered include project definition, evaluation, planning, monitoring, control, and team management. Students will learn how to assess project viability, create schedules, manage risks, monitor progress, and organize teams. This course equips students with the necessary skills to successfully lead software projects and deliver them on time and within budget.

Course Objectives:

This course enables students to

1. Understand the fundamental concepts and principles of software project management
2. Identify project planning goals, along with various cost/effort estimation models.
3. Organize & schedule project activities to compute critical paths for risk analysis.
4. Gain knowledge and techniques for monitoring and controlling software projects.
5. Learn effective strategies for managing people and organizing teams.

UNIT I INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT 9 hours

Project Definition - Contract Management - Activities Covered By Software Project Management - Overview of Project Planning - Stepwise Project Planning.

UNIT II PROJECT EVALUATION 9 hours

Strategic Assessment - Technical Assessment - Cost Benefit Analysis -Cash Flow Forecasting - Cost Benefit Evaluation Techniques - Risk Evaluation.

UNIT III ACTIVITY PLANNING 9 hours

Objectives - Project Schedule - Sequencing and Scheduling Activities -Network Planning Models - Forward Pass - Backward Pass - Activity Float - Shortening Project Duration - Activity on Arrow Networks - Risk Management - Nature Of Risk - Types Of Risk - Managing Risk - Hazard Identification - Hazard Analysis - Risk Planning And Control.

UNIT IV MONITORING AND CONTROL 9 hours

Creating Framework - Collecting The Data - Visualizing Progress - Cost Monitoring - Earned Value - Prioritizing Monitoring - Getting Project Back To Target - Change Control - Managing Contracts - Introduction - Types Of Contract - Stages In Contract Placement - Typical Terms Of A Contract - Contract Management - Acceptance.

UNIT V MANAGING PEOPLE AND ORGANIZING TEAMS 9 hours

Introduction - Understanding Behavior - Organizational Behaviour: A Background - Selecting The Right Person For The Job - Instruction In The Best Methods - Motivation - The Oldman - Hackman Job Characteristics Model - Working In Groups - Becoming A Team -Decision Making – Leadership Organizational Structures - Stress - Health And Safety - Case Studies.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Demonstrate a comprehensive understanding of software project management principles and practices.
2. Apply project evaluation techniques to assess the viability and feasibility of software projects.
3. Develop project plans and schedules using appropriate methodologies and tools.
4. Monitor and control software projects effectively, making informed decisions based on project data and progress.
5. Demonstrate effective leadership and team management skills to ensure successful project outcomes and collaboration among team members.

Text Book(s)

1. "Software Project Management" by Bob Hughes and Mike Cotterell, 5th Edition, Tata McGraw Hill, 2009.

Reference Books

1. "Effective Software Project Management" by Robert K. Wysocki, Wiley Publication, 2011.
2. "Software Project Management: A Unified Framework" by Walker Royce, Addison-Wesley, 1998.
3. "Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models" by Gopalaswamy Ramesh, McGraw Hill Education, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – III

20CSD410 DATABASE SECURITY

L	T	P	C
3	0	0	3

Pre-requisite: Database Management System

Course Description:

This course is about database security, with many methods and techniques that will be helpful in securing, monitoring, and auditing database environments. It covers diverse topics that include all aspects of database security and auditing -including network security for databases, authentication and authorization issues, links and replication, database Trojans, etc.

Course Objectives:

This course enables students to

1. Understand the fundamental concepts and importance of database security
2. Understand the role of authorization in controlling user access to databases
3. Recognize common application vulnerabilities
4. Implement techniques to monitor and secure communication between databases
5. Apply encryption methods to protect data during transmission and storage

UNIT I Introduction 9 hours

Introduction to database security – Security in Information Technology - importance of data – database review - identity theft – Levels of security -Human level: Corrupt/careless User, Network/User Interface, Database application program, Database system, Operating System, Physical level.

UNIT II Authentication and Authorization 9 hours

Passwords, Profiles, Privileges and Roles - Authentication – operating system authentication, database authentication, Network or third-party authentication, Database vector password policies - Authorization – User Account authorization,- Database/Application Security - Limitations of SQL Authorization - Access-control in Application Layer.

UNIT III Application Vulnerabilities 9 hours

Application Vulnerabilities - Application Security - OWASP Top 10 Web Security Vulnerabilities - Invalidated input, Broken access control, Broken account/session management, Cross-site scripting (XSS) flaws, Buffer overflows- SQL Injection flaws, Improper error handling, Insecure storage, Denial-of-service, Insecure configuration management.

UNIT IV Securing Database to Database Communications 9 hours

Monitor and limit outbound communications – secure database links – protect link usernames and passwords – monitor usage of database links – secure replication mechanisms - map and secure all data sources and sinks. Trojans – four types of database Trojans

UNIT V Encrypting and Auditing the Data 9 hours

Encrypting data in transit – encrypting data at rest – auditing architectures – audit trail – architectures of external audit systems - archive auditing information –secure auditing information – audit the audit system.

Course Outcomes:

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

1. Understand the importance of database security in protecting sensitive information.
2. Explain the purpose of authentication and authorization in database security.
3. Identify and describe the common vulnerabilities present in database applications.
4. Implement measures to secure communication between databases.
5. Implement data encryption and auditing techniques to ensure data confidentiality and integrity.

Text Book(s)

1. "Implementing Database Security and Auditing: A Guide for DBAs, Information Security Administrators and Auditors" by Ron Ben-Natan, Elsevier, 2005.

Reference Books

1. "Database Security" by Silvana Castano, Addison-Wesley, 1994.
2. "Database Security" by Alfred Basta, Melissa Zgola, Dana Bullaboy, Thomas L. Witlock, google books, 2011.
3. "Database System Concepts" by Silberschatz, Korth and Sudarshan, McGraw Hill Education, 6th Edition, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – III

20CSD411 COGNITIVE SCIENCE AND ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Fundamentals of AI

Course Description:

This course explores the area of cognitive computing and its implications for now a day's world of big data analytics and evidence-based decision making. Cognitive computing design principles, natural language processing, knowledge representation, this is an opportunity to build cognitive applications, and explore how knowledge-based artificial intelligence and deep learning are impacting the field of data science.

Course Objectives:

This course enables students to

1. Understand the cognitive science and cognitive computing with AI
2. Understand the algorithms that use AI and machine learning
3. Expose the system to human interaction and help system to make choices/decisions
4. Analyze the Hypothesis Generation and Scoring
5. Evaluate the new models of Cognitive Systems using some case studies.

UNIT I OVERVIEW OF COGNITIVE SCIENCE 9 hours

Introduction: Cognitive science and cognitive Computing with AI, 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.

UNIT II INTRODUCTION TO KNOWLEDGE-BASED AI 9 hours

Introduction to Knowledge-Based AI – Human Cognition on AI – Cognitive Architectures. Cognitive Computing with Inference and Decision Support Systems: Intelligent Decision making, Fuzzy Cognitive Maps

UNIT III LEARNING ALGORITHMS 9 hours

Learning algorithms: Nonlinear Hebbian Learning – Data driven NHL - Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps. Cognitive Computing with Machine Learning: Machine learning Techniques for cognitive decision making.

UNIT IV MACHINE LEARNING AND DEEP LEARNING 9 hours

Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies - Deep Learning

UNIT V CASE STUDIES ON COGNITIVE SYSTEMS 9 hours

Case Studies: Cognitive Systems in health care – Cognitive Assistant for visually impaired – AI for cancer detection, Predictive Analytics - Text Analytics - Image Analytics -Speech Analytics – IBM Watson

Course Outcomes:

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

1. Interpret the basics of Cognitive Computing and its differences from traditional approaches to computing.
2. Understand the cognitive architectures and human cognition of AI
3. Analyze the learning algorithms and machine Learning
4. Utilize the natural language processing
5. Design and develop cognitive systems in healthcare

Text Book(s)

1. "Cognitive Computing and Big Data Analytics" by Hurwitz, Kaufman, and Bowles, Wiley, 1st Edition, 2015.
2. "Cognitive Computing Recipes-Artificial Intelligence Solutions Using Microsoft Cognitive Services and Tensor Flow" by Masood, Adnan and Hashmi, Apress, 2019.

Reference Books

1. "Cognitive Computing: A Brief Guide for Game Changers" by Peter Fingar, Meghan Kiffer Pr, 2015
2. "Cognitive Computing Complete Self-Assessment Guide" by Gerardus Blokdyk, Createspace Independent Publishing Platform, 2018.
3. "Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service" by Rob High and Tanmay Bakshi, Packt Publishing Limited, 2019.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – IV

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – IV

20CSD412 VIDEO ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Machine Learning and Deep Learning

Course Description:

This course provides students with a comprehensive understanding of the principles, techniques, and applications of video analytics. Through five units, students will explore topics such as video acquisition and storage, video preprocessing and feature extraction, video content analysis, video analytics algorithms and models, and real-world applications. They will gain hands-on experience with computer vision and deep learning techniques for object detection, tracking, activity recognition, and event detection in videos. The course will also delve into video-based crowd analysis, surveillance, video summarization, and autonomous vehicles.

Course Objectives:

This course enables students to

1. Understand the fundamentals of video analytics and its applications in various domains.
2. Develop proficiency in video preprocessing techniques for enhancing video quality and extracting relevant features.
3. Gain knowledge of object detection and tracking algorithms to identify and follow objects of interest in videos.
4. Learn video content analysis techniques for segmenting, annotating, and indexing video data.
5. Apply video analytics methods to real-world scenarios and evaluate their effectiveness in solving practical problems.

UNIT I Introduction to Video Analytics 9 hours

Introduction to video analytics and its applications-Overview of video processing techniques-Video acquisition and storage-Video data formats and compression techniques

UNIT II Video Preprocessing and Enhancement 9 hours

Video preprocessing techniques (e.g., stabilization, denoising)-Keyframe extraction and summarization-Color correction and enhancement-Image and video resizing-Temporal and spatial filtering

UNIT III Object Detection and Tracking in Videos 9 hours

Introduction to object detection and tracking-Traditional methods for object detection and tracking-Deep learning-based object detection algorithms-Multi-object tracking in videos-Evaluation metrics for object detection and tracking

UNIT IV Video Content Analysis 9 hours

Video segmentation and shot boundary detection-Motion estimation and analysis-Activity recognition and behaviour analysis-Face detection and recognition in videos-Video annotation and indexing

UNIT V Video Analytics Applications and Case Studies 9 hours

Surveillance and security applications-Video-based crowd analysis-Video summarization and retrieval-Video analytics for smart cities-Ethical considerations in video analytics

Course Outcomes:

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

1. Gain a comprehensive understanding of video analytics and its diverse applications.
2. Acquire proficiency in video preprocessing techniques and enhance video quality for subsequent analysis.
3. Develop the ability to detect and track objects of interest accurately in video sequences.

4. Learn techniques for analyzing video content, including segmentation, motion analysis, and face detection/recognition.
5. Apply video analytics methods to real-world applications, evaluate their performance, and explore ethical considerations.

Text Book(s)

1. "Computer Vision: Algorithms and Applications" by Richard Szeliski, Springer, 2011th edition, 2010.
2. "Video Processing and Communications" by Yao Wang, Jörn Ostermann, and Ya-Qin Zhang, Pearson Education, 2001.

Reference Books

1. "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods, Pearson Education, 4th Edition, 2017.
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 2016.
3. "Video Analytics. Face and Facial Expression Recognition and Audience Measurement" by Kamal Nasrollahi, Cosimo Distante, Gang Hua, Andrea Cavallaro, Thomas B. Moeslund, Sebastiano Battiato, Qiang Ji, Springer, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – IV

20CSD413 MALWARE ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisite: Operating System, Computer Networks and Cryptography and Network Security

Course Description:

This course introduces the fundamentals of malware and to set up a protected static and dynamic malware analysis environment. This course is to provide an insight to fundamentals of malware analysis and to learn various malware behaviour monitoring tools and actionable detection signatures from malware indicators. Learn how to trick malware into exhibiting behavior's that only occur under special conditions.

Course Objectives:

This course enables students to

1. Introduce the fundamentals of malware, types and its effects.
2. Learn various malware types by static analysis.
3. Understand and analyse various malware types by dynamic analysis.
4. Explore different types of Malware Functionalities.
5. Practice the android malware analysis techniques for real world applications

UNIT I Introduction 9 hours

Introduction: Definition of Malware – Goals of. Malware Analysis– Malware Analysis Techniques - Types of Malware Analysis – General Rules for Malware Analysis. Analyzing malicious windows programs: Windows API – Windows Registry – Networking APIs – Following Running Malwares – Kernel vs User Mode- Native API.

UNIT II Static Analysis 9 hours

X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.

UNIT III Dynamic Analysis 9 hours

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, API calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching.

UNIT IV Malware Functionality 9 hours

Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

UNIT V Android Malware 9 hours

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis. **Case Study** – Recent Trends.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Understand the nature of malware, its capabilities, and how it is combated through detection and classification. Implement different malware analysis techniques.
2. Apply the tools and methodologies used to perform static analysis on unknown executables.
3. Identify the skills necessary to carry out independent analysis of modern malware samples using dynamic analysis techniques.
4. To be able to safely analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development.

