

**B. Tech Computer Science & Engineering (Data Science)**

**MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE**

**MADANAPALLE  
(UGC-AUTONOMOUS)**

**[www.mits.ac.in](http://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)**

**MADANAPALLE INSTITUTE OF TECHNOLOGY &  
SCIENCE, MADANAPALLE**

**Branch: COMPUTER SCIENCE & ENGINEERING  
(Data Science)**

<b>Total Credits</b>	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**

<b>Sl.No</b>	<b>Title</b>	<b>Duration</b>
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

**B. Tech Computer Science & Engineering (Data Science)****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
<b>Total</b>				<b>11</b>	<b>3</b>	<b>11</b>	<b>25</b>	<b>19.5</b>

**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
<b>Total</b>				<b>14</b>	<b>0</b>	<b>11</b>	<b>25</b>	<b>19.5</b>

(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
<b>Total</b>				<b>17</b>	<b>1</b>	<b>11</b>	<b>29</b>	<b>21.5</b>

**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
<b>Total</b>				<b>17</b>	<b>1</b>	<b>11</b>	<b>29</b>	<b>21.5</b>

(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
<b>Total</b>				<b>17</b>	<b>1</b>	<b>11</b>	<b>29</b>	<b>21.5</b>

\* 2 Months internship during 2<sup>nd</sup> 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** /20HUM102#	Universal Human Values	2/3	0	0	2/3	0/3
<b>Total</b>				<b>17/18</b>	<b>1</b>	<b>11</b>	<b>29/30</b>	<b>21.5/24.5</b>

\*\* 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

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

**B. Tech Computer Science & Engineering (Data Science)****Tentative Curriculum Structure from IV Year Onwards****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
<b>Total</b>				<b>19</b>	<b>0</b>	<b>8</b>	<b>27</b>	<b>23</b>

\* 2 Months internship during 2<sup>nd</sup> 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, Seminar and Internship in Industry (6 months)	0	0	24	24	12
<b>Total</b>				<b>0</b>	<b>0</b>	<b>24</b>	<b>24</b>	<b>12</b>

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

**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

## B. Tech Computer Science & Engineering (Data Science)

### ANNEXURE - II

<b>OPEN ELECTIVE – I</b>			
(To be offered under MOOC's Category from SWAYAM – NPTEL)			
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Offered by Department of</b>
1	20HUM3M01	Project Management for Managers	Management Studies
2	20HUM3M02	Ethics in Engineering Practice	Management Studies
3	20CE3M01	Integrated Waste Management for Smart City	Civil
4	20CE3M02	Soil and Water Conservation Engineering	Civil
5	20CE3M03	Plastic Waste Management	Civil
6	20CE3M04	Safety in Construction	Civil
7	20ME3M01	Introduction to Industry 4.0 and Industrial Internet of Things	Mechanical
8	20ME3M02	Operations Management	Mechanical
9	20ME3M03	Design Thinking and Innovation	Mechanical
10	20EEE3M01	Non-Conventional Energy Sources	EEE
11	20EEE3M02	Design of Photovoltaic Systems	EEE
12	20ECE3M01	Microprocessors and Interfacing	ECE
13	20ECE3M02	Microprocessors and Microcontrollers	ECE
14	20IE3M01	Intellectual Property Rights and Competition Law	Multidisciplinary
15	20IE3M02	Introduction to Research	Multidisciplinary
16	20IE3M03	Roadmap for Patent Creation	Multidisciplinary

Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.



