

**B. Tech.**  
**COMPUTER SCIENCE AND ENGINEERING**  
**(B.Tech 1<sup>st</sup>, 2<sup>nd</sup> 3<sup>rd</sup> and 4<sup>th</sup> Year Syllabus)**



**Department of Computer Science and Engineering**  
**(B. Tech. CSE Programme Accredited by NBA)**

**VELAGAPUDI RAMAKRISHNA**  
**SIDDHARTHA ENGINEERING COLLEGE**

**(An Autonomous, ISO 9001:2015 Certified Institution)**

**(Approved by AICTE, Accredited by NAAC with 'A' Grade,**  
**Affiliated to JNTUK, Kakinada)**

**(Sponsored by Siddhartha Academy of General & Technical**  
**Education)**

**Kanuru, Vijayawada**

**Andhra Pradesh - 520007, INDIA.**

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

### **INSTITUTE VISION**

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

### **INSTITUTE MISSION**

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and pro-active nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

### **DEPARTMENT VISION**

The department vision is clearly defined and is in line with the college's vision. The vision of the department is:

"To evolve as a centre of academic excellence and advanced research in Computer Science and Engineering discipline."

### **DEPARTMENT MISSION**

This mission of the Department is concise and supports the College's mission. The mission of the Computer Science and Engineering Department is:

"To inculcate students with profound understanding of fundamentals related to discipline, attitudes, skills, and their application in solving real world problems, with an inclination towards societal issues and research."

### **Program Educational Objectives(UG)**

We have program educational objectives for our Computer Science and Engineering Program. Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

#### **Our Computer Science and Engineering program objectives are:**

- I. The graduates of the Program will have solid foundation in the principles and practices of computer science, including mathematics, science and basic engineering.
- II. The graduates of the Program will have skills to function as members of multi-disciplinary teams and to communicate effectively using modern tools.
- III. The graduates of the Program will be prepared for their careers in the software industry or pursue higher studies and continue to develop their professional knowledge.
- IV. The graduates of the program will practice the profession with ethics, integrity, leadership and social responsibility.

## **PROGRAM OUTCOMES**

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

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

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

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

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

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

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

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

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

**PO10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design

documentation, make effective presentations, and give and receive clear instructions.

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

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

### **PROGRAM SPECIFIC OUTCOMES**

**PSO1:** Develop software applications/solutions as per the needs of Industry and society

**PSO2:** Adopt new and fast emerging technologies in computer science and engineering.

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR20]**

**SEMESTER I****CONTACT HOURS: 26**

<i>S.No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1.	20BS1101	Basic Science	Matrices and Differential Calculus	3	0	0	3
2.	20BS1102A	Basic Science	Applied Physics (CSE/IT)	3	0	0	3
3.	20ES1103	Engineering Science	Programming for Problem Solving	3	0	0	3
4.	20ES1104	Engineering Science	Basics of Electrical Engineering	3	0	0	3
5.	20HS1105	Humanities and Social Science	Technical English and Communication Skills	2	0	0	2
6.	20BS1151A	Basic Science	Engineering Physics Laboratory	0	0	3	1.5
7.	20ES1152	Engineering Science	Programming for Problem Solving Laboratory	0	0	3	1.5
8.	20HS1153	Humanities and Social Science	Technical English and Communication Skills Laboratory	0	0	3	1.5
9.	20ES1154	Engineering Science	Computing and Peripherals Laboratory	0	0	2	1
10.	20MC1106	Mandatory Course	Technology and Society	1	0	0	-
<b>Total</b>				<b>15</b>	<b>0</b>	<b>11</b>	<b>19.5</b>
11.	20MC1107	Mandatory Course	Induction Program				-