Text Book(s)

1. "Practical Malware Analysis" by Michael Sikorski and Andrew Honig, 1st Edition, No Starch Press, 2012.
2. "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" by Bill Blunden, 2nd Edition, Jones & Bartlett Publishers, 2012.
3. "Android Malware and Analysis" by Dunham Ken, Auerbach Publications, 1st Edition, 2014

Reference Books

1. "Rootkits: Subverting the Windows Kernel" by Jamie Butler and Greg Hoglund, Addison-Wesley Professional, 2005.
2. "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation" by Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, Wiley, 1st Edition, 2014.
3. "Android Malware and Analysis" by Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales and Tim Strazzere, CRC Press, 2015.
4. "Windows Malware Analysis Essentials" by Victor Marak, Packt Publishing, 2015

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – IV

20CSD414 GPU PROGRAMMING USING CUDA

L	T	P	C
3	0	0	3

Pre-requisite: Computer System Architecture

Course Description:

The course covers the basics of conventional CPU architectures, their extensions for single instruction multiple data processing (SIMD) in modern GPUs. We cover GPU architecture basics in terms of functional units and then dive into the popular CUDA programming model commonly used for GPU programming. The architecture specific details like memory access coalescing, shared memory usage, GPU thread scheduling etc. which primarily affect program performance is also covered in detail. Throughout the course we provide different architecture-aware optimization techniques relevant to both CUDA and OpenCL.

Course Objectives:

This course enables students to

1. Introduce the basics of GPU architectures
2. Expose the student to a variety of Optimizing CUDA Applications
3. Analyze the CUDA Error Handling Parallel Programming Issues
4. Analyze the openCL standards and the Memory Models
5. Evaluate the Parallel Patterns with different algorithms

UNIT I GPU Architecture 9 hours

Overview of GPU architecture and its advantages - Parallelism with GPU – GPU programming languages and frameworks - Introduction to CUDA - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory, and Texture Memory

UNIT II CUDA Programming 9 hours

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT III Programming Issues 9 hours

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

UNIT IV OpenCL Basics 9 hours

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

UNIT V Algorithms on GPU 9 hours

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Interpret the design of GPU Architecture
2. Develop simple applications using CUDA Programming
3. Utilize efficient parallel programming patterns to solve problems
4. Analyze the Memory Models and openCL Examples
5. Evaluate the Parallel Patterns algorithms

Text Book(s)

1. "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)" by Shane Cook, 1st Edition, Morgan Kaufmann, 2012.
2. "Heterogeneous computing with OpenCL" by David R. Kaeli, Perhaad Mistry, Dana Schaa and Dong Ping Zhang, 3rd Edition, Morgan Kauffman, 2015.

Reference Books

1. "CUDA Handbook: A Comprehensive Guide to GPU Programming" by Nicholas Wilt, Addison - Wesley, 2013.
2. "CUDA by Example: An Introduction to General Purpose GPU Programming" by Jason Sanders, Edward Kandrot, Addison - Wesley, 2010.
3. "Programming Massively Parallel Processors - A Hands-on Approach" by David B. Kirk and Wen-mei W. Hwu, 3rd Edition, Morgan Kaufmann, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – IV

20CSD415 PREDICTIVE ANALYSIS IN IOT

L	T	P	C
3	0	0	3

Pre-requisite: Machine Learning

Course Description:

The course is designed to provide students with a comprehensive understanding of the fundamentals and practical aspects of analytics in the context of the Internet of Things (IoT). The course explores the challenges and opportunities associated with analyzing and extracting valuable insights from IoT data.

Course Objectives:

This course enables students to

1. Understand the concept of IoT analytics and its role in extracting valuable insights from IoT data.
2. Familiarize with various IoT access technologies
3. Gain insights into popular cloud platforms for IoT analytics
4. Apply machine learning techniques to IoT data
5. Understand the development of smart cities and the role of IoT in shaping their architecture and security.

UNIT I IoT Analytics and IoT Network Architecture 9 hours

Defining IoT analytics: Defining Analytics, Defining Internet of Things, The concepts of constrained – IoT analytics challenges: the Data volume, Problem with time and space, Data quality, Analytics Challenges -Business value concerns-Drivers behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT II Smart Objects and Connecting Smart Objects 9 hours

Sensors, Actuators, and Smart Objects, Sensor Networks-Communications Criteria, Range, Frequency Bands, Power Consumption, Topology, Constrained Devices, Constrained-Node Networks, IoT Access Technologies, IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, LoRaWAN.

UNIT III IoT Analytics for the Cloud 9 hours

Building elastic analytics, Elastic analytics concepts, designing for scale, Cloud security and analytics, The AWS overview, Microsoft Azure overview.

UNIT IV Data Science for IoT Analytics 9 hours

Machine learning (ML), Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Comparing different models to find the best fit using R, Random forest models using R,Anomaly detection using R.

UNIT V Internet of Things for Smart Cities 9 hours

Introduction, Development of Smart Cities and the IoT, The Combination of the IoT with Development of City Architecture to Form Smart Cities, Unification of the IoT, Security of Smart Cities. A Roadmap for Application of IoT-Generated Big Data in Environmental Sustainability: Role of Big Data in Sustainability, Present Status and Future Possibilities of IoT in Environmental Sustainability, Proposed Roadmap, Identification and Prioritizing the Barriers in the Process.

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

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

1. Explain the concept of IoT analytics and its significance in extracting valuable insights from IoT data.
2. Gain knowledge of various IoT access technologies and their applications in connecting smart objects.
3. Utilize popular cloud platforms, such as AWS and Microsoft Azure, for IoT analytics.
4. Acquire the skills to apply machine learning techniques to IoT data.
5. Understand the role of IoT in the development of smart cities.

Text Book(s)

1. "Analytics for the Internet of things" by Andrew Minteer, Packt publishing, 2017.
2. "Big Data Analytics for Internet of Things" by Tausifa Jan Saleem and Mohammad Ahsan Chishti, Wiley, 1st Edition,2021.

Reference Books

1. "The Internet of Things, Enabling Technologies, Platforms, and Use Cases" by Pethuru Raj, Anupama C. Raman, CRC Press, 2017.
2. "Internet of Things Principles and Paradigms" by Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufmann, 1st edition, 2016.
3. "Internet of Things with Arduino Cookbook" by Marco Schwartz, Packt Publishing, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – IV

20CSD416 DESIGN PATTERNS

L	T	P	C
3	0	0	3

Pre-requisite: Object Oriented Programming

Course Description:

This course is designed to equip students with the knowledge and skills to effectively utilize design patterns in their projects. Through a comprehensive syllabus, students will be introduced to the fundamental principles and concepts of design patterns, exploring their history and importance in software development. The course delves into various categories of design patterns, including creational, structural, and behavioural patterns, providing practical examples and real-world applications.

Course Objectives:

This course enables students to

1. Understand the significance of design patterns
2. Identify and apply various design patterns
3. Enhance software design skills
4. Solve common software design challenges
5. Apply design patterns in real-world scenarios

UNIT I Introduction to Design Patterns 9 hours

Definition and importance of design patterns-History and evolution of design patterns-Principles of object-oriented design-Common terminology and concepts in design patterns

UNIT II Creational Design Patterns 9 hours

Singleton pattern-Factory pattern-Abstract Factory pattern-Builder pattern-Prototype pattern -
Case Study: Factory Method and Abstract Factory Patterns
Applying Factory Method and Abstract Factory patterns to a software system, Analyzing the benefits of using these patterns, Comparing and contrasting the usage of the two patterns

UNIT III Structural Design Patterns 9 hours

Adapter pattern-Decorator pattern-Composite pattern-Facade pattern-Bridge pattern
Case Study : Composite and Decorator Patterns
Applying Composite and Decorator patterns to a real-world scenario, Examining the impact of these patterns on code flexibility and extensibility, Discussing the trade-offs and considerations when using these patterns

UNIT IV Behavioral Design Patterns 9 hours

Observer pattern-Strategy pattern-Template method pattern-Command pattern-Iterator pattern
Case Study : Observer and Strategy Patterns
Implementing Observer and Strategy patterns in a software application, Evaluating the benefits of using these patterns,Comparing and contrasting the use of these patterns in different scenarios

UNIT V Additional Design Patterns 9 hours

Proxy pattern-Flyweight pattern-Chain of Responsibility pattern-Mediator pattern-Visitor pattern

Course Outcomes:

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

1. Gain a solid understanding of the significance and historical context of design patterns
2. Develop the ability to identify and implement creational design patterns
3. Acquire the knowledge and skills to apply structural design patterns
4. Gain proficiency in utilizing behavioural design patterns
5. Understand the applications of additional design patterns

Text Book(s)

1. "Design patterns: Elements of Reusable object-oriented software" by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Pearson Education,1st Edition, 2015.

Reference Books

1. "Design Patterns Explained: A New Perspective on Object-Oriented Design"Alan Shalloway and James R. Trott, Pearson Education, 2nd Edition, 2005
2. "Design Patterns in Ruby" by Russ Olsen, Pearson Education, 1st Edition, 2007

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – IV

20CSD417 TEXT ANALYTICS AND NLP

L	T	P	C
3	0	0	3

Pre-requisite: Fundamentals of AI and Machine Learning

Course Description:

This course is designed to provide students with a comprehensive understanding of various techniques and methods used in text extraction, document clustering, content-based classification, introduction to Natural Language Processing (NLP), and text processing with an emphasis on morphology.

Course Objectives:

This course enables students to

1. Understand the methods for word extension from documents.
2. Learn clustering methods for grouping of documents.
3. Explore the methods for classification of documents and e-mails.
4. Familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
5. Relate mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text.

UNIT I TEXT EXTRACTION 9 hours

Introduction – Rapid automatic keyword extraction; candidate keywords, keyword scores, adjoining keywords, extracted keywords – benchmark evaluation; precision and recall, efficiency, stoplist generation, evaluation on new articles.

UNIT II DOCUMENT CLUSTERING 9 hours

Multilingual document clustering; Multilingual LSA, Tucker 1 method, PARAFAC2 method, LSA with term alignments, LMSA, LSMA with term alignments; constrained clustering with k – means type algorithms.

UNIT III CONTENT BASED CLASSIFICATION 9 hours

Classification algorithms for Document Classification, Content – based spam email classification, Utilizing non – negative matrix factorization for email classification problems.

UNIT IV INTRODUCTION TO NLP 9 hours

Introduction to NLP, Various stages of NLP, The Ambiguity of language: Why NLP is Difficult Parts of speech: Nouns and Pronouns, Words: Determiners and Adjectives, Verbs, phrase structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language, Cross entropy.

UNIT V TEXT PROCESSING AND MORPHOLOGY 9 hours

Character encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.

Course Outcomes:

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

1. Design text extraction techniques.
2. Devise clustering techniques for text mining.
3. Design classification techniques for text mining
4. Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.

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5. Realize semantics and pragmatics of English language for text processing. Create CORPUS linguistics based on digestive approach (Text Corpus method)

Text Book(s)

1. "Text Mining Applications and Theory" by Michael W. Berry & Jacob Kogan, Wiley publications, 2010.
2. "Mining text data" by Aggarwal, Charu C., and ChengXiangZhai, Springer Science & Business Media, 2012.
3. "Foundations of Natural Language Processing" by Christopher D. Manning and Hinrich Schutze, MIT Press, 6th Edition, 2003.

Reference Books

1. "Practical text mining and statistical analysis for non-structured text data applications" by Gary Miner, John Elder IV, and Andrew Fast, Academic Press, 2012.
2. "Text mining: Classification, clustering, and applications" by Srivastava, Ashok N. and Mehran Sahami, Chapman and Hall/CRC, 1st Edition, 2009.
3. "Handbook of Natural Language Processing" by Nitin Indurkhya and Fred J. Damerau, Chapman and Hall/CRC, 2nd Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – V

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – V

20CSD418 EXPLORATORY DATA ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisite: Data Visualization and Python for Data Science

Course Description:

This course will help in learning pre-processing tasks in Data Science, AI and ML operations. The way of collecting raw data and importance of pre-processing is explained clearly in this course. Different tools for performing pre-processing methods can be learned from this course. The applications of different technique in time series analysis is also included in the scope of course.

Course Objectives:

This course enables students to

1. Understand the methods for data preparation.
2. Learn general and common methods for selecting features and other basic pre-processing steps.
3. Familiar with the use of predictive analytics, data science and Data Visualization
4. Provide basic statistical and visualization methods for understanding data
5. Learn how to handle time-series and multi-variate data

UNIT I Introduction to Exploratory Data Analysis 9 hours

EDA fundamentals – Steps in data exploration - Significance of EDA – Making sense of data - The basic data types - Data Type Portability –Data transformation techniques - Merging database, reshaping, and pivoting, Transformation techniques.

UNIT II Preprocessing and Feature Selection 9 hours

Introduction to Missing data, Traditional methods for dealing with missing data. Improving the accuracy of analysis. Feature selection algorithms: filter methods, wrapper methods and embedded methods, Forward selection backward elimination, Relief, greedy selection, genetic algorithms for features election

UNIT III Dimensionality Reduction 9 hours

Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality. Introduction, Principal Component Analysis (PCA), Kernel PCA, Canonical Correlation Analysis, Factor Analysis, Multi-dimensional scaling, Correspondence Analysis

UNIT IV Visualization and Outlier Analysis 9 hours

Software tools for EDA – Visual Aids for EDA - Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data.

UNIT V Multivariate And Time Series Analysis 9 hours

Introducing a Third Variable – Causal Explanations – Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Grouping – Resampling.

Course Outcomes:

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

1. Outline the fundamentals of Exploratory Data Analysis process.
2. Understand different pre-processing and feature selection methods.
3. Express the importance of scaling, transformation, and dimensionality reductions techniques.
4. Describe the data using basic statistics and visualization methods.
5. Demonstrate many techniques for handling time-series data

Text Book(s)

1. "Hands-On Exploratory Data Analysis with Python" by Suresh Kumar Mukhiya, Usman Ahmed, Packt Publishing, 2020.
2. "Python Data Science Handbook: Essential Tools for Working with Data" by Jake Vander Plas, 1st Edition, O Reilly, 2017.
3. "Python Data Science Handbook: Essential Tools for Working with Data" by Catherine Marsh, Jane Elliott, Wiley Publications, 2nd Edition, 2008.