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<b>OPEN ELECTIVE – II</b>			
(To be offered under Conventional Mode)			
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Offered by Department of</b>
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 advanced 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	20CE3M04	Remote Sensing and GIS	Civil
2	20CE3M05	Waste Water Treatment and Recycling	Civil
3	20ME3M04	Power Plant Engineering	Mechanical
4	20ME3M05	Mechatronics and Manufacturing Automation	Mechanical
5	20EEE3M03	Introduction to Smart Grid	EEE
6	20ECE3M05	Introduction to Embedded Systems	ECE
7	20ECE3M06	Embedded System Design with ARM	ECE

Any new Interdisciplinary Course offered by SMAYAM NPTEL can be appended in future

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<b>OPEN ELECTIVE – IV</b>			
(To be offered under Conventional Mode)			
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Offered by Department of</b>
1	20MAT303	Graph Theory	Mathematics
2	20MAT304	Mathematical Modelling and Numerical Simulation	Mathematics
3	20PHY303	Thin Film Technology and its Applications	Physics
4	20CHE303	Introduction to Nano Science and Technology	Chemistry
5	20CHE304	Computational Methods in Materials Science and Engineering	Chemistry
6	20CE304	Green Building and Energy Conservation	Civil
7	20CE305	Environmental Engineering	Civil
8	20ME303	Internet of Manufacturing Things	Mechanical
9	20ME304	Total Quality Management	Mechanical
10	20ME305	Entrepreneurship	Mechanical
11	20EEE303	Robotics	EEE
12	20EEE304	Electrical Safety	EEE
13	20ECE303	Nano Electronics	ECE
Any advanced courses can be appended in future.			

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### OPEN ELECTIVE – V (HUMANITIES)

(To be offered under Conventional Mode)

<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Offered by Department of</b>
1	20HUM301	Principles of Management	Humanities
2	20HUM302	Human Resource Development	Humanities
3	20HUM303	Soft Skills	Humanities
4	20HUM304	National Cadet Corps	Humanities

Any advanced courses can be appended in future.

## B. Tech Computer Science & Engineering (Data Science)

### ANNEXURE – III

#### List of Professional Electives

<b>Professional Elective – I</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
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.		

<b>Professional Elective – II</b>		
(To be offered under MOOC's Category from SWAYAM – NPTEL)		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1.	20CSD4M01	Blockchain Architecture Design and Use Case
2.	20CSD4M02	Medical Image Data Analysis
3.	20CSD4M03	Online Privacy
4.	20CSD4M04	Privacy and Security in Online Social Media
5.	20CSD4M05	Ethical Hacking
6.	20CSD4M06	Mobile Computing
7.	20CSD4M07	Natural Language Processing
8.	20CSD4M08	Augmented Reality and Virtual Reality
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

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<b>Professional Elective – III</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1.	20CSD406	Social Media Analytics
2.	20CSD407	Information Retrieval System
3.	20CSD408	Stochastic Decision Making
4.	20CSD409	Software Defined Network
5.	20CSD410	Service Oriented Architecture
6.	20CSD411	Cognitive Science and Analytics
Any advanced courses can be appended in future.		

<b>Professional Elective – IV</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1.	20CSD412	Video Analytics
2.	20CSD413	Malware Analysis
3.	20CSD414	GPU Programming using CUDA
4.	20CSD415	Internet of Things
5.	20CSD416	Mining Massive Dataset
6.	20CSD417	Predictive Data Analytics
Any advanced courses can be appended in future.		

<b>Professional Elective – V</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1.	20CSD418	Exploratory Data Analysis
2.	20CSD419	Software Quality Assurance
3.	20CSD420	Reinforcement Learning
4.	20CSD421	Wireless Network System
5.	20CSD422	Ethics for Data Science
6.	20CSD423	Human Computer Interaction
Any advanced courses can be appended in future.		