**SEMESTER II****CONTACT HOURS: 27**

<i>S.No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1.	20BS2101	Basic Science	Laplace Transforms and Integral Calculus	3	0	0	3
2.	20BS2102	Basic Science	Engineering Chemistry	3	0	0	3
3.	20ES2103A	Engineering Science	Object Oriented Programming using Python	3	0	0	3
4.	20ES2104A	Engineering Science	Basic Electronics Engineering	3	0	0	3
5.	20ES2105	Engineering Science	Engineering Graphics	1	0	4	3
6.	20BS2151B	Basic Science	Engineering Chemistry Laboratory	0	0	3	1.5
7.	20ES2152A	Engineering Science	Object Oriented Programming using Python Laboratory	0	0	3	1.5
8.	20ES2153	Engineering Science	Engineering Workshop	0	0	3	1.5
9.	20MC2106	Mandatory Course	Professional Ethics and Practice	1	0	0	-
<b>Total</b>				<b>14</b>	<b>0</b>	<b>13</b>	<b>19.5</b>

**SEMESTER III****CONTACT HOURS: 28**

<i>S.No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1.	20BS3101A	Basic Science	Discrete Mathematics	3	0	0	3
2.	20ES3102	Engineering Science	Java Programming	3	0	0	3
3.	20CS3303	Program Core	Operating Systems	3	0	0	3
4.	20CS3304	Program Core	Digital logic and Computer Design	3	0	0	3
5.	20CS3305	Program Core	Data Structures	3	0	0	3
6.	20ES3151	Engineering Science lab	Java Programming Laboratory	0	0	3	1.5
7.	20CS3352	Program Core Lab 1	Digital logic Design Laboratory	0	0	3	1.5
8.	20CS3353	Program Core Lab 2	Data Structures Laboratory	0	0	3	1.5
9.	20TP3106	<b>Soft Skills – 1</b>	Logic and Reasoning	0	0	2	1
10.	20MC3107A	Mandatory Course (AICTE suggested)	Environmental Studies	2	0	0	-
<b>Total</b>				<b>17</b>	<b>0</b>	<b>11</b>	<b>20.5</b>

**SEMESTER IV****CONTACT HOURS: 31**

<i>S.No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1.	20BS4101	Basic Science	Probability and Statistics	3	0	0	3
2.	20CS4302	Program Core	Advanced Data Structures and Algorithms	3	0	0	3
3.	20CS4303	Program Core	Computer Organization and Microprocessor	3	0	0	3
4.	20CS4304	Program Core	Computer Networks	3	0	0	3
5.	20HS4105	Humanities and Social Sciences	Universal Human Values	3	0	0	3
6.	20CS4351	Program Core Lab1	Advanced Data Structures and Algorithms Laboratory	0	0	3	1.5
7.	20CS4352	Program Core Lab 2	Microprocessor Laboratory	0	0	3	1.5
8.	20CS4353	Program Core Lab 3	Computer Networks Laboratory	0	0	3	1.5
9.	20TP4106	<b>Soft Skills – 2</b>	English for Professionals	0	0	2	1
10	20CS4607	<b>Skill Oriented Course -1</b>	Industry Standard coding practice-1	1	0	2	2
11	20MC4108B	Mandatory Course (AICTE suggested)	Indian Constitution	2	0	0	-
<b>Total</b>				<b>18</b>	<b>0</b>	<b>13</b>	<b>22.5</b>
<b>Summer Internship 6 weeks (Mandatory) during summer vacation (EPICS)</b>							
<b>Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)</b>				<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**SEMESTER V****CONTACT HOURS: 33**

<i>S.No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1	20CS5301	Program Core	Database Management Systems	3	0	0	3
2	20CS5302	Program Core	Advanced Java Programming	3	0	0	3
3	20HS5103	Humanities and Social Sciences	Engineering Economics and Management	2	0	0	2
4	20CS5404	Program Elective 1	Program Elective 1	3	0	0	3
5	20CS5205	Open Elective1	Open Elective1	2	0	2	3
6	20CS5351	Program Core Lab 1	Database Management SystemsLaboratory	0	0	3	1.5
7	20CS5352	Program Core Lab 2	Advanced Java Programming Laboratory	0	0	3	1.5
8	20HS5153	Humanities and Social Sciences	English Communication Skills Laboratory	0	0	2	1
9	20TP5106	<b>Soft Skills – 3</b>	Personality Development	0	0	2	1
10	20CS5354	Internship / Project (6 weeks)	EPICS	0	0	3	1.5
11	20CS5607	<b>Skill Oriented course -2</b>	Industry Standard Coding Practice - II	1	0	2	2
12	20MC5108A	Humanities Elective (AICTE suggested)	Biology for Engineers	2	0	0	-
<b>Total</b>				<b>16</b>	<b>0</b>	<b>17</b>	<b>22.5</b>
<b>Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)</b>				<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**SEMESTER VI****CONTACT HOURS: 30**