Reference Books

1. "Data Mining The Textbook" by Charu C. Aggarwal, Springer, 2015th Edition, 2015.
2. "Analysis of Multivariate and High dimensional data" by Inge Koch, Cambridge University Press, 2014.
3. "Exploratory and multivariate data analysis" by Michael Jambu, Academic Press Inc., 1990.
4. "Data Classification Algorithms and Applications" by Charu C. Aggarwal, CRC press, 2015

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

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Professional Elective – V

20CSD419 SOFTWARE QUALITY ASSURANCE

L	T	P	C
3	0	0	3

Pre-requisite: Software Engineering

Course Description:

This course provides a comprehensive understanding of Software Quality (SQ) and its importance in software development. The course covers various aspects of SQ, including quality challenges, software quality assurance (SQA), quality factors, and quality models. It also delves into the architecture of SQA systems and explores the components of the software project life cycle.

Course Objectives:

This course enables students to

1. Understand the basic tenets of software quality and quality factors.
2. Understand how the SQA components can be integrated into the project life cycle.
3. Familiar with the software quality infrastructure.
4. Get exposed to the management components of software quality.
5. Understand the software quality standards and certificates.

UNIT I INTRODUCTION TO SQ & ARCHITECTURE 9 hours

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall‟s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

UNIT II SQA COMPONENTS AND PROJECT LIFE CYCLE 9 hours

Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

UNIT III SOFTWARE QUALITY INFRASTRUCTURE 9 hours

Procedures and work instructions – Templates – Checklists – 3S developmenting – Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

UNIT IV SOFTWARE QUALITY MANAGEMENT & METRICS 9 hours

Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.

UNIT V STANDARDS, CERTIFICATIONS 9 hours

Quality management standards – ISO 9001 and ISO 9000-3 – Capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE 1012 & 1028 – Organization of Quality Assurance

Course Outcomes:

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

1. Understand the Software Quality Assurance (SQA) architecture.
2. Utilize the concepts in software development life cycle.
3. Demonstrate their capability to adopt quality standards.
4. Assess the quality of software product.
5. Apply the concepts in preparing the quality plan & documents.

Text Book(s)

1. "Software Quality Assurance" by Daniel Galin, Pearson Publication, 2009.

Reference Books

1. "Metrics and Models in Software Quality Engineering" by Stephen H. Kan, Pearson Education, 2002.
2. "Software Quality: Producing Practical, Consistent Software" by Mordechai Ben-Menachem, Garry S.Marliss, BS Publications, 2014.
3. "Software Quality: Theory and Management" by Allan C. Gillies, Cengage Learning, 2003.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – V

20CSD420 REINFORCEMENT LEARNING

L	T	P	C
3	0	0	3

Pre-requisite: Linear Algebra, Engineering Calculus and Machine Learning

Course Description:

Reinforcement learning is a paradigm that aims to model the trial-and-error learning process that is needed in many problem situations where explicit instructive signals are not available. The purpose is for the agent to learn an optimal, or nearly-optimal, policy that maximizes the "reward function" or other user-provided reinforcement signal that accumulates from the immediate rewards.

Course Objectives:

This course enables students to

1. Identify the best known action for any given state and assigned values relative to one another.
2. Expose knowledge of basic and advanced reinforcement learning techniques.
3. Create a basic understanding of Temporal-Difference Learning
4. Enable students to plan and evaluate with tabular methods.
5. Learn the policy approximations for more complex agents.

UNIT I OVERVIEW OF REINFORCEMENT LEARNING 9 hours

The Reinforcement Learning Problem: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe, History of Reinforcement Learning. Multi-arm Bandits: An n-Armed Bandit Problem, Action-Value Methods, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search

UNIT II FINITE MARKOV DECISION PROCESSES 9 hours

The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notations, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation. Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Efficiency of Dynamic Programming.

UNIT III TEMPORAL-DIFFERENCE (TD) LEARNING 9 hours

TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning: Off-Policy TD Control, Games, After states, and Other Special Cases. Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control.

UNIT IV PLANNING AND LEARNING 9 hours

Models and Planning, Integrating Planning, Acting, and Learning, When the Model Is Wrong, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search.

UNIT V POLICY APPROXIMATION 9 hours

On-policy Approximation of Action Values: Value Prediction with Function Approximation, Gradient-Descent Methods, Linear Methods, Control with Function Approximation. Policy Approximation: Actor–Critic Methods, Eligibility Traces for Actor–Critic Methods, R-Learning and the Average-Reward Setting.

Course Outcomes:

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

1. Understand the action-state interactions and assigned values relative to one another.
2. Acquire knowledge of basic and advanced reinforcement learning techniques
3. Develop a basic understanding of Temporal-Difference Learning
4. Enable students to plan and evaluate with tabular methods
5. Apply the policy approximations for more complex agents

Text Book(s)

1. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto, MIT Press, 2nd Edition, 2018.

Reference Books

1. "Handbook of Reinforcement Learning and Control " by Kyriakos G. Vamvoudakis, Yan Wan, Frank L. Lewis and Derya Cansever, Springer,1st Edition, 2021.
2. “Reinforcement Learning Algorithms: Analysis and Applications" by Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi and Jan Peters, Springer,1st Edition, 2021.
3. "Deep Reinforcement Learning with Python: With PyTorch, TensorFlow and OpenAI Gym" by Nimish Sanghi, Apress,1st Edition, 2021.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – V

20CSD421 RECOMMENDER SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite: Fundamentals of AI and Machine Learning

Course Description:

Recommender systems have become an integral part of our online experience, enabling personalized recommendations for movies, products, music, and more. This course provides a comprehensive introduction to the fundamental algorithms, techniques, and applications of recommender systems. This course will equip students with the knowledge and skills to tackle real-world recommendation challenges and contribute to the field of recommender systems.

Course Objectives:

This course enables students to

1. Understand the core concepts and types of recommender systems, including collaborative filtering and content-based filtering.
2. Gain practical experience in preprocessing and representing data for recommender systems.
3. Implement user-based and item-based collaborative filtering algorithms for personalized recommendations.
4. Apply content-based filtering techniques to recommend items based on their features and user preferences.
5. Evaluate and compare the performance of recommender systems using appropriate evaluation metrics.

UNIT I Introduction to Recommender Systems 9 hours

Overview of recommender systems and their impact-Importance of personalized recommendations-Types of recommender systems: collaborative filtering, content-based filtering, hybrid models-Evaluation metrics for recommender systems-Data preprocessing and representation for recommender systems

UNIT II Collaborative Filtering 9 hours

User-based collaborative filtering-Item-based collaborative filtering-Matrix factorization techniques: SVD, NMF-Neighbourhood-based collaborative filtering-Handling sparsity and scalability issues in collaborative filtering

UNIT III Content-Based Filtering 9 hours

Content representation and feature extraction-Similarity measures for content-based filtering-TF-IDF and cosine similarity-Term-based and vector space models-Utilizing textual, categorical, and numerical data for recommendations

UNIT IV Hybrid Recommender Systems 9 hours

Combining collaborative filtering and content-based filtering-Weighted and switching hybrid models Feature combination techniques-Ensemble methods in recommender systems

UNIT V Context-Aware Recommender Systems 9 hours

Incorporating contextual information in recommendations-Temporal and spatial context-User and item context-Context-aware collaborative filtering-Context-aware content-based filtering

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Course Outcomes:

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

1. Explain the key concepts and principles of recommender systems, including collaborative filtering and content-based filtering.
2. Apply data preprocessing techniques to prepare data for recommender systems.
3. Implement user-based and item-based collaborative filtering algorithms to generate personalized recommendations.
4. Utilize content-based filtering techniques to recommend items based on their features and user preferences.
5. Evaluate and interpret the performance of recommender systems using appropriate evaluation metrics.

Text Book(s)

1. "Recommender Systems: An Introduction" by Dietmar Jannach, Markus Zanker, Alexander Felfernig, and Gerhard Friedrich, Cambridge University Press, 2010.

Reference Books

1. "Recommender Systems Handbook" edited by Francesco Ricci, Lior Rokach, Bracha Shapira, and Paul B. Kantor, Springer, 2011.
2. "Mining of Massive Datasets" by Jure Leskovec, Anand Rajaraman, and Jeff Ullman, Dreamtech Press, 2nd Edition, 2016.
3. "Building Recommender Systems with Machine Learning and AI" by Suresh Kumar Gorakala, Packt Publishing Limited, 2016.
4. "Practical Recommender Systems" by Kim Falk, Manning Publishers, 2019.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

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Professional Elective – V

20CSD422 ADVANCED PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

Pre-requisite: Programming for Problem Solving (Python) and Object Oriented Programming

Course Description:

This course is designed to provide basics of Advanced Python Programming, Functions, Modules, Exceptions, File Handling, Classes, Threading, Generators, Iterators, Regular Expressions and Database connections in Python.

Course Objectives:

This course enables students to

1. Understand Functions and Modules concepts, and apply them in solving problems
2. Learn the concepts of Exceptions and Manipulate data using File Handling.
3. Getting exposed to the concepts of Classes and Threading.
4. Demonstrate the use of Generators, Iterators and GUIs in Python.
5. Demonstrate Regular Expressions and Learn the design of GUI using Database programming in Python

UNIT I FUNCTIONS AND MODULES 9 hours

Create your own functions, Functions Parameters, Variable Arguments, Scope of a Function, Function, Documentations, Lambda Functions and map, N Exercise with functions, Create a Module, Standard Modules.

UNIT II EXCEPTIONS AND FILE HANDLING 9 hours

Exceptions: Exception handling with try, handling Multiple Exceptions, Writing your own Exception

File handling: File Handling Modes, Reading Files, Writing and Appending to Files, Handling File Exceptions, The with statement.

UNIT III CLASSES AND THREADING IN PYTHON 9 hours

Classes in Python: New Style Classes, Creating Classes, Instance Methods, Inheritance, Polymorphism, Exception Classes, Custom Exceptions.

Threading in Python Threads Life cycle**,** Creation, Execution of threads using threading module, Multi-threading, Synchronization.

UNIT IV GENERATORS, ITERATORS AND GUIS IN PYTHON (Tkinter) 9 hours

Generators and Iterators: Generators, Iterators, The Functions any and all, With Statement, Data Compression

GUIs in Python (Tkinter): Introduction, Components and Events, An Example GUI, The root Component, Adding a Button, Entry Widgets, Text Widgets, Check buttons

UNIT V Regular Expressions and Database programming using Python 9 hours

Regular Expressions: Split, working with special characters, date, emails | Quantifiers, Match and find all, character sequence and substitute, Search method

Database programming using Python: Introduction, Installation, DB Connection, Creating DB Table, INSERT, READ, UPDATE, DELETE operations, Commit and Rollback operation, handling Errors.

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Course Outcomes:

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

1. Understand functions, modules and apply them in problem-solving techniques.
2. Handle exceptions and files in Python.
3. Develop Classes and Threads in Python.
4. Utilize Generators, Iterators and to develop GUIs.
5. Use regular Expressions and database connectivity in applications.

Text Book(s)

1. "Think Python: How to Think Like a Computer Scientist" by Allen B. Downey, Shroff/O'Reilly Publishers, 2nd edition, 2016.
2. "Python 3:The Comprehensive Guide t" by Johannes Ernesti and Peter Kaiser, SAP Press, 2022.

Reference Books

1. "An Introduction to Python" by Guido van Rossum and Fred L. Drake Jr, Network Theory Ltd., 2011.
2. "Python Cookbook 3e: Recipes for Mastering Python 3: No. 3" by David Beazley and Brian K. Jones, O′Reilly, 3rd Edition, 2013.
3. "Practical Programming: An Introduction to Computer Science using Python 3" by Paul Gries, Jennifer Campbell and Jason Montojo, Pragmatic Programmers LLC, 2nd Edition, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Professional Elective – IV

20CSD423 HUMAN COMPUTER INERACTION

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:

This course provides a comprehensive understanding of the fundamental theory of User Interface Design and Multimedia applications. Human-computer interaction is an interdisciplinary field that integrates theories and methodologies from computer science, cognitive psychology, design, and many other areas. The course is intended to introduce the student to the basic concepts of human-computer interaction. It will cover the basic theory and methods that exist in the field.

Course Objectives:

This course enables students to

1. Gain an overview of Human-computer Interaction (HCI), with an understanding of user interface design.
2. Become familiar with the vocabulary associated with sensory and cognitive systems as relevant to task performance by humans
3. Apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks and recognize the limits of human performance as they apply to the computer operation
4. Familiar with a variety of both conventional and non-traditional user interface paradigms
5. Understand and apply HCC concepts in graphics and testing context.

UNIT I INTRODUCTION TO HCC 9 hours

Introduction: Importance of user Interface: Definition, Importance of Good Design, Benefits of Good Design, A Brief History of Screen Design.

The Graphical User Interface : Popularity of Graphics, the Concept of Direct Manipulation, Graphical System, Characteristics,

Web User –Interface Popularity, Characteristics- Principles of User Interface.

UNIT II DESIGN PROCESS AND SCREEN DESIGNING 9 hours

Design process –Understanding how people interact with computers, importance of human characteristicshuman consideration, Human interaction speeds, and understanding business functions.

Screen Designing: Design goals–Screen meaning and purpose, organizing screen elements, ordering ofscreen data and content – screen navigation and flow – Visually pleasing composition – amount of information– focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design

UNIT III SYSTEM MENUS 9 hours

System menus: Structures of Menus, Functions of Menus, Content of Menus, Kinds of Graphical menus

Windows: Window characteristics, Components of a window, Window presentation styles, Types of windows, Window management.