**B. Tech Computer Science & Engineering (Data Science)****ANNEXURE – IV****SKILL ORIENTED COURSES**

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

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

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

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

<b>Skill Oriented Course – V</b>		
<b>Sl. No</b>	<b>Course Code</b>	<b>Course Title</b>
1	20CSD608	Data Warehousing and Data Mining
2	20CSD609	Blockchain Development
3	20CSD610	Cryptography Algorithms
Any advanced courses can be appended in future		

## B. Tech Computer Science & Engineering (Data Science)

### ANNEXURE - V

#### Honors in Computer Science & Engineering (Data Science)

Sl.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
<b>III Year I Semester</b>								
1	<b>Professional Elective Course (Choose any two from three courses)</b>	20HDCSD101	R Programming	3	0	0	3	3
2		20HDCSD102	Business Intelligence	3	0	0	3	3
3		20HDCSD103	Advanced Algorithms	3	0	0	3	3
<b>Sub Total</b>				<b>6</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>
<b>III Year II Semester</b>								
4	<b>Professional Elective Course (Choose any two from three courses)</b>	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
<b>Sub Total</b>				<b>6</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>
<b>IV Year I Semester</b>								
7	<b>Professional Elective Course (Choose any two from three courses)</b>	20HDCSD107	Soft Computing	3	0	0	3	3
8		20HDCSD108	Machine Translation	3	0	0	3	3
9		20HDCSD109	Federated Machine Learning	3	0	0	3	3
10	<b>SOC</b>	20HDCSD601	Web Application Development	1	0	2	3	2
<b>Sub Total</b>				<b>7</b>	<b>0</b>	<b>2</b>	<b>9</b>	<b>8</b>
<b>Total</b>				<b>19</b>	<b>0</b>	<b>2</b>	<b>21</b>	<b>20</b>



**B. Tech Computer Science & Engineering (Data Science)**

# **I Year I Semester**

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.

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### UNIT-IV:

**String Handling -Modules:** Creating modules, import statement, from import statement, name spacing  
**Files and Directories:**

- Implement Python program to perform various operations on string using string libraries.
- Implement Python program to remove punctuations from a given string.
- 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.
- 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”
- Write a Python script to display file contents.
- Write a Python script to copy file contents from one file to another.
- Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.
- 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

- 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.
- 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

- Write a python script to display following shapes using turtle.



### Course Outcomes:

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

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

## **B. Tech Computer Science & Engineering (Data Science)**

### **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)

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**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 acquainted 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)

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- 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**)
- 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 writing (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)

## **B. Tech Computer Science & Engineering (Data Science)**

### **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/](http://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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **Reference Books:**

1. Physics Laboratory Manual
2. Optics, A. Ghatak, 4<sup>th</sup> Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4<sup>th</sup> 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



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### 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 Kirchoff'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

## **B. Tech Computer Science & Engineering (Data Science)**

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.

### **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.

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### **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, Birkhäuser, 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 ( $H_2-O_2$ ).



## B. Tech Computer Science & Engineering (Data Science)

### 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<sub>2</sub>).

#### 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, 1st Edition., (S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1st 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **Text Books:**

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

### **Reference Books:**

1. Let us C, Yashavant Kanetkar, 15<sup>th</sup> Edition, BPB Publications, 2016.
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education, 5<sup>th</sup> 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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  $\geq 65$
  - ii. Marks in Physics  $\geq 55$
  - iii. Marks in Chemistry  $\geq 50$OR
  - iv. Total in all three subject  $\geq 180$
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



## **B. Tech Computer Science & Engineering (Data Science)**

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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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) – Single V 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.

## **B. Tech Computer Science & Engineering (Data Science)**

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.

### **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 compilers 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.

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- 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**
- 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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, 42<sup>nd</sup> 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](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 basic 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)**

### **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 AI: 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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.



## **B. Tech Computer Science & Engineering (Data Science)**

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

### **Reference Books**

1. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, 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  $ax^2 + bx + c = 0$ . Read in a, b, c and use the quadratic formula. If the discriminant  $b^2 - 4ac$  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 first 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.

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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 StringTokenizer 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 JtextField, 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

## **B. Tech Computer Science & Engineering (Data Science)**

### **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. Schalkof, 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.