<i>S.No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1	20CS6301	Program Core	Machine Learning	3	0	0	3
2	20CS6302	Program Core	Cryptography and Network Security	3	0	0	3
3	20CS6303	Program Core	Software Engineering	2	0	0	2
4	20CS6404	Program Elective 2	Program Elective 2	3	0	0	3
5	20CS6205	Open Elective 2	Open Elective 2	2	0	2	3
6	20CS6351	Program Core Lab 1	Machine Learning Laboratory	0	0	3	1.5
7	20CS6352	Program Core Lab 2	Cryptography and Network Security Laboratory	0	0	3	1.5
8	20CS6353	Program Core lab 3	Software Engineering Laboratory	0	0	3	1.5
9	20TP6106	<b>Soft Skills –4</b>	Quantitative Aptitude	0	0	2	1
10	20CS6554	Internship / Project	Mini Project – I	0	0	2	1
11	20MC6107B	Mandatory Course (AICTE suggested)	Innovation, IPR & Entrepreneurship	2	0	0	0
<b>Total</b>				<b>15</b>	<b>0</b>	<b>15</b>	<b>20.5</b>
<b>Industrial/Research Internship six weeks (Mandatory) during summer vacation</b>							
<b>Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)</b>				<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>



**SEMESTER VII****CONTACT HOURS: 21**

<i>S. No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1	20CS7301	Program Core	Automata & Compiler Design	3	0	0	3
2	20CS7402	Program Elective 3	Program Elective 3	3	0	0	3
3	20CS7403	Program Elective 4	Program Elective 4	3	0	0	3
4	20CS7404	Program Elective 5	Program Elective 5	3	0	0	3
5	20CS7205	Open Elective 3	Open Elective 3	0	0	0	3
6	20CS7206	Open Elective 4	Open Elective 4	0	0	0	3
7	20CS7607	<b>Advanced Skill Course</b>	Corporate Readiness Skills	1	0	2	2
8	20CS7551	Internship / Project	Mini Project - II	0	0	3	1.5
9	20CS7552	Internship / Project	Industrial / Research Internship	0	0	3	1.5
<b>Total</b>				<b>13</b>	<b>0</b>	<b>8</b>	<b>23</b>
<b>Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)</b>				<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

Note: Open Elective Courses 3 and 4 are self-learning. Students may opt from any MOOCs platform. They have to submit the certificate before the last instruction day of VII semester. Course selection for MOOCs is subject to approval by the Head of the Department.

**SEMESTER VIII****CONTACT HOURS: 24**

<i>S.No</i>	<i>Course Code</i>	<i>Course Category</i>	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
1	20CS8551	Internship / Project**	Major Project and Internship (6 Months)	0	0	24	12
<b>Total</b>				<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

\*\* The student should undergo internship and simultaneously he/she should work on a project with well-defined objectives. At the end of the semester the student should submit an internship completion certificate and a project report.

\*\* If any of our associated company comes forward to offer an emerging course that will be offered as an industry offered course in V, VI or VII semesters under program elective with the approval of BoS. This is incorporated to enhance student skills and Employability in cutting edge technologies.

**LIST OF PROGRAM ELECTIVES****Streams:**

- Artificial Intelligence & Machine Learning (AI/ML)
- Data Science
- IoT& Cloud (IoT&C)
- Cyber security & Block Chain (CSBC)
- AR & VR Game Tech (AR&VR)
- Computer Networks(CN)
- Others
- Industry offered Courses (IOC)

**SEMESTER V (Program Elective I)**

S.No	Course Code	Stream	Course Name	L	T	P	Credits
1.	20CS5404A	AI/ML& Data Science	Applied Statistics	3	0	0	3
2.	20CS5404B	IoT& C	Principles of Cloud Computing	3	0	0	3
3.	20CS5404C	CSBC	Information Security and Risk Management	3	0	0	3
4.	20CS5404D	AR & VR	Programming for Games	2	0	2	3
5.	20CS5404E	CN	Network Programming	2	0	2	3
6.	20CS5404F	Others	Object Oriented Analysis and Design	3	0	0	3
7.	20CS5404G	IOC	Industry offered course	3	0	0	3