UNIT IV CONTROLS 9 hours

Controls: Characteristics of device-based controls, Selecting the proper device-based controls, Operable controls, Text Entry/Read-only controls, Selection controls, Combination Entry/selection controls, Selecting the proper controls.

UNIT V GRAPHICS AND TESTING 9 hours

Graphics: Icons, Multimedia, Colour-what is it, Colour uses, Colour and Human vision, Choosing colours **Testing:** The purpose and importance of usability testing, Scope of testing, Prototypes, Kinds of Tests, Developing and conducting the test

Course Outcomes:

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

1. Understand usability and the factors affecting universal usability.
2. Apply the principles of the design process in human-computer interaction.
3. Develop innovative ways to interact with computers.
4. Apply cognitive psychology in the control of devices for interaction.
5. Facilitate the disabled by designing non-traditional ways of interacting.

Text Book(s)

1. "The essential guide to user interface design" by Wilbert O Galitz, Wiley, 2nd edition, 2013.

Reference Books

1. "Designing the user interface: Strategies for Effective Human-Computer Interaction" by Ben Shneidermann, Pearson Education Asia,5th Edition, 2009.
2. "Human Computer Interaction" by D.R.Olsen, Cengage Learning, 1st Edition, 2009.
3. "Human Computer Interaction: An Empirical Research Perspective" by I.Scott Mackenzie, Morgan Kaufmann Publishers, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Courses

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course – I

20CSD601 WEB SCRIPTING

L	T	P	C
1	0	2	2

Pre-requisite NIL

Course Description:

This course will expose students to the techniques used in programming web pages for interactive content. The course begins by reviewing basic web technologies (HTML, CSS style sheets, XML, JavaScript (Node and Angular) and jQuery and exploring the use of event-driven programming in JavaScript to add interactive elements such as buttons and text fields to web pages.

This course provides the knowledge necessary to design and develop dynamic, database-driven web pages using PHP. Students also learn how to configure PHP and Web Servers like Apache, IIS, WAMP and XAMPP.

Course Objectives:

1. To build web applications using HTML, CSS and PHP with client side validations.
2. To build XML documents with DTD, Schemas and style sheets.
3. To maintain session management tracking using cookies & HTTP Sessions.
4. To develop a web application with database interaction using Node JavaScript and Angular JavaScript
5. To build jQuery enabled web applications.

UNIT – I: HTML & CSS

Introduction to HTML, HTML5 New Features, Structural, Content, Application-focused tags. History of CSS, The Power of CSS, Selectors and Pseudo Classes, Fonts and Text Effects, Colors.

a. Creation College Website using HTML.
b. Design a website using style sheets so that the pages have uniform style.

UNIT – II: INTRODUCTION TO JAVASCRIPT

Introduction to JavaScript, Comments, Variables, Exploring JavaScript Data Types, Popup Boxes, Objects, Functions, Conditions, Loops, Form Validation.

a. Design a form and validate all the controls placed on the form using Java Script.
b. Write a JavaScript program to measure the time taken by a function to execute.

UNIT – III: JQUERY WITH HTML

Introduction to jQuery, Installation, Selectors, Events, Effects, Callbacks, jQuery and HTML, jQuery

a. Working on Blink text using jQuery.
b. Using jQuery right click to toggle background color.

UNIT – IV: INTRODUCTION TO XML AND PHP DATABASE

Introduction to XML, Creating XML Documents, XSL, PHP Concepts: Sessions, authenticating users Database Access: Database Concepts, MYSQL database connectivity and operations.

a. Display Library information using XML.
b. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page,
c. Write a PHP program to connect to that database and extract data from the tables and display them. Experiment with various SQL queries.

UNIT – V: NODEJS AND ANGULAR JS

Introduction to Node JS, Advantage of Node JS, File System: Using file operation. Data base Connectivity: Connecting strings and configuring. Database operations on create table data -Angular JS forms.

a. Working on file write, read and delete using Node.js
b. Write a Node JavaScript program to connect to that database and extract data from the tables and display them.
c. Using AngularJS to read input value from text box and will be displayed it.
d. Using AngularJS to demonstrate Arithmetic operations of two numbers.

Course Outcomes:

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

1. Design pages with HTML and CSS attributes.
2. Design and develop web applications with the support of client side validations.
3. Use well-formed XML documents and develop PHP scripts with may support of object oriented features.
4. Manage the session in web browser through Cookies & Sessions and able to communicate with other web pages through form GET and POST methods.
5. Design and develop web applications with the database interactions (thorough SQL queries) and apply Node JavaScript and Angular JavaScript for faster performance.

Text Books

1. PHP 5 Recipes A problem Solution Approach Lee Babin, Nathan A Good, Frank M.Kromann and Jon Stephens.
2. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Leeand B.Ware(Addison Wesley) Pearson Education.
3. Professional Angular JS, Valeri Karpov and Diego Netto, John Willey Edition.
4. Beginning Node.JS by Basarat Syed, 2014.

Reference Books

1. HTML & CSS:The Complete Reference ,Thomas.A Powel “Fifth Edition”Kindle Edition,2017
2. Marty Hall and Larry Brown,”Core Web Programming” Second Edition, Volume I andII, Pearson Education, 2001. Learning jQuery, Jonathan Chaffer, Karl Swedberg, Third Edition, Packt Publishing Ltd
3. HTML & CSS:The Complete Reference ,Thomas.A Powel “Fifth Edition”Kindle Edition,2017
4. Marty Hall and Larry Brown,”Core Web Programming” Second Edition, Volume I andII, Pearson Education, 2001. Learning jQuery, Jonathan Chaffer, Karl Swedberg, Third Edition, Packt Publishing Ltd

Mode of Evaluation: Model Lab Examinations, External Lab End Examination

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course – I

20CSD602 ANDROID APPLICATION DEVELOPMENT

L	T	P	C
1	0	2	2

Pre-requisite **NIL**

Course Description:

This course is concerned with the development of applications on Android platform. Android is used as a basis for the development of mobile applications. This course starts with the basic concepts of Java, history of android and architecture. It also covers the development of applications using widgets, events, networking. It provides ideas on sensors, their types and writing programs based on sensor classes for application development. They will design and develop Mobile applications with the use of J2ME, like SMS, MMS, Gaming, Multimedia, JavaFX & Android.

Course Objectives:

While studying this course student will be able to

1. Understand Android history and its fundamentals and know the building blocks of android
2. Get idea on the creation of android user interface and its testing mechanisms
3. Identify the usage of threads, broadcast receivers, indents, services and their working methodology
4. Know about the storage mechanism in android using SQLite and the usage of content providers

5.Recognize the usage of android widgets and sensors in android based applications

UNIT- I INTRODUCTION AND INSTALLATION OF ANDROID TOOLS

Installation and Use of Android Tools: Installing the Android SDK - Anatomy of an Android Project Drawable Resources – XML Introduction - Creating user interface using XML – Overview of Android Building Blocks.

a) Develop an android application to display a simple text in the emulator

b) Develop an android application to display the internal keyboard in the emulator

UNIT- II USER INTERACTION

Input Components – Text View – Image View – List View and Alert Dialogues – Menus: Popup, Options and Context Menus – Screen Navigation through App Bar – Recycler View – Material Design – Testing the User Interface

a) Write an android program to display a message in the toast

b) Write an android program to input a text through a text and the same must be displayed in the toast when a button is clicked on the screen

c) Develop an application to perform 5 arithmetic operations: Addition, Subtraction, Multiplication, Division and Modulo operation with necessary user interface creation

d) Develop an android application to process a student mark list by creating proper UI using the necessary controls

UNIT-III THREADS, LOADERS AND ASYNCTASK LOADER, SERVICES

Threading in Android – AsyncTask – Loaders – AsyncTask Loader -Alarms and system services – Examples on alarms and services – Services: Services Life Cycle – Intent Service – Implementing Intent Service – Notifications.

1. Write an android application to create a calculator
2. Create an android UI that consists of Different Departments of a company namely Production, Finance, Marketing and HR. If the user clicks on any department it should show details of that department. Use indents.

UNIT IV: SAVING, RETRIEVING AND LOADING DATA:

Android File systems and Files, Databases on Android - SQLite - Status Contract Class, Update Refresh Service – Cursors – Backups - Content Providers: Overview – Role of Content Providers, Content Resolver.

a) Design an android application to display a list of items on the android screen. If the user clicks any one of the list items a dialogue box should show that the user has clicked that particular item (Use array adopters)
b) Develop an android application to show some categories such as education, entertainment, health, provisions etc., If the user clicks on any one of the items it should show the sub categories of the category and if is again clicked it should the details of those items. (Use indents and lists)
c) i. Design an android application to create a service that shows the service is running in the background in the form of a toast

UNIT-V APPLICATIONS WIDGETS, INTERACTION AND SENSORS

App Widgets: Creation of Application Widgets - Interaction and Animation- Sensors: Sensor API in Android - Motion Sensor, Position Sensor, Sensor Values, Sensor Manager Class, Sensor Event class, Sensor Event Listener.

a) Develop an android application to demonstrate the concept of Fragments in Android
b) Develop an android application to demonstrate the database connectivity with the SQLite database to post and retrieve data through the User Interface
(Example: Student mark list processing, Email Registration and Login, Products and sales)
c) Demonstrate the usage of Sensors in android by developing proper application.

Course Outcomes:

Upon successful completion of this course, students can able to:

1. Work on android basic components and Install android
2. Create User Interfaces with various Layouts and views using android building blocks
3. Work with Broadcast Receivers and Services
4. Create Database in Android, Store and Retrieve data using SQLite and Content Providers
5. Develop widgets, Wall papers for an android application and write programs based on Sensors

Text Books

1. Android Programming-The Big Nerd Ranch Guide, Bill Philips, Christ Stewart, Kristin Mariscano, Big Nerd Ranch publishers, 3rd Edition,2017

2. Android Programming for Beginners, John Horton, PACKT publishers,2018

3 Learning Android, By Marko Gargenta& Masumi Nakamura, O'Reilly, II Edition,2014

4 Android Application Development All in One for Dummies, Barry Burd, Wiley, 2nd Edition,2015

Reference Books

1. Android application Development-Black Book, Pradeep Kothari, dreamtech,2014

2. Android Programming - Unleashed, B.M.Harwani, Pearson Education, 2013

3 Head First Android Development: A Brain-Friendly Guide, Dawn Griffiths and David Griffiths, O'Reilly, 2nd Edition,2017
4 Android System Programming, Roger Ye, PACKT publishers,2017
5 Programming Android,ByZigurdMednieks,LairdDornin,G.BlakeMeike& Masumi Nakamura,O'Reilly,2011

Mode of Evaluation: Model Lab Examinations, External Lab End Examination

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course – II

20ENG601 CORPORATE COMMUNICATION

L	T	P	C
1	0	2	2

Pre-requisite: **18ENG201**

Course Description:

English is practical and it is a must for any institution to provide students with opportunities to indulge in actively applying their language skills. Thus the Communication Skills Lab facilitates students with adequate opportunities to put their communication skills in use. It also accommodates peer learning by engaging students in various interactive sessions. This lab will be accompanied by a practical lab component.

Course Objectives:

This course enables the students to –

1. Focus on their interactive skills
2. Develop their communicative competency
3. Fortify their employability skills
4. Empower their confidence and overcome their shyness
5. Become effective in their overall performance in the industry

UNIT I LISTENING SKILLS **8 hours**

Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures, discussions from TV/Radio/Podcast.

UNIT II SPEAKING **10 hours**

Articulation of sounds; Intonation.; Conversational skills (Formal and Informal); Group Discussion; Making effective Oral presentations**:** Role play.

UNIT III READING SKILLS **8 hours**

Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Reading different genres of texts ranging from newspapers to creative writing; Reading Comprehension.

UNIT IV WRITING SKILLS **9 hours**

Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion.
Writing job applications and resume; Emails; Letters; Memorandum; Reports; Writing abstracts and summaries; Interpreting visual texts.

UNIT V INTERVIEW SKILLS **10 hours**

Different types of interviews: Answering questions and offering information; Mock interviews; Body Language.

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Course Outcomes:

At the end of the course, learners will be able to—

1. Read articles from magazines and newspapers
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind, draft Reports and personal letters and emails in English.

Text Books:

1. Sanjay Kumar and Pushp Lata; Communication Skills; Oxford University Press, 2012.
2. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.
3. S.P. Dhanavel; English and Communication Skills for Students of Science and Engineering; Orient Blackswan, 2009.
4. M. Ashraf Rizvi; Effective Technical Communication; Tata Mc Graw Hill Co. ltd, 2005.

Reference:

1. Dr. M.Adithan; Study Skills for Professional Students in Higher Education; S.Chand & Co. Pvt., 2014.
2. Guy Brook Hart & Vanessa Jakeman; Complete IELTS: Cambridge University Press, 2014.
3. Vanessa Jakeman & Clare Mcdowell; Action Plan for IELTS: Cambridge University Press, 2006.
4. Guy Brook Hart; Instant IELTS; Cambridge University Press, 2004.
5. S.P.Bakshi & Richa Sharma; Descriptive General English; Arihant Publications, 2012.
6. Charles Browne, Brent Culligan 7 Joseph Phillips; In Focus (level 2); Cambridge University Press.
7. Steven Gershon; Present Yourself 2 (second edition); Cambridge University Press.
8. Leo Jones; Let's Talk 3 (second edition); Cambridge University Press.
9. Nutall J. C.; Reading Comprehension; Orient Blackswan.
10. www.cambridgeenglish.org/in/
11. https://learnenglish.britishcouncil.org/en/english-grammar
12. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course - III

20CSD603 MULTIMEDIA COMPUTING

L	T	P	C
1	0	2	2

Pre-requisite : NIL

Course Description:

This course provides interactive, computer-based applications that allow students to communicate ideas and information with digital and print elements. It helps to develop and manage online graphics and content. It provides an interaction between users and digital information.