**B. Tech Computer Science & Engineering (Data Science)**

# **II Year II Semester**

## **B. Tech Computer Science & Engineering (Data Science)**

### **B. Tech II Year II Semester**

#### **20HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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).

## **B. Tech Computer Science & Engineering (Data Science)**

**UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING 9 hours**  
Ratio Analysis - Liquidity, Leverage, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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, 3<sup>rd</sup> Edition, 2010.
3. B.Kolman, R.C.Busby and S.C.Ross, "Discrete Mathematical structures", 6<sup>th</sup> 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**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, Dining Philosopher Problem etc. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.



## **B. Tech Computer Science & Engineering (Data Science)**

### **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

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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,  $\epsilon$  - 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 computes 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 an 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 asks 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

## **B. Tech Computer Science & Engineering (Data Science)**

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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

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.
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  
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  $S = \{S_1, S_2, \dots, S_n\}$  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.



## **B. Tech Computer Science & Engineering (Data Science)**

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.

#### **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. Sharma, 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 SYSTEMS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**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

## **B. Tech Computer Science & Engineering (Data Science)**

### **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 give a basic knowledge on machine learning, classification techniques and the various algorithms in machine learning. It helps the students to explore 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 Tree, 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 matplotlib, 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

## B. Tech Computer Science & Engineering (Data Science)

- 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 matplotlib
  - 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 matplotlib 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 11267 using 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **Course Outcomes:**

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

1. Differentiate the various tools for data visualization.
2. Analyse 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.

### **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. 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,



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urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

### **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 deleting 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **AUTOENCODERS**

Autoencoders, Denoising autoencoders, sparse autoencoders, contractive Autoencoders

#### **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 pursue 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.

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### **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 filesii) 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)

## **B. Tech Computer Science & Engineering (Data Science)**

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 the words 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:**

## **B. Tech Computer Science & Engineering (Data Science)**

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.

## **B. Tech Computer Science & Engineering (Data Science)**

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

## **B. Tech Computer Science & Engineering (Data Science)**

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 pursue 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, 6<sup>th</sup>, Tata McGraw Hill, 2021.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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

## **B. Tech Computer Science & Engineering (Data Science)**

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  $\infty$ -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.

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### **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

#### **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, Patrick O. Wheatley, Applied Numerical Analysis, Pearson Education, 7<sup>th</sup> Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4<sup>th</sup> Edition, 2005.

#### **Reference Books:**

1. B.S. Grewal, Higher Engineering Mathematics, 43<sup>rd</sup> edition (2014), Khanna publishers.
2. Burden and Faires, Numerical Analysis 7<sup>th</sup> ed., Thomson Learning, 2001.
3. Advanced Engineering Mathematics by E. Kreyszig, 10<sup>th</sup> ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3<sup>rd</sup> 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., 5<sup>th</sup> 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)  $:(\infty/\text{FCFS})$ , (M/M/1)  $:(N/\text{FCFS})$ .

#### 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **Text Books:**

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5<sup>th</sup> edition, 2013.
2. B.S. Grewal, Higher Engineering Mathematics, 43<sup>rd</sup> 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, 2<sup>nd</sup> 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**

Fraunhofer 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.

## **B. Tech Computer Science & Engineering (Data Science)**

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.

### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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 Rullière, 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, Neutralizing 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.

## B. Tech Computer Science & Engineering (Data Science)

### 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.

#### 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 Hancsó, *Fuels and fuel additives*, Wiley VCH Verlag GmbH & Co, Weinheim, 2004.
4. Robert O. Anderson, *Fundamentals of the Petroleum Industry*—University of Oklahoma Press, 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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

#### **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 Alvis 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 & GROUTING**

**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 reamed piles.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.

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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, NewDelhi.
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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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 Pblcation

**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.

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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.

### **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

## **B. Tech Computer Science & Engineering (Data Science)**

### **Text Books:**

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006
2. G.K. Ananthuresh 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **Text Books:**

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.
2. J.G. Webster, 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", 2<sup>nd</sup> 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 Characteristics, C-V Characteristics, 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 Edition 2009. 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

# **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

## **B. Tech Computer Science & Engineering (Data Science)**

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 Applications William 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

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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



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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

## **B. Tech Computer Science & Engineering (Data Science)**

### **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, Pearson Education, 2011 .
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Fourth 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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, 2nd edition, 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.