**SEMESTER VI (Program Elective II)**

S.No	Course Code	Stream	Course Name	L	T	P	Credits
1.	20CS6404A	AI/ML	Artificial Intelligence	3	0	0	3
2.	20CS6404B	Data Science	Programming For Data Science	2	0	2	3
3.	20CS6404C	IoT& C	Internet of Things	2	0	2	3
4.	20CS6404D	CSBC &CN	Software Defined Networks	3	0	0	3
5.	20CS6404E	AR & VR	Advanced Programming for Games	3	0	0	3
6.	20CS6404F	Others	Natural Language Processing	3	0	0	3
7.	20CS6404G	IOC	Industry offered course	3	0	0	3

**SEMESTER VII (Program Elective III)**

S.No	Course Code	Stream	Course Name	L	T	P	Credits
1.	20CS7402A	AI/ML, Data Science	Business Intelligence and Data Visualization	3	0	0	3
2.	20CS7402B	IoT& C	Cloud Architecture	3	0	0	3
3.	20CS7402C	CSBC	Cyber Security	3	0	0	3
4.	20CS7402D	AR & VR	UI&UX design	3	0	0	3
5.	20CS7402E	CN	High Performance Computing	3	0	0	3
6.	20CS7402F	Others	Pattern Recognition	3	0	0	3
7.	20CS7402G	IOC	Industry offered course	3	0	0	3

**SEMESTER VII (Program Elective IV)**

S.No	Course Code	Stream	Course Name	L	T	P	Credits
1.	20CS7403A	AI/ML	Predictive Modelling & Analytics	3	0	0	3
2.	20CS7403B	Data Science	Big Data Analytics	3	0	0	3
3.	20CS7403C	IoT& C	Big Data on Cloud	3	0	0	3
4.	20CS7403D	CSBC	Cyber Forensics	3	0	0	3
5.	20CS7403E	AR & VR	Cross Platform Game Development	3	0	0	3
6.	20CS7403F	CN	Wireless Communication Networks	3	0	0	3
7.	20CS7403G	Others	Software Testing Methodologies	3	0	0	3
8.	20CS7403H	IOC	Industry offered course	3	0	0	3

**SEMESTER VII (Program Elective V)**

S.No	Course Code	Stream	Course Name	L	T	P	Credits
1.	20CS7404A	AI/ML, Data Science	Deep Learning	3	0	0	3
2.	20CS7404B	IoT& C	Adhoc and Sensor Networks	3	0	0	3
3.	20CS7404C	CSBC	Block chain Technology	3	0	0	3
4.	20CS7404D	AR & VR	Virtual Reality Technologies & AR Development	3	0	0	3
5.	20CS7404E	CN	Cyber Physical Systems	3	0	0	3
6.	20CS7404F	Others	Mobile Commerce	3	0	0	3

7.	20CS7404G	IOC	Industry offered course	3	0	0	3
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## LIST OF OPEN ELECTIVES

## SEMESTER V (OE I)

S.No	Course Code	Course	Course Name	L	T	P	Credits
1.	20CS5205A	Open Elective I	Web Programming	2	0	2	3
2.	20CS5205B	Open Elective I	LINUX Essentials	2	0	2	3
3.	20CS5205C	Open Elective I	Fundamentals of Data Structures <b>*For the students of Non CSE(AI&amp;DS, AI&amp;ML/IT branches only)</b>	2	0	2	3
4.	20CS5205D	Open Elective I	Data Mining & Data warehousing	2	0	2	3

## SEMESTER VI (OE II)

S.No	Course Code	Course	Course Name	L	T	P	Credits
1.	20CS6205A	Open Elective II	Mobile Application Development	2	0	2	3
2.	20CS6205B	Open Elective II	No SQL Databases	2	0	2	3
3.	20CS6205C	Open Elective II	Fundamentals of Java Programming <b>*For the students of Non CSE (AI&amp;DS, AI&amp;ML/IT branches only)</b>	2	0	2	3
4.	20CS6205D	Open Elective II	Introduction to Artificial Intelligence & Machine Learning <b>* For the students of Non CSE(AI&amp;DS, AI&amp;ML/IT branches only)</b>	2	0	2	3