Course Objectives:

This course enables students to

1. develop student's competency in producing dynamic and creative graphic solutions for multimedia productions.
2. Introduce the advanced scripting skills necessary for implementing highly interactive, rich internet applications using multimedia technologies and authoring tools.
3. Develop aesthetic value and competencies in multimedia authoring.
4. Learn visual style and layout design are stressed, as well as the editing and integration of graphic video, audio, images and animation, files.
5. Master industry-wide software and technologies to create highly interactive, rich internet applications.

UNIT I INTRODUCTION TO EDITING AND MULTIMEDIA TECHNOLOGIES 9 hours

Video editing is used to structure and present all video information, including films and television shows, video advertisements and video essays. Non-linear editing systems (NLE) allow video to be edited on computers with specialized software. Offline editing is the process by which raw footage is copied from an original source, without affecting the original film stock or video tape. Online editing is the process of reassembling the edit to full resolution video after an offline edit has been performed.

(a) Video Editing
(b) Audio Editing
(c) Image Editing

UNIT II PRINCIPLES OF ANIMATION 9 hours

The term 2D means 2 dimensional which means that an image for the animation can be moved in two-dimensional space that is X-axis and Y-axis. 3D animation is an animation that is created in three-dimensional space which makes the characters and objects appear realistic and lively. Thus, a 3D animation has height, width as well as depth.

(a) 2D Animation
(b) 3D Animation

UNIT III MULTIMEDIA TECHNOLOGIES 9 hours

Multimedia combines different media for text, sound, and images into one presentation to create a more enriched and entertaining message. Multimedia technologies include the machines and systems used to create and transmit these messages. You experience multimedia when you go to the movies, watch television, play video games, or explore Web sites on the Internet.

(a)Write a Program to create an animated e-card using adobe flash
(b)Write a Program to create an animation to indicate a ball bouncing on steps
(c)Write a Program to simulate a ball hitting another ball

UNIT IV MULTIMEDIA TECHNOLOGIES USING FLASH 9 hours

For computer-drawn animation, the beginning and ending images in a sequence are drawn first. The artist then saves the images to the animation program's memory. The computer fills in the images in between the beginning and the ending images. Feature-length animated films contain hundreds of thousands of separate digital images. Without the aid of computers, these films would take years to draw.

(a)Write a Program to change a circle into a square using flash
(b)Write a Program to perform motion tweening operation using flash

UNIT V VIDEO MOTION ANALYSIS 9 hours

In video and computer games, the graphics on the screen are always changing. Game software has many animation sequences and sounds stored in its memory. Each move you make with the controller tells the computer which sequence to run. As you play, you create a story.

(a)Write a Program to change and object shape using a shape tweening concept
(b)Write a Program to create a 24 spokes on a wheel using flash

Course Outcomes:

After completing this course, students will be able to

1. Describe different realizations of multimedia tools and the way in which they are used.
2. Compare various data compression schemes.
3. Analyse user interface for a given application.
4. Ability to apply different multimedia development tools to produce web based and standalone user interfaces.
5. Demonstrate 2D and 3D animations using animation software.

Text Book(s)

1. "Fundamentals of Multimedia" by Ze-Nian Li and Mark S. Drew, PHI Learning, 2004.
2. "AJAX, Rich Internet Applications, and Web Development for Programmers" by Paul J Deitel and Harvey M Deitel, Deitel Developer Series, Pearson Education, 2008. (UNITS 4,5)

Reference Books

1. "Professional Adobe Flex 3" by Joseph Balderson, Peter Ent, et al, Wrox Publications, Wiley India, 2009
2. "Multimedia Communications: Applications, Networks, Protocols and Standards" by Fred Halsall, Pearson Education, 2001, RP 2005

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course - III

20CSD604 R PROGRAMMING FOR DATA SCIENCE

L	T	P	C
1	0	2	2

Pre-requisite : Basic programming concepts and mathematical concepts

Course Description:

This course is designed to introduce the fundamentals of R programming and its application in data analysis. R is a powerful and widely-used programming language specifically designed for statistical computing and data manipulation. Throughout the course, students will learn how to utilize R for data analysis, visualization, and basic statistical operations.

Course Objectives:

This course enables students to

1. Provide a solid understanding of R programming language and its syntax.
2. Manipulate and analyze data using R.
3. Introduce basic statistical operations and their implementation in R.
4. Enable students to create meaningful data visualizations using R.
5. Introduce data import/export techniques for seamless data handling.
6. Provide an introduction to machine learning concepts and decision trees in R.

UNIT I INTRODUCTION TO R AND BASIC SYNTAX 9 hours

Overview of R and its applications in data analysis - Installing R and RStudio - R Syntax: Variables, data types, basic operations - Working with R console and scripts - R packages and their installation

1.Study of basic Syntax's in R.

UNIT II CONTROL STRUCTURES, FUNCTIONS, AND DATA STRUCTURES 9 hours

Implementation of loop control structures: for, while, if-else - Understanding and creating functions in R - Working with lists and vectors in R - Vector operations and functions

1. Implementation of loop control structures.
2. Learn to implement Functions in R
3. List, Vector operations in R language.

UNIT III MATRICES, ARRAYS, AND FACTORS 9 hours

Creation and manipulation of matrices in R - Array implementation and operations - Understanding factors and their use in R

1. Implementation of matrix operations in R.
2. Implementation and use of array and factors in R.

UNIT IV DATA FRAMES AND BASIC STATISTICAL OPERATIONS 9 hours

Implementation and use of data frames in R - Data manipulation and exploration - Basic statistical operations: mean, median, variance, standard deviation, etc.

1. Implementation and use of data frames in R.
2. Learn basic statistical Operations using R

B. Tech Computer Science & Engineering (Data Science)

UNIT V **DATA VISUALIZATION, DATA IMPORT/EXPORT, AND MACHINE LEARNING** **9 hours**

Data visualization using R: ggplot2 and other libraries - Importing and exporting data from Excel and CSV files - Introduction to machine learning with decision trees - Implementation of regression using decision trees in R - Implementation of classification using decision trees in R

1. Implementation of Data Visualization in R.
2. Import and export data from excel and csv files and perform analytics on it.
3. Implementation of Regression with decision tree in R.
4. Implementation of Classification with decision tree in R.

Course Outcomes:

After completing this course, students will be able to

1. Utilize R programming language proficiently for data analysis tasks.
2. Manipulate data using vectors, matrices, and data frames.
3. Create meaningful data visualizations with R's plotting libraries.
4. Perform basic statistical operations for data analysis.
5. Implement decision trees for regression and classification tasks in R.

Text Book(s)

1. R for Data Science" by Hadley Wickham and Garrett Grolemund, O'Reilly Media, 2021.

Reference Books

1. "An Introduction to Statistical Learning with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tib shirani, Springer, 2017.
2. "Advanced R" by Hadley Wickham, CRC Press, Second Edition, 2019.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course - IV

20CSD605 - FULL STACK DEVELOPMENT

L	T	P	C
1	0	2	2

Pre-requisite: NIL

Course Description:

Full Stack Web Development course will help students become masters in front-end technology. It provides basic information and experiments to grow to be a Full-Stack web developer. With fast growing technologies, the students can update their knowledge of technologies. This will help the students to learn the complete set of process like designing development and deployment.

Course Objectives:

This course enables students to

1. Build web applications using HTML, JavaScript, CSS, and PHP with client-side validations.
2. Create and integrate Plug-ins with jQuery (Events, Animation).
3. Build XML documents with DTD, Schemas, and style sheets.
4. Develop a web application with database interaction using Node JavaScript and Angular JavaScript
5. Implement MongoDBModels.

UNIT I INTRODUCTION TO HTML & CSS 6 hours

History of HTML/XHTML/HTML5, HTML5 New Features, HTML5 vs HTML4 vs XHTML, Structural, Content, Application-focused tags, Deprecated elements. History of CSS, The Power of CSS, Selectors and Pseudo Classes, Fonts and Text Effects, Colors.

(a). Develop static pages (using only HTML) of an online ticket reservation.
(b). Design a website using style sheets so that the pages have uniform style.

UNIT II INTRODUCTION TO JAVASCRIPT 7 hours

Introduction to JavaScript, Comments, Variables, Exploring JavaScript Data Types, Popup Boxes, Objects, Functions, Conditions, Loops, JavaScript Break and Continue, Error handling, Form. Validation, RegExp Object, String Object, Date Object

(a). Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference, and quotient.
(b). Design a form and validate all the controls placed on the form using Java Script.
(c). Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays. “TEXTSHRINKING” in BLUE color. Then the font size decreases to 5pt.

UNIT III INTRODUCTION TO PHP 9 hours

Overview of PHP Data types and Concepts: Variables and data types, Operators, Expressions and Statements. Advanced Concepts: Using Sessions, authenticating users. PHP and Database Access: Basic Database Concepts, connecting to a MYSQL database, Retrieving and Displaying results, Modifying, Updating and Deleting data.

(a). Write a PHP program to store page views count in SESSION, to increment the count on each. refresh, and to show the count on web page.
(b). Design Webpage for Data collection, store, retrieve and manipulate data using SQL database. using PHP

UNIT IV INTRODUCTION TO JQUERY, NODEJS AND ANGULAR JS 9 hours

Introduction to jQuery, Installation, Selectors, Events, Effects, Callbacks, jQuery, and HTML, jQuery. Introduction to Node JS, Advantage of Node JS, File System: Using file operation (open, read, write, and delete). Introduction to AngularJS: What is Angular JS? Why Angular JS? Features of Angular JS. Working with Angular JS forms.

(a). Working on Blink text using jQuery.
(b). Using jQuery right click to toggle background color.
(c). Develop a Form and validate using Angular JS
(d). Working on file write, read, and delete using Node.js

UNIT V INTRODUCTION TO XML & MONGODB 9 hours

Introduction to XML, Creating ML Documents, Creating XML DTDs, XMLSchemas, XSL. Introduction to MongoDB – Data Modelling, Data Types.

(a). Design an XML document to store information about a student. The information must include Roll no, Name, and Name of the College, Branch, Year of Joining, and email id. Make up. sample data for 3 students. Create a CSS style sheet and use it to display the document.
(b). Implement MongoDB data models.

Course Outcomes:

After completing this course, students will be able to

1. Design pages with HTML and CSS attributes.
2. Design and develop web applications with the support of client-side validations.
3. Use well-formed XML documents and develop PHP scripts with may support of object-oriented features.
4. Manage the session in web browser through Sessions and able to communicate with other web pages through form GET and POST methods.
5. Design and develop web applications with the database interactions (thorough MongoDB) and apply Node JavaScript and Angular JavaScript for faster performance.

Textbook(s)

1. PHP 5 Recipes A problem Solution Approach Lee Babin, Nathan A Good, Frank M. Kromann and Jon Stephens.
2. HTML & CSS: The Complete Reference, Thomas. A Powel “Fifth Edition” Kindle Edition,2017.
3. Professional Angular JS, Valeri Karpov and Diego Netto, John Willey Edition.
4. Beginning Node.JS by Basarat Syed, 2014.
5. MongoDB Basics 1st ed. Edition by Peter Membrey (Author), David Hows (Author), Eelco Plugge (Author)

Reference Books

1. Web Coding Bible, An Accelerated Course, Chong Lip Phang, 2015
2. Java Script for ProgrammersPaul J. Deitel, Deitel & Associates, Inc.Harvey M. Deitel, Deitel& Associates, Inc.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course – IV

20CSD406 UML DESIGN

L	T	P	C
1	**0**	**2**	**2**

Pre-requisite : **None**

Course Description:

This course will give an overview of UML and how to use UML diagrams and views to support requirements, architectural and systems design. The main contents are using case diagram, class diagram, sequence diagram, state diagram, activity diagram, component diagram and deployment diagram of UML. CASE tool of UML is used to analyse and design the course project systems.

Course Objectives:

This course enables students to

1. To analyze and design solutions to problems using object-oriented approach.
2. To make the student to learn and apply the process of object-oriented analysis and design to solve complex problems with the different applications.

UNIT I INTRODUCTION **9 hours**

Introduction about Object Orientated Technology, Development and OO Modeling, History, Modeling design Technique.

1. To develop a problem statement.
2. 2.Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart)

UNIT II INTERACTION MODELING **9 hours**

Object and class concepts, link and association, Generalization, Inheritance, Use case Models, Activity model.

1. Identify Use Cases and develop the Use Case model.
2. Identify the business activities and develop an UML Activity diagram.
3. Identity the conceptual classes and develop a domain model with UML Class diagram.

UNIT III BEHAVIORAL MODELING **9 hours**

Event, state, Transition and conditions, state diagram, state diagram, behaviour, concurrency, State models

1. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
2. Draw the State Chart diagram.

UNIT IV LOGICAL ARCHITECTURE AND UML PACKAGE DIAGRAMS **9 hours**

Layers-User Interface, Technical Services layer, Domain objects layer, Software architecture, UML package diagrams

1.Identify the User Interface, Domain objects, and technical services.
2.Draw the partial layered, logical architecture diagram with UML package diagram notation.
3. Implement the Technical services layer.
4. Implement the Domain objects layer.
5. Implement the User Interface layer

UNIT V Architectural Modeling 9 hours

Architectural Modeling: Components, Deployment, Component diagrams, Deployment diagrams Common modeling techniques

1. Draw Component and Deployment diagrams.

Suggested domains for Mini project

1. Passport automation system
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management System

Course Outcomes:

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

1. Analyse problems using object-oriented approach.
2. Design structural and behavioral diagrams.
3. Apply forward engineering to the given problems.
4. Design object-oriented models using UML.
5. Develop real time applications using object oriented concept

Text Book(s)

1. "The Unified Modeling Language User Guide" by Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, 2nd Edition.