# **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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, intents, 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 – RecyclerView – 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

## **B. Tech Computer Science & Engineering (Data Science)**

### **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 adapters)
- 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

## **B. Tech Computer Science & Engineering (Data Science)**

### **Text Books**

1. Android Programming-The Big Nerd Ranch Guide, Bill Philips, Christ Stewart, Kristin Mariscano, Big Nerd Ranch publishers, 3<sup>rd</sup> 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, 2<sup>nd</sup> 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, 2<sup>nd</sup> 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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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/](http://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:**

1. This course aims to develop student's competency in producing dynamic and creative graphic solutions for multimedia productions.
2. It introduces students with the advanced scripting skills necessary for implementing highly interactive, rich internet applications using multimedia technologies and authoring tools.
3. Students will develop aesthetic value and competencies in multimedia authoring.
4. Artistic visual style and layout design are stressed, as well as the editing and integration of graphic video, audio, images and animation, files.
5. The course allows students to master industry-wide software and technologies to create highly interactive, rich internet applications.

#### **List of Programs:**

1. Video Editing.
2. Audio Editing.
3. Image editing.
4. 2D Animation.
5. 3D Animation.
6. Write a program to create an animated e-card using adobe Flash.
7. Write a Program to create an animation to represent the Growing Moon.
8. Write a Program to create an animation to indicate a ball bouncing on Steps.
9. Write a Program to simulate a ball hitting another ball.
10. Write a Program to change a circle into a square using Flash.
11. Write a Program to perform motion tweening operation using flash.
12. Write a Program to change and object shape using a shape tweening concept.
13. Write a Program to create 24 spokes on a wheel using flash.

#### **Course Outcomes:**

Upon successful completion of the 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

## **B. Tech Computer Science & Engineering (Data Science)**

### **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, Paul J Deitel and Harvey M Deitel, Deitel Developer Series, Pearson Education, 2008. (UNITS 4,5)

### **Reference Books**

1. Professional Adobe Flex 3, Joseph Balderson, Peter Ent, et al, Wrox Publications, Wiley India, 2009
2. Multimedia Communications: Applications, Networks, Protocols and Standards, Fred Halsall, Pearson Education, 2001, RP 2005

**Mode of Evaluation:** Continuous Internal Evaluation and 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** 20CSD108, 20CSD207

#### Course Description:

This course is an applied statistics course focusing on data analysis. The course will begin with an overview of how to organize, perform, and write-up data analyses. Instead of focusing on mathematical details, the lectures will be designed to help you apply these techniques to real data using the R statistical programming language, interpret the results, and diagnose potential problems in your analysis.

#### Course Objectives:

1. To manipulate data within R.
2. To create simple graphs and charts used in introductory statistics.
3. The given data using different distribution functions in R.
4. The hypothesis testing and calculate confidence intervals; perform linear regression models for data analysis.
5. The relevance and importance of the theory in solving practical problems in the real world.

#### List of Programs:

1. Study of basic Syntaxes in R.
2. Implementation of loop control structures.
3. Learn to implement Functions in R
4. List, Vector operations in R language.
5. Implementation of matrix operations in R.
6. Implementation and use of array and factors in R.
7. Implementation and use of data frames in R.
8. Learn basic statistical Operations using R
9. Implementation of Data Visualization in R.
10. Import and export data from excel and csv files and perform analytics on it.
11. Implementation of Regression with decision tree in R.
12. Implementation of Classification with decision tree in R.

#### Course Outcomes:

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

1. Install and use R for simple programming tasks.
2. Extend the functionality of R by using add-on packages
3. Extract data from files and other sources and perform various data manipulation tasks on them
4. Explore statistical functions and Tables to visualize results of various statistical operations on data in R
5. Apply the knowledge of R gained to data Analytics for real-life applications.