## SEMESTER VII (OE III)

S.No	Course Code	Course	Course Name	L	T	P	Credits
1.	20CS7205A	Open Elective III	Programming in C++: A Hands-on Introduction Specialization (Offered by Codio)	0	0	0	3
2.	20CS7205B	Open Elective III	Social Networks(Offered by NPTEL)	0	0	0	3
3.	20CS7205C	Open Elective III	Any other MOOC Course decided by the department	0	0	0	3

## SEMESTER VII (OE IV)

S.No	Course Code	Course	Course Name	L	T	P	Credits
1.	20CS7206A	Open Elective IV	Mastering Software Development in R Specialization(Offered by Johns Hopkins University)	0	0	0	3
2.	20CS7206B	Open Elective IV	Foundations of R Software(Offered by NPTEL)	0	0	0	3
3.	20CS7206C	Open Elective IV	Any other MOOC Course decided by the department	0	0	0	3

## **SEMESTER – I**

## 20BS1101

### MATRICES AND DIFFERENTIAL CALCULUS

<b>Course</b>	Institutional Core	<b>Credits:</b>	3
<b>Category:</b>			
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial- Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Fundamentals of Matrices, Fundamentals of Calculus, Integration, Differentiation.	<b>Continuous Evaluation: Semester end Evaluation: Total Marks:</b>	30 70 100

### COURSE OUTCOMES

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

- |            |   |
|------------|---|
| <b>CO1</b> | Determine Eigen values, Eigen vectors of a matrix.                  |
| <b>CO2</b> | Estimate Maxima and Minima of Multivariable functions.              |
| <b>CO3</b> | Solve the Linear differential equations with constant coefficients. |
| <b>CO4</b> | Solve the Linear differential equations with variable coefficients. |

**Contribution of Course Outcomes towards achievement of Program Outcomes  
(L – Low, M - Medium, H – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
<b>CO1</b>	3	2			1							
<b>CO2</b>	3	2			1							
<b>CO3</b>	3	2			1							
<b>CO4</b>	3	2			1							

### COURSE CONTENT

#### UNIT I

**Matrices:** Consistency of Linear System of Equations, Linear Transformations

Vectors, Eigen values and Eigen vectors, Properties of Eigen values, Finding Inverse and Powers of a Matrix by Cayley-Hamilton Theorem. Reduction to Diagonal form, Reduction of Quadratic form to Canonical form, Nature of a Quadratic form, Complex matrices.

## UNIT II

**Differential Calculus:** Fundamental Theorems-Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem and Taylor's Theorem. Expansions of functions-Maclaurin's Series and Taylor's Series.

**Application:** Curvature, Radius of Curvature.

**Functions of two or more Variables:** Taylor's Theorem for Function of two Variables, Maxima and Minima of Functions of two Variables, Lagrange's Method of Undetermined Multipliers.

## UNIT III

**Differential Equations of First Order:** Exact Differential Equations, Equations Reducible to Exact Equations.

**Applications:** Orthogonal Trajectories, Newton's Law of Cooling.

**Linear Differential Equations of Higher Order:** Definitions, Operator D, Rules for Finding the Complementary Function, Inverse Operator, Rules for finding Particular Integral, Working Procedure to Solve the Equation.

## UNIT IV

Method of Variation of Parameters, Method of Undetermined Coefficients. Equations Reducible to Linear Equations with Constant Coefficients: Cauchy's Homogeneous Linear Equation, Legendre's Linear Equation, Linear Dependence of Solutions, Simultaneous Linear Equations with Constant Coefficients.

**Application:** L-C-R Circuits.

## TEXT BOOK

1. B.S.Grewal , Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> Edition, 2019.

## REFERENCE BOOKS

[1].Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10<sup>th</sup> Edition, 2015.

[2].B.V.Ramana, Higher Engineering Mathematics, Tata MC Graw Hill, 1<sup>st</sup> Edition, 2015.