Reference Books

1. "Design Patterns: Elements of Reusable Object Oriented Software" by Erich Gamma, Richard Belm, Ralph Johnson, John Vlissides, Addison-Wesley, 1994.
2. "Fundamentals of Object Oriented Design in UML" by Meilir Page-Jones, Pearson Education, 2000.
3. "Object Oriented Analysis & Design" by Atul Kahate, McGraw-Hill, 2004.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course IV

20CSD607 DevOps

L	T	P	C
1	**0**	**2**	**2**

Pre-requisite : Software Testing, Web Development Basics, Cloud Computing

Course Description:

The DevOps Lab is an immersive hands-on course that equips students with practical experience in applying DevOps principles and tools. Through guided exercises and real-world projects, students will learn to implement version control with Git, automate web testing using Selenium, build CI/CD pipelines, provision infrastructure with IAC tools, utilize Docker and Kubernetes for containerization, and master monitoring solutions. Ideal for software developers, DevOps engineers, and IT professionals, this lab empowers participants to enhance software delivery efficiency and quality.

Course Objectives:

This course enables students

1. To learn DevOps principles and methodologies.
2. To gain hands-on experience in DevOps tools like Git, Selenium, Docker, and Kubernetes.
3. To implement automated web testing using Selenium.
4. To build and optimize CI/CD pipelines for efficient software delivery.
5. To enhance collaboration and efficiency between development and operations teams.

UNIT I Introduction **9 hours**

Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

1. Implementing Continuous Integration with Version Control
2. Setting Up a Scrum or Kanban Board for Task Management

UNIT II SOFTWARE DEVELOPMENT MODELS AND DEVOPS **9 hours**

DevOps Lifecycle for Business Agility, DevOps and Continuous Testing. DevOps influence on Architecture**:** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

1. Implementing Continuous Testing in the DevOps Lifecycle
2. Microservices Architecture and Resilience in DevOps

UNIT III INTRODUCTION TO PROJECT MANAGEMENT **9 hours**

The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

3. Create a new Git repository and add a README file to it. Commit the changes and push them to the remote repository.
4. Create a new branch called "MITS" and make some changes to a file. Commit the changes and merge the branch with the main branch.
5. Use Git log to view the commit history of a repository and find the commit hash of a specific commit.
6. Clone a Git repository from a remote repository.
7. Push the changes from the local repository to the remote repository.

UNIT IV Introduction to Selenium and Automated Web Testing 9 hours

Overview of Automated Web Testing - Setting up the Selenium Environment - Inspecting Web Elements with Selenium - Facebook Login Automation with Selenium- Automated Testing of Google Homepage

1. Open an edge browser and inspect any one web element in Google homepage using selenium.
2. Open a Facebook login page in edge browser and authenticate your account details and display your facebook homepage using selenium.
3. Open a Google home page in edge browser and test all the web elements present in the homepage using selenium.

UNIT V TESTING AND DEVELOPMENT 9 hours

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

5. Basic Dockers Commands
6. Build and run an HTML webpage displaying "Hello, World!" using Dockers.
7. Build a Dockers image based on the official alpine image that installs the Nano text editor. Run a container from this image and verify that you can use Nano inside the container.
8. Build a Dockers image that pulls MySQL image and execute it with simple query in terminal.
9. Build a Dockers image that pulls MySQL image and create a database using phpmyadmin..

Course Outcomes:

After completing this course, students will be able

1. To understand the key principles and practices of DevOps.
2. To demonstrate proficiency in using essential DevOps tools like Git, Selenium, Docker, and Kubernetes.
3. To successfully implement automated web testing using Selenium for web applications.
4. To create and optimize CI/CD pipelines for streamlined software delivery.
5. To foster collaboration and efficiency within development and operations teams to improve software development processes..

Text Book(s)

1. "The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations" by Gene Kim, Patrick Debois, John Willis, and Jez Humble.IT Revolution Press. 2016

Reference Books

1. "Selenium WebDriver Recipes in Python: The problem-solving guide to Selenium WebDriver in Python" by Zhimin Zhan. Leanpub Publishing, 2018

2. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley.Addison-Wesley, 2010

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course – V

20CSD608 BLOCKCHAIN DEVELOPMENT

L	T	P	C
1	0	2	2

Pre-requisite: **Cryptography and Network Security**

Course Description:

A blockchain is a decentralized, distributed, and public digital ledger that is used to record transactions across many computers so that the record cannot be altered retroactively without the alteration of all subsequent blocks and the consensus of the network.

This course provides a broad overview of the essential concepts of blockchain technology and by initially exploring the Bitcoin protocol followed by the Ethereum protocol. It familiarizes with the functional/operational aspects of cryptocurrency eco-system.

Course Objectives:

This course enables students to

1. Understand the importance of fundamentals of blockchain technology
2. Acquire knowledge about cryptography and algorithms.
3. Understand the knowledge in the concepts of bitcoin and consensus algorithms.
4. Implement decentralized blockchain-based software using etherium
5. Examine the needed frameworks, standards, tools and libraries to build blockchains and related applications using Hyper ledger.

UNIT I INTRODUCTION TO BLOCKCHAIN 9 hours

Introduction to Blockchain Technology - The growth of blockchain technology - Distributed systems - The history of blockchain - Benefits and limitations of blockchain - Types of blockchain - Consensus - CAP theorem and blockchain - Decentralization using blockchain - Methods of decentralization - Routes to decentralization - Platforms for decentralization

3. Write a simple program for the creation of blocks.
4. Create a simple blockchain using.
5. Write a program for implementing distributed systems.

UNIT II CRYPTOGRAPHY IN BLOCKCHAIN 9 hours

Cryptography in Blockchain: Introduction - Cryptographic primitives - Symmetric Cryptography - Data Encryption Standard (DES) - Advanced Encryption Standard - Asymmetric Cryptography - public and private keys - RSA - Secure Hash Algorithms.

1. Write a program for reading a content from the file and generate message digest.
2. Write a java program for implementing SHA
3. Write a java program for implementing DES

UNIT III INTRODUCTION TO BITCON 9 hours

BitCoin - Introduction – Transactions - Structure - Transactions types – Blockchain - Wallets and its types - Bitcoin payments - Bitcoin improvement proposals (BIPs) - Bitcoin investment and buying and selling bitcoins - Bitcoin installation - Bitcoin limitations - Consensus Algorithms - Smart Contract - History of Smart Contract - Ricardian contracts

1. Write program for creating merkle root.
2. Write program for adding transactions to the blockchain.
3. Write a program for implementing proof of work consensus algorithm

UNIT IV ETHEREUM 9 hours

Ethereum - The yellow paper - The Ethereum network - Ethereum block chain - Components of the Ethereum block chain - Accounts and its types - The Ethereum Virtual Machine - Blocks and blockchain - Mining - Wallets - Applications developed on Ethereum - Scalability and security issues - Blockchain usecases in Banking & Financial Service

1. Using solidity, create a smartcontract named MYCONTRACT and try to work with different types of variables.
2. Create a smartcontract called EXCEPTION that triggers three types of exception: require, assert and revert.
3. Create a smartcontract that deposits and withdraw money form the account.
4. Write a smart contract that automates lottery system.

UNIT V HYPERLEDGER 9 hours

Hyperledger as a protocol - The reference architecture - Fabric - Hyperledger Fabric - Distributed Ledger - Sawtooth lake - Corda - Hyperledger projects.

2. Install Hyperledger Fabric and docker containers.
3. Create a chaincode for voting application.
4. Create a chaincode for supply chain management system

Course Outcomes:

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

1. Understand the fundamentals of blockchain technology.
2. Obtain knowledge on analysing various cryptographic algorithms.
3. Implement Bitcoin to develop solutions in the appropriate domains.
4. Devise a decentralized blockchain-based software Ethereum
5. Apply Hyperledger Fabric to implement the Block chain Application.

Text Book(s)

1. "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained" by Imran Bashir, Packt Publishing, 2nd Edition, 2018.

Reference Books

1. "Bitcoin and Cryptocurrency Technologies a Comprehensive Introduction" by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, Princeton University Press, 2016.
2. "Blockchain:The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming" by Josh Thompson, Create Space Independent Publishing Platform, 2017.
3. "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols" by Merunas Grincalaitis, Packt Publishing, 2019.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course – V

20CSD609 CRYPTOGRAPHY ALGORITHMS

L	T	P	C
1	0	2	2

Pre-requisite: Linear Algebra, Computer Networks

Course Description:

This course covers the principles and practices of cryptography. The fundamental topics of attacks, attack model, and few classical techniques are introduced. Symmetric and Asymmetric ciphers are illustrated. Message authentication and Hash functions are exemplified. Also, practical exposure on encryption algorithms, authentication techniques.

Course Objectives:

This course enables students to

6. Understand the basic categories of threats to computers and networks
7. Learn the Symmetric cryptographic algorithms.
3. Learn the Asymmetric cryptographic algorithms
4. Understand cryptographic Hash Functions
5. Understand message authentication and Digital Signature

UNIT I Ciphers 9 hours

Overview: The OSI security Architecture, security Attacks, Security Services, Security Mechanisms, A model for Network Security.

Classical Encryption Techniques:

Symmetric Cipher model, substitution techniques, Transposition Techniques.

Exercise:

1. a) Implementation of Caesar cipher
   b) Implementation of playfair cipher
   c) Implementation of Column transposition

UNIT II Block ciphers and Data Encryption Standard: 9 hours

Block cipher principles, Data Encryption Standard (DES),DES Example, The Strength of DES, Differential and Linear cryptanalysis, Block cipher design principles.

Advanced Encryption Standard:

The Origins AES, AES Structure, AES round functions, AES Key Expansion, An AES Example

Exercise:

2**.** Implementation of AES

UNIT III Public –Key Cryptography 9 hours

Number Theory: Prime Numbers, Fermat's Theorem, Euler's Theorem, Testing for primality, The Chinese Remainder Theorem, Discrete Logarithms.

Public –Key Cryptography and RSA:

Principles of Public-Key Cryptosystems, RSA Algorithm, Diffie-Hellman key exchange, ElGamal cryptosystems, Elliptic curve cryptography

Exercise:

3. a) Implementation of RSA Algorithm
   b) Implementation of Diffie-Hellman Algorithm

UNIT IV Cryptographic Hash Functions 9 hours

Stream Ciphers and Pseudorandom number generation :
Principles of Pseudorandom number generation, Pseudorandom number generators, Pseudorandom number generation using a block cipher, stream ciphers, RC4
Cryptographic Hash Functions: Applications of cryptographic Hash Functions,
Two simple hash functions, requirements and security, Hash functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.
Exercise:
4. a) Implementation of RC4 Algorithm
   b) Implementation of SHA-3 Algorithm

UNIT V Digital Signatures 9 hours

Message Authentication Codes: Message Authentication Reqirements, Message Authentication functions, Message Authentication codes, security of MAC's, HMAC
Digital Signatures: Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital signature scheme, Digital Signature Standard(DSS).
Exercise:
5. a)Implementation of HMAC
   b)Implementation of DSS

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Implement classical Encryption Techniques
2. Apply symmetric key cryptographic algorithms
3. Experiment with various asymmetric key cryptographic algorithms
4. Execute stream cipher algorithms and hash algorithms
5. Make use of Authentication functions

Text Book(s)
1. "Cryptography and Network Security - Principles and Practice" by William Stallings, Pearson Education, 7th Edition, 2017.

Reference Books
1. "Cryptography and Network Security" by C K Shyamala, N Harini and Dr T R Padmanabhan, Wiley, 1st Edition, 2011.
2. "Cryptography and Network Security" by Forouzan and Mukhopadhyay, McGraw Hill, 2nd Edition, 2010.
3. "Cryptography and Network Security" by Atul Kahate, McGraw Hill, 3rd Edition, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Skill Oriented Course – V

20CSD610 ADVANCED MACHINE LEARNING

L	T	P	C
1	0	2	2

Pre-requisite: Machine Learning

Course Description:

This course helps the students to understand and implement advanced Machine Learning (ML) algorithms such as Exploratory Data Analysis, Dimensionality Reduction techniques, cross-validation on a learning problem, Apriori algorithm, FP-Growth algorithm, K-means clustering, hierarchical clustering algorithms, DBSCAN clustering algorithm, density-based clustering, graph-based clustering, Web scraping.