## **B. Tech Computer Science & Engineering (Data Science)**

### **Text Book(s)**

1. The Art of R Programming: A Tour of Statistical Software Design, Norman Matloff, No Starch Press, 2011.
2. R for Everyone: Advanced Analytics and Graphics, Jared P. Lander, Addison-Wesley Data & Analytics Series, 2013.

### **Reference Books**

1. SandipRakshit, “Statistics with R Programming”, McGraw Hill Education, 2018.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, “An Introduction to Statistical Learning: with Applications in R”, Springer Texts in Statistics, 2017.

**Mode of Evaluation:** Continuous Internal Evaluation and 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

#### Course Description:

Full Stack Web Development course will make students to become master 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 on technologies. This will help the students to learn the complete set of process like designing development and deployment.

#### Course Objectives:

1. To build web applications using HTML, Javascript, CSS and PHP with client-side validations.
2. To create and integrating Plug-ins with JQuery (Events, Animation).
3. To build XML documents with DTD, Schemas and style sheets.
4. To develop a web application with database interaction using Node JavaScript and Angular JavaScript.
5. To implement MongoDB Models.
6. To learn all about SQL and Mongo databases

#### List of Programs:

1. Develop static pages (using only HTML) of an online ticket reservation.
2. Develop static pages (using only HTML) of an online Book store. The pages should resemble [www.amazon.com](http://www.amazon.com). The website should consist of the following pages.
  - Home page
  - Registration and user Login
  - User profile page
  - Books catalog
  - Shopping cart
  - Payment by credit card Order Conformation
3. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient
4. Design a form and validate all the controls placed on the form using Java Script.
5. 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.
6. Develop and demonstrate PHP Script for the following problems:
  - a) Write a PHP Script to find out the Sum of the Individual Digits.
  - b) Write a PHP Script to check whether the given number is Palindrome or not
7. 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. Tech Computer Science & Engineering (Data Science)**

8. Design a website using style sheets so that the pages have uniform style.
9. Create animation using JQuery
  - (a) Working on Blink text using jQuery.
  - (b) Using jQuery right click to toggle background color.
10. Design an XML document to store information about a student. The information must include Rollno, 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.
11. Working on file write, read and delete using Node.js
12. Develop a Form and validate using Angular JS
13. Design Webpage for Data collection, store, retrieve and manipulate data using SQL database.
14. Implement MongoDB data models.
15. Implement the following in Angular JS
  - a) Angular Js data binding.
  - b) Angular JS directives and Events.
  - c) Using angular Js fetching data from MySQL.
16. Create an Online fee payment form using JScript and MangoDB

### **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 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.

### **Text book(s)**

1. PHP 5 Recipes A problem Solution Approach Lee Babin, Nathan A Good, Frank M.Kromann andJon 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)

## **B. Tech Computer Science & Engineering (Data Science)**

### **Reference Books**

1. Web Coding Bible, An Accelerated Course, Chong Lip Phang, 2015
2. Java Script for Programmers Paul J. Deitel, Deitel & Associates, Inc. Harvey M. Deitel, Deitel & Associates, Inc.

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

## **B. Tech Computer Science & Engineering (Data Science)**

### **Skill Oriented Course – IV**

#### **20CSD606 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 use case diagram, class diagram, sequence diagram, state diagram, activity diagram, component diagram and deployment diagram of UML. CASE tool of UML is used to analyze and design the course project systems.

#### **Course Objectives:**

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.

#### **List of Programs:**

To develop a mini project the following 12 exercises listed below

1. To develop a problem statement.
2. Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart).
3. Identify Use Cases and develop the Use Case model.
4. Identify the business activities and develop an UML Activity diagram.
5. Identify the conceptual classes and develop a domain model with UML Class diagram.
6. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
7. Draw the State Chart diagram.
8. Identify the User Interface, Domain objects, and technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
9. Implement the Technical services layer.
10. Implement the Domain objects layer.
11. Implement the User Interface layer.
12. 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

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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 concepts.