Edition, 2007. [3].N.P.Bali, Dr.Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 9<sup>th</sup> Edition, 2014.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1]. [www.nptel.videos.com/mathematics/](http://www.nptel.videos.com/mathematics/) (Math Lectures from MIT,Stanford,IIT'S)

[2]. [nptel.ac.in/courses/122104017](http://nptel.ac.in/courses/122104017)

[3]. [nptel.ac.in/courses/111105035](http://nptel.ac.in/courses/111105035)

[4]. Engineering Mathematics Open Learning Project.  
[www.3.ul.ie/~mlc/support/Loughborough%20website/](http://www.3.ul.ie/~mlc/support/Loughborough%20website/)

## 20BS1102A APPLIED PHYSICS

<b>Course</b>	Institutional Core	<b>Credits:</b>	3
<b>Category:</b>			
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial- Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	10 + 2 level Physics	<b>Continuous Evaluation:</b>	30
		<b>Semester end</b>	70
		<b>Evaluation:</b>	100
		<b>Total Marks:</b>	

### COURSE OUTCOMES

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

<b>CO1</b>	Understand the importance of quantum mechanics.
<b>CO2</b>	Analyse and understand various types of lasers and their applications.
<b>CO3</b>	Elaborate different types of optical fibers and understand the concept of Superconductivity
<b>CO4</b>	Understand the fabrication of nanomaterials and carbon Nanotubes.

**Contribution of Course Outcomes towards achievement of Program Outcomes  
(L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>	3											
<b>CO2</b>	3		2									
<b>CO3</b>	3		1									
<b>CO4</b>	3				2							

### COURSE CONTENT

#### Unit-I : Quantum Mechanics

**Quantum Mechanics:** Dual nature of light, Matter waves and Debroglie's hypothesis, Davisson-Germer's experiment, G. P. Thomson experiment, Heisenberg's uncertainty principle and its applications (Non existence of electron orbits)



in nucleus, Finite width of spectral lines), One dimensional time independent and time dependent Schrödinger's wave equations, physical significance of wave function, Particle in a box (One dimension).

## **Unit-II :Lasers**

**Lasers:** Introduction, Characteristics of laser, Basic Principles of laser (absorption, spontaneous emission, stimulated emission), Requirements of laser (pumping, population inversion, cavity resonance), Einstein's coefficients, different types of lasers: solid-state lasers (Ruby, Neodymium), gas lasers (He-Ne, CO<sub>2</sub>), Semiconductor laser, applications of lasers in science, engineering and medicine.

## **Unit- III : Fibre Optics and Superconductivity**

**Fibre Optics:** Introduction, Fundamentals of optic fibre, Propagation of light through optical fiber, Types of optical fibers, Numerical aperture, Fractional Refractive Index change, Fiber optics in communication and its advantages.

**Superconductivity:** Introduction, Critical parameters, Flux quantization, Meissner effect, Types of Superconductors, BCS theory, Cooper pairs, London's equation, penetration depth, high temperature superconductors, Applications of superconductors.

## **TEXT BOOKS**

- [1]. M.N. Avadhanulu & P.G. Kshirsagar, Engineering Physics, S. Chand publications, Revised Edition, 2014
- [2]. P.K. Palanisamy, "Applied Physics", Scitech Publications(INDIA) Pvt. Ltd., Fifth Print, 2008.

## **REFERENCE BOOKS**

- [1]. B. K. Pandey and S. Chaturvedi, 'Engineering Physics' Cengage Learning' Delhi, 2012.
- [2]. O. Svelto, Principles of Lasers, 5<sup>th</sup> Edition, Springer, London, 2010
- [3]. M.R. Srinivasan, "Engineering Physics", New age international publishers, First Edition, 2011.
- [4]. Gaur and Gupta, Engineering Physics, Dhanpatrai publishers, 8<sup>th</sup> edition 2008

## **E-RESOURCES AND OTHER DIGITAL MATERIAL**

1. <https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2013/lecture-videos/>
2. <https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics>

spring-2008/laser-fundamentals-i/

3. <http://nptel.ac.in/courses/112106198/19>

4. <https://www.peterindia.net/NanoTechnologyResources.html>

**20ES1103****PROGRAMMING FOR