Course Objectives:

This course enables students to

1. Understand feature engineering techniques in machine learning
2. Learn simple regression algorithms
3. Apply comparative analysis among simple and advanced regression algorithms
4. Explore various types of clustering methods
5. Analyze feature extraction in NLP and object detection techniques using OpenCV

UNIT I INTRODUCTION **9 hours**

Exploratory Data Analysis (EDA), Outliers, Dimensionality Reduction, Apriori Algorithm, FP-Growth Algorithm

1) Implement a program to perform Exploratory Data Analysis on real time datasets using the following approaches: a) Univariate Analysis b) Multivariate Analysis c) Visualization using correlation matrix
2) Implement a program to generate Association Rules using the Apriori algorithm
3) Implement a program to generate Association Rules using the FP-Growth algorithm

UNIT II SIMPLE REGRESSION **9 hours**

Simple Linear Regression, Multiple Linear Regression, One Hot Encoding, Polynomial Linear Regression

1) Implement a program to evaluate r2_score for finding the accuracy using simple linear regression
2) Implement a program to perform multiple linear regression model for predicting house prices
3) Implement a program to convert textual data into numeric data using one hot encoding

UNIT III ADVANCED REGRESSION **9 hours**

Ride Regression, Lasso Regression, Elastic net Regression, Logistic Regression: binary classification and multi-class classification

1) Implement a program using Ridge Regression to predict height depending on weight
2) Implement a program using Lasso regression on Boston house prices and select the best feature that mostly influences the price of the house
3) Apply binary and multi-class classification techniques to develop a program using logistic regression

UNIT IV CLUSTERING **9 hours**

K-Means, Hierarchical, DBSCAN, density-based, graph-based clustering algorithms

1) Develop a program to implement K-means clustering algorithm
2) Implement a program for density-based clustering algorithm
3) Implement a program for graph-based clustering algorithm

UNIT V NLP and Computer Vision **9 hours**

Tokenization, Stemming, Lemmatization, Stop words, Parts of Speech (Pos), Count Vectorizer
Face Detection, Contours

1) Implement a program to extract SURF/SIFT feature using OpenCV on a sample image
2) Develop a program to eliminate multiple rectangular boxes

Course Outcomes:

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

1. Understand various Feature Extracting, Feature Engineering techniques and Exploratory Data Analysis on real time datasets
2. Develop various simple regression techniques
3. Implement various advanced regression techniques
4. Develop clusters from real time data using various Clustering Algorithms
5. Implement bag of words and object detection techniques using NLP and computer vision

Text Book(s)

1. "Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems" by Dipanjan Sarkar, Raghav Bali and Tushar Sharma, Apress, 2018.

Reference Books

1. "Machine Learning" by Sikar Dutt, Subramanian Chandramouli and Amit Kumar Das, Pearson, 2022.
2. "Mastering Machine Learning with Python in Six Steps -A Practical Implementation Guide to Predictive Data Analytics Using Python" by Manohar Swamynathan, Apress, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

HONORS

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD101 FEDERATED MACHINE LEARNING

L	T	P	C
3	0	0	3

Pre-requisite: Machine learning

Course Description:

This course teaches theoretical foundations and efficient algorithms for federated learning (FL) applications. FL is an umbrella term for training machine learning models in a collaborative fashion from distributed collections of data. FL techniques are privacy friendly as they do not require to share raw data between nodes but only model parameter updates. You will learn how to formulate FL applications as a regularised empirical risk minimisation and solve it using distributed implementations of gradient descent.

Course Objectives:

This course enables students to

1. Introduce the fundamental concepts of federated learning.
2. Get familiar with key concept of distributed machine learning.
3. Understand horizontal and vertical federated learning.
4. Analyze the design for federated learning.
5. Understand the significance of Federated Learning for Vision, Language, and Recommendation

UNIT I INTRODUCTION 9 hours

Motivation, Federated Learning as a Solution, The Definition of Federated Learning, Categories of Federated Learning, Current Development in Federated Learning, Research Issues in Federated Learning, Open-Source Projects, Standardization Efforts, The Federated AI Ecosystem.

UNIT II DISTRIBUTED MACHINE LEARNING 9 hours

Introduction to DML, The Definition of DML, DML Platforms, Scalability-Motivated DML, Large-Scale Machine Learning, Scalability-Oriented DML Schemes, Privacy-Motivated DML, Privacy-Preserving Decision Trees, Privacy-Preserving Techniques, Privacy Preserving DML Schemes, Privacy-Preserving Gradient Descent, Vanilla Federated Learning, Privacy Preserving Methods.

UNIT III HORIZONTAL AND VERTICAL FEDERATED LEARNING 9 hours

Horizontal Federated Learning: The Definition of HFL, Architecture of HFL, The Client- Server Architecture, The Peer-to-Peer Architecture, Global Model Evaluation, The Federated Averaging Algorithm, Federated Optimization, The FedAvg Algorithm, The Secured FedAvg Algorithm, Improvement of the FedAvg Algorithm, Communication Efficiency, Client Selection.

Vertical Federated Learning: The Definition of VFL, Architecture of VFL, Algorithms of VFL, Secure Federated Linear Regression, Secure Federated Tree-Boosting.

UNIT IV FEDERATED TRANSFER LEARNING 9 hours

Heterogeneous Federated Learning, Federated Transfer Learning, The FTL Framework, Additively Homomorphic Encryption, The FTL Training Process, The FTL Prediction Process, Security Analysis, Secret Sharing-Based FTL Incentive Mechanism.

Design for Federated Learning: Paying for Contributions, Profit- Sharing Games, Reverse Auctions, A Fairness-Aware Profit-Sharing Framework, Modeling Contribution, Modeling Cost, Modeling Regret, Modeling Temporal Regret, The Policy Orchestrator, Computing Payoff Weightage.

UNIT V FEDERATED LEARNING FOR VISION, LANGUAGE, AND RECOMMENDATION **9 hours**

Federated Learning for Computer Vision, Federated CV, Federated Learning for NLP, Federated NLP, Federated Learning for Recommendation Systems, Recommendation Model, Federated Recommendation System.

Course Outcomes:

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

1. Knowledge of the basic concepts, architecture, and applications of FL.
2. Understand the key concepts of distributed machine learning.
3. Analyze horizontal and vertical federated learning.
4. Design for federated learning.
5. Apply the Federated Learning for Vision, Language, and Recommendation

Text Book(s)

1. "Federated Learning (Synthesis Lectures on Artificial Intelligence and Machine Learning)" by Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, and Han Yu, 2019.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD102 BUSINESS INTELLIGENCE

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course introduces the concepts of business intelligence (BI) as components and functionality of information systems. It explores how business problems can be solved effectively by using operational data to create data warehouses, and then applying data mining tools and analytics to gain new insights into organizational operations. Detailed discussion of the analysis, design and implementation of systems for BI, including: the differences between types of reporting and analytics, enterprise data warehousing, data management systems, decision support systems, knowledge management systems, big data and data/text mining. Case studies are used to explore the use of application software, web tools, success, and limitations of BI as well as technical and social issues.

Course Objectives:

1. Introduce the concepts and components of Business Intelligence (BI)
2. Evaluate the technologies that make up BI (data warehousing, OLAP)
3. Define how BI will help an organization and whether it will help yours
4. Identify the technological architecture that makes up BI systems
5. Plan the implementation of a BI system

UNIT I INTRODUCTION 9 hours

Introduction - History and Evolution: Effective and Timely decisions, Data Information and Knowledge, Architectural Representation, Role of mathematical Models, Real Time Business Intelligent System.

UNIT II BI – DATA MINING & WAREHOUSING 9 hours

Data Mining - Introduction to Data Mining, Architecture of Data Mining and How Data mining works (Process) , Functionalities & Classifications of Data Mining, Representation of Input Data, Analysis Methodologies.

Data Warehousing - Introduction to Data Warehousing, Data Mart, Online Analytical Processing (OLAP) – Tools, Data Modelling, Difference between OLAP and OLTP, Schema – Star and Snowflake Schemas, ETL Process – Role of ETL

UNIT III BI – DATA PREPARTTION 9 hours

Data Validation - Introduction to Data Validation, Data Transformation – Standardization and Feature Extraction, Data Reduction – Sampling, Selection, PCA, Data Discretization.

UNIT IV BI – DATA ANALYTICS PROCESS 9 hours

Analytics Process - Introduction to analytics process, Types of Analytical Techniques in BI – Descriptive, Predictive, Perspective, Social Media Analytics, Behavioral, Iris Datasets

UNIT V IMPLEMENTATION OF BI – ANALYTICS PROCESS 9 hours

Operational Intelligence: Technological – Business Activity Monitoring, Complex Event Processing, Business Process Management, Metadata, Root Cause Analysis.

Course Outcomes:

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

1. Understand the essentials of BI & data analytics and the corresponding terminologies
2. Analyze the steps involved in the BI - Analytics process.
3. Illustrate competently on the topic of analytics.
4. Understand & Implement the K-Means Clustering with Iris Dataset.
5. Demonstrate the real time scenario (Case study) by using BI & Analytics techniques

Text Book(s)

1. Carlo-Vercellis, "Business Intelligence Data Mining and Optimization for Decision-Making", First Edition.
2. Drew Bentely, "Business Intelligence and Analytics" ,@2017 Library Pres., ISBN: 978-1-9789- 2136-8.

Reference Books

1. Larissa T. Moss & Shaku Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications", First Edition, Addison-Wesley Professional,2003

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD103 ADVANCED ALGORITHMS

L	T	P	C
3	0	0	3

Pre-requisite: Computer Programming and Data Structure

Course Description:
Advanced algorithms build upon basic ones and use new ideas. We will start with networks flows which are used in more typical applications such as optimal matchings, finding disjoint paths and flight scheduling as well as more surprising ones like image segmentation in computer vision.

Course Objectives:

1. Introduces the recurrence relations for analyzing the algorithms.
2. Introduces the graphs and their traversals.
3. Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate.
4. Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Introduces string matching algorithms.
6. Introduces linear programming.

UNIT I **9 hours**

Introduction: Role of Algorithms in computing, Order Notation, Recurrences, Probabilistic Analysis and Randomized Algorithms. Sorting and Order Statistics: Heap sort, Quick sort and Sorting in Linear Time.
Advanced Design and Analysis Techniques: Dynamic Programming- Matrix chain Multiplication, Longest common Subsequence and optimal binary Search trees.

UNIT II **9 hours**

Greedy Algorithms - Huffman Codes, Activity Selection Problem. Amortized Analysis.
Graph Algorithms: Topological Sorting, Minimum Spanning trees, Single Source Shortest Paths, Maximum Flow algorithms.

UNIT III **9 hours**

Sorting Networks: Comparison Networks, Zero-one principle, bitonic Sorting Networks, Merging Network, Sorting Network.
Matrix Operations- Strassen's Matrix Multiplication, inverting matrices, Solving system of linear Equations

UNIT IV **9 hours**

String Matching: Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, Knuth- Morris - Pratt algorithm.

UNIT V **9 hours**

NP-Completeness and Approximation Algorithms: Polynomial time, polynomial time verification, NP-Completeness and reducibility, NP-Complete problems. Approximation Algorithms- Vertex cover Problem, Travelling Salesperson problem

Course Outcomes:

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

1. Ability to analyze the performance of algorithms.
2. Ability to choose appropriate data structures and algorithm design methods for a specified application.
3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.

Text Book(s)

1. Introduction to Algorithms," T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, Third Edition, PHI.

Reference Books

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd.
2. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson
3. Algorithm Design: Foundations, Analysis and Internet examples, M.T. Goodrich and R. Tomassia, John Wiley and sons.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD104 NoSQL

L	T	P	C
3	0	0	3

Pre-requisite: Basic Knowledge about DBMS

Course Description:

Introduction to non-relational (NoSQL) data models, such as Key-Value, Document, Column, Graph and Object-Oriented database models. Advantages and disadvantages of the different data architecture patterns will be discussed. Hands-on experience with a representative sample of open-source NoSQL databases will be provided. The rapid and efficient processing of data sets with a focus on performance, reliability, and agility will be covered. Big Data distributed and cloud computing concepts will be introduced. Intended for students with previous programming experience.

Course Objectives:

1. Explain and compare different types of NoSQL Databases
2. Compare and contrast RDBMS with different NoSQL databases.
3. Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4. Explain performance tune of Key-Value Pair NoSQL databases.
5. Apply Nosql development tools on different types of NoSQL Databases

UNIT I **9 hours**

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points

UNIT II **9 hours**

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT III **9 hours**

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT IV **9 hours**

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency,

Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT V **9 hours**

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases

Course Outcomes:

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

1. Define NoSQL, its characteristics and history, and the primary benefits for using NoSQL databases
2. Define the major types of NoSQL databases including a primary use case and advantages/disadvantages of each type
3. Create wide-column, document, key-value, graph and object-oriented databases, add content, and run queries
4. Describe the NoSQL data architecture patterns
5. Use NoSQL to manage Big Data.
6. Develop NoSQL desktop and cloud database solutions.

Text Book(s)

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

WEB REFERENCES:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-datab

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD105 INTELLIGENT AGENTS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:

Intelligent agents are software programs that can sense their environment, choose rational actions based on their percepts, and execute these actions. If an agent does all of this without the aid of a human, then it is generally considered autonomous. Often, agents interact with other agents, either by cooperating or competing; such environments are called multiagent systems. Agents can be embedded in completely electronic environments such as the Web or a simulation or may actually be robots "living" in the real world. The potential applications of agents are numerous -- including web search assistants, travel advisors, electronic secretaries, bidders in on-line auctions, tutoring systems, and actors in games or simulations. The course will cover the underlying theory of agents, the common agent architectures, methods of cooperation, and the potential applications for agents. In order to gain a better understanding of the concepts, students will construct their own agents for solving different types of problems.

Course Objectives:

1. Determine the fundamental concepts, depictions, and processes for Designing.
2. Improve reinforcement learning model for real world problems.
3. Get to use of language models for various NLP tasks.
4. Model Agent’s contributions awareness and preprocessing practices.
5. Create and execute machine hardware and software.

UNIT I INTELLIGENT AGENTS 9 hours

Agents and environments, good behavior: The concept of rationality, The nature of environments, The structure of agents.

UNIT II CLASSICAL PLANNING 9 hours

Definitions, Algorithms, Planning graphs, Classical planning approaches, Analysis. PLANNING AND ACTING IN THE REAL WORLD – Time, schedule and resources, Hierarchical planning, Planning, and acting in nondeterministic domains, Multiagent planning.

UNIT III KNOWLEDGE REPRESENTATION 9 hours

Ontological engineering, Categories and objects, Events, Mental events and mental objects, Reasoning systems for categories, Reasoning with default information, The Internet shopping world.