### **Textbook(s)**

1. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Pearson Education, 2nd Edition.

### **Reference Books**

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object Oriented Software, Addison-Wesley, 1994.
2. Meilir Page-Jones, Fundamentals of Object Oriented Design in UML, Pearson Education, 2000.
3. Atul Kahate, Object Oriented Analysis & Design, McGraw-Hill, 2004.

**Mode of Evaluation:** Continuous Internal Evaluation and 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** -NIL-

#### Course Description:

The DevOps course curriculum renders a professional capacity to manage and track different versions of source code, automate testing procedures, manage to cluster, and perform continuous monitoring with the help of many tools. With the right course, a candidate can also get their hands on industry projects and understand their performance in a reliable manner. Depending on the duration of the course, it can be divided into a given number of case studies and projects for the complete understanding of the professionals. Several people are seeking DevOps course syllabus today. This makes the DevOps course syllabus quite attractive for budding professionals.

#### Course Objectives:

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability
3. Implement automated system update and DevOps lifecycle.

#### 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.

#### UNIT II SOFTWARE DEVELOPMENT MODELS AND DEVOPS

**9 hours**

**Software development models and DevOps:** 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.

#### 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.

#### UNIT IV INTEGRATING THE SYSTEM

**9 hours**

Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

#### 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

## **B. Tech Computer Science & Engineering (Data Science)**

### **Course Outcomes:**

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

1. Identify components of Devops environment
2. Describe Software development models and architectures of DevOps
3. Apply different project management, integration, testing and code deployment tool
4. Investigate different DevOps Software development models
5. Assess various Devops practices
6. Collaborate and adopt Devops in real-time projects

### **Text Book(s)**

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley

### **Reference Books**

1. 1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.

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



**B. Tech Computer Science & Engineering (Data Science)**

**HONORS**

## **B. Tech Computer Science & Engineering (Data Science)**

### **Honors**

#### **20HDCSD101 R PROGRAMMING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite: Nil**

#### **Course Description:**

The course covers practical issues in statistical computing which includes programming in R, reading data into R, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code. Topics in statistical data analysis will provide working examples.

#### **Course Objectives:**

1. To understand and able to use basic programming concepts
2. To automate data analysis, working collaboratively and openly on code
3. To know how to generate dynamic documents
4. Able to use a continuous test-driven development approach

#### **UNIT I INTRODUCTION**

**9 hours**

Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

#### **UNIT II CONTROL STRUCTURES AND VECTORS**

**9 hours**

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations.

#### **UNIT III LISTS**

**9 hours**

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations.

#### **UNIT IV FACTORS AND TABLES**

**9 hours**

Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

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### **UNIT V OBJECT-ORIENTED PROGRAMMING**

**9 hours**

S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation

#### **Course Outcomes:**

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

1. Study and use fundamental concepts to solve the real-world problem using R programming language.
2. Design and implement the solution using scalar, vectors, matrices and statistical problems in R program.
3. Design and implement the program using data frame, list to provide the solution for various problem.
4. Study about factors and tables and to solve statistical problems.
5. Minimize and maximize functions, simulation and visualization and statistical analysis using R.

#### **Text Book(s)**

1. Roger D. Peng, "R Programming for Data Science", 2012
2. Norman Matloff, "The Art of R Programming- A Tour of Statistical Software

#### **Reference Books**

1. Garrett Golemund, Hadley Wickham, "Hands-On Programming with R: Write Your Own Functions and Simulations", 1st Edition, 2014
2. Venables, W.N., and Ripley, "S programming", Springer, 2000.

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

## **B. Tech Computer Science & Engineering (Data Science)**

### **Honors**

#### **20HDCSD102 BUSINESS INTELLIGENCE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

## **B. Tech Computer Science & Engineering (Data Science)**

### **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 Bentley, “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

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### **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,



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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.

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### **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.

## **B. Tech Computer Science & Engineering (Data Science)**

### **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.