UNIT IV REINFORCEMENT LEARNING AND NPL 8 hours

Introduction, Passive and active reinforcement learning, Generalization in reinforcement learning, Policy search, Applications of reinforcement learning. **NPL:** Language models, Text classification, Information retrieval, Information extraction.

UNIT V NATURAL LANGUAGE FOR COMMUNICATION, PERCEPTION, ROBOTICS 10 hours

Phrase structure grammars, syntactic analysis, Augmented grammars and semantic interpretation, Machine translation, Speech recognition.

PERCEPTION – Image formation, Early image processing operations, Object recognition by appearance, Reconstructing the 3D world, Object recognition from structural information, Using vision.

ROBOTICS – Introduction, Robot hardware, Robotic perception, planning to move, Planning uncertain movements, Moving, Robotic software architectures, Application domains.

Course Outcomes:

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

1. Demonstrate the basic concepts, representations, and algorithms for Planning.
2. Develop reinforcement learning model for real world problems.
3. Make use of language models for various NLP tasks.
4. Model Agent's inputs perception and preprocessing techniques.
5. Design and implement robot hardware and software.

Text Book(s)

1. Stuart Russell, Peter Norvig, "Artificial Intelligence -A Modern Approach", 2/e, Pearson, 2003.
2. Nils J Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann Publications, 2000.

Reference Books

1. An Introduction to Multiagent Systems (first edition) by Michael Wooldridge. ISBN 0-471-49691-X
2. A Modern Approach, Second Edition by Stuart Russell and Peter Norvig. ISBN 0-13-790395-2 (especially recommended for students who have not taken CSE 327 at Lehigh)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD106 INFORMATION THEORY AND CODING

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:

This course is meant to serve as an introduction to some basic concepts in information theory and error-correcting codes, and some of their applications in computer science and statistics. We plan to cover the following topics: Introduction to entropy and source coding.

Course Objectives:

1. Understand the basics of information theory and coding theories.
2. Introduce the concept of amount of information, entropy, channel capacity, error, detection and error-correction codes, block coding, convolution coding, and Viterbi decoding algorithm.
3. Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
4. Describe the real life applications based on the fundamental theory.
5. Calculate entropy, channel capacity, bit error rate, code rate, and steady-state probability and so on.
6. Implement the encoder and decoder of one block code or convolution code using any program language.

UNIT I CODING FOR RELIABLE DIGITAL TRANSMISSION AND STORAGE — 9 hours

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

UNIT II LINEAR BLOCK CODES — 9 hours

Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT III CYCLIC CODES — 9 hours

Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT IV CONVOLUTIONAL CODES 9 hours

Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT V BCH CODES 9 hours

Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

Course Outcomes:

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

1. Learn measurement of information and errors.
2. Obtain knowledge in designing various source codes and channel codes
3. Design encoders and decoders for block and cyclic codes
4. Understand the significance of codes in various applications

Text Book(s)

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.
2. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989

Reference Books

1. Digital Communications- John G. Proakis, 5th ed., , TMH 2008.
2. Introduction to Error Control Codes-Salvatore Gravano-oxford
3. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD107 HEALTHCARE DATA ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Fundamentals of AI and Machine Learning

Course Description:

Exploration of healthcare informatics and its relation to health information technology. Students will apply basic knowledge and skills from healthcare data mining, data science, data management, and professional project management to address practical healthcare business and clinical intelligence issues.

Course Objectives:

This course enables students to

1. Discuss the role of data analytics in healthcare and the available resources.
2. Describe the components and challenges of EHR data in health care organizations.
3. Enable the learners to develop skills required for biomedical image and signal analysis.
4. Familiarize the learner with data mining techniques for clinical text.
5. Identify data analytics techniques for pervasive health.

UNIT I Introduction to Healthcare Data Analytics 9 hours

Introduction, Healthcare Data Sources and Basic Analytics, Advanced Data Analytics for Healthcare, Applications and Practical Systems for Healthcare, Resources for Healthcare Data analytics.

UNIT II Electronic Health Records 9 hours

Introduction, History of HER, Components of EHR, Coding Systems, Benefits of EHR, Barriers to Adopting EHR, Challenges of Using EHR Data.

UNIT III Biomedical Image and Signal Analysis 9 hours

Biomedical Image Analysis: Introduction, Biomedical Imaging Modalities, Object Detection, Image Segmentation, Image Registration, Feature Extraction.

Biomedical Signal Analysis: Types of Biomedical Signals, ECG Signal Analysis, Multivariate Biomedical Signal Analysis.

UNIT IV Data Mining for Clinical Text 9 hours

Information Extraction, Current Methodologies -Rule Based Approaches, Pattern Based Algorithms, Clinical Text Corpora and Evaluation Metrics, Challenges of Processing Clinical Reports, Clinical Applications.

UNIT V Data Analytics for Pervasive Health 9 hours

Introduction, Supporting Infrastructure and Technology-Body Area Networks(BAN),Dense/Mesh Sensor, Basic Analytic Techniques, Applications-Continuous Monitoring, Assisted Living.

Course Outcomes:

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

1. Understand the role of data analytics in health care.
2. Analyze the components and challenges of EHR data in health care organizations.
3. Identify methods for biomedical image and signal analysis.
4. Use effective data mining techniques for clinical text.
5. Apply the appropriate data analytics techniques in pervasive healthcare.

Text Book(s)

1. "Healthcare data analytics (Vol. 36)" by Reddy, C. K., & Aggarwal, C. C. (Eds.), CRC Press, 2015.

Reference Books

1. "Healthcare Analytics for Quality and Performance Improvement" by Trevor L. Strome John, Wiley & Sons, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD108 MACHINE TRANSLATION

L	T	P	C
3	0	0	3

Pre-requisite: Machine Learning

Course Description:

This course provides an in-depth exploration of machine translation, covering the principles, algorithms, and techniques used in automated translation systems. The course begins with an introduction to machine translation, including its applications and historical development. It then delves into various approaches to machine translation, including rule-based, statistical, and neural methods.

Course Objectives:

This course enables students to

1. Understand the foundations and principles of machine translation
2. Explore different approaches to machine translation
3. Develop proficiency in statistical machine translation
4. Gain practical knowledge of neural machine translation
5. Explore advanced topics in machine translation, such as transformer models and domain adaptation.

UNIT I Introduction to Machine Translation 9 hours

Overview of machine translation and its applications-Historical development and milestones in machine translation-Types of machine translation approaches (rule-based, statistical, neural)

UNIT II Rule-Based Machine Translation 9 hours

Rule-based approaches in machine translation-Linguistic rules and grammatical frameworks-Lexical transfer and syntactic transformation rules-Challenges and limitations of rule-based machine translation

UNIT III Statistical Machine Translation 9 hours

Statistical machine translation (SMT) models and algorithms-Phrase-based and hierarchical SMT models-Language modeling and translation probability estimation-Training and decoding techniques in statistical machine translation

UNIT IV Neural Machine Translation 9 hours

Introduction to neural networks and deep learning-Encoder-decoder architecture for neural machine translation-Attention mechanisms in neural machine translation-Training and optimization of neural machine translation models

UNIT V Advanced Topics in Machine Translation 9 hours

Neural machine translation enhancements (e.g., transformer models)-Multilingual and zero-shot translation-Domain adaptation and transfer learning in machine translation-Evaluation and quality estimation in machine translation

Course Outcomes:

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

1. Understand the fundamental concepts and applications of machine translation.
2. Design lexical transfer and syntactic transformation rules for rule-based machine translation.
3. Implement statistical machine translation models, such as phrase-based and hierarchical models.
4. Design and implement encoder-decoder architectures for neural machine translation.
5. Analyze the challenges in machine translation.

Text Book(s)

1. "Statistical Machine Translation" by Philipp Koehn, Cambridge University Press, 2009.

Reference Books

1. "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schütze, MIT Press,1999.
2. ” Natural Language Processing with PyTorch" by Delip Rao and Brian McMahan, O'Reilly, 2019,

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD109 DATA SCIENCE FOR BUSINESS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:

This course provides a concise introduction to cloud computing, covering its definition, characteristics, and underlying principles. Students will learn about enabling technologies like service-oriented architecture and virtualization, as well as cloud architecture, services, and storage.

Course Objectives:

This course enables students to

1. Develop an understanding of the ubiquity of data opportunities and the strategic value of data
2. Identify business problems and apply data mining tasks to generate data-driven solutions.
3. Gain knowledge and skills in supervised segmentation for predictive modeling.
4. Explore data science tasks and techniques for business
5. Understand how data science can be leveraged to achieve competitive advantage in business

UNIT I INTRODUCTION: DATA-ANALYTIC THINKING 9 hours

The Ubiquity of Data Opportunities-Data Science, Engineering, and Data-Driven Decision Making-Data Processing and "Big Data"-From Big Data 1.0 to Big Data 2.0-Data and Data Science Capability as a Strategic Asset-Data-Analytic Thinking

UNIT II BUSINESS PROBLEMS AND DATA SCIENCE SOLUTIONS 9 hours

From Business Problems to Data Mining Tasks-Supervised Versus Unsupervised Methods-Data Mining and Its Results-The Data Mining Process-Business Understanding-Data Understanding-Data Preparation-Modeling-Evaluation-Deployment-Implications for Managing the Data Science Team

UNIT III INTRODUCTION TO PREDICTIVE MODELING 9 hours

Models, Induction, and Prediction-Supervised Segmentation-Selecting Informative Attributes-Supervised Segmentation with Tree-Structured Models-Visualizing Segmentations-Trees as Sets of Rules-Probability Estimation

UNIT IV DATA SCIENCE TASKS AND TECHNIQUES 9 hours

Co-occurrences and Associations: Finding Items That Go Together-Measuring Surprise: Lift and Leverage-Associations Among Facebook Likes-Profiling: Finding Typical Behavior-Link Prediction and Social Recommendation-Data Reduction, Latent Information, and Movie Recommendation-Bias, Variance, and Ensemble Methods-Data-Driven Causal Explanation and a Viral Marketing Example

UNIT V DATA SCIENCE AND BUSINESS STRATEGY 9 hours

Thinking Data-Analytically, Redux-Achieving Competitive Advantage with Data Science-Sustaining Competitive Advantage with Data Science-Formidable Historical Advantage-Unique Intellectual Property-Unique Intangible Collateral Assets-Superior Data Scientists-Superior Data Science Management-Attracting and Nurturing Data Scientists and Their Teams- Data Science Case Studies

B. Tech Computer Science & Engineering (Data Science)

Course Outcomes:

Understand and apply the foundational concepts of web development.

1. Develop a data-analytic mindset and recognize the strategic value of data in making informed business decisions.
2. Apply data mining techniques to solve business problems.
3. Gain proficiency in utilizing predictive modeling techniques to make accurate predictions
4. Analyze data associations and employ ensemble methods for improved data-driven decision making.
5. Understand the role of data science in achieving and sustaining competitive advantage for business success.

Text Book(s)

1. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett, O'Reilly Media, 1st Edition, 2013.

Reference Books

1. "Data Science" by John D. Kelleher and Brendan Tierney, MIT Press, 2018.
2. "The Elements of Statistical Learning: Data Mining, Inference, and Prediction" by Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2nd Edition, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Computer Science & Engineering (Data Science)

Honors

20HDCSD601 CLOUD COMPUTING

L	T	P	C
1	0	2	2

Pre-requisite: NIL

Course Description:

This course provides a concise introduction to cloud computing, covering its definition, characteristics, and underlying principles. Students will learn about enabling technologies like service-oriented architecture and virtualization, as well as cloud architecture, services, and storage.

Course Objectives:

This course enables students to

6. Introduce the broad perceptive of cloud architecture and model
7. Understand the concept of Virtualization and design of cloud Services
8. Develop web applications in cloud
9. Learn the design and development process involved in creating a cloud based application
10. Learn to implement and use parallel programming using Hadoop

UNIT I Introduction 9 hours

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

Exercise:

1. Implement concurrent echo client-server application.

2. Implement concurrent day-time client-server application.

UNIT II Vitualization 9 hours

Basics of Virtualization – Types of Virtualizations – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices – Virtualization Support and Disaster Recovery.

Exercise

1. Install Virtualbox/VMware Workstation with different flavours 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

UNIT III Cloud Architecture, Services and Storage 9 hours

Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage.

Exercise

1. Install Google App Engine. Create hello world app and other simple web applications using python/java.

2. Use GAE launcher to launch the web applications.

UNIT IV Resource Management 9 hours

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources

Exercise

1. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

2. Find a procedure to transfer the files from one virtual machine to another virtual machine.

UNIT V Cloud Technologies 9 hours

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine –Open Stack

Exercise

1. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

2. Install Hadoop single node cluster and run simple applications like wordcount.

Course Outcomes:

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

1. Configure various virtualization tools such as Virtual Box, VMware workstation.
2. Design and deploy a web application in a PaaS environment.
3. Learn how to simulate a cloud environment to implement new schedulers.
4. Install and use a generic cloud environment that can be used as a private cloud.
5. Manipulate large data sets in a parallel environment.

Text Book(s)

1. "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things" by Kai Hwang, Geoffrey C. Fox and Jack G. Dongarra Morgan, Kaufmann Publishers, 2012.
2. “Cloud Computing: Implementation, Management and Security” by Rittinghouse, JohnW., and James F. Ransome, CRC Press, 2017.

Reference Books

1. “Mastering Cloud Computing” by Rajkumar Buyya, Christian Vecchiola and S. ThamaraiSelvi, Tata Mcgraw Hill, 2013.
2. "Cloud Computing -A Practical Approach” by Toby Velte, Anthony Velte and Robert Elsenpeter, Tata Mcgraw Hill, 2009.
3. "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)” by George Reese, O'Reilly, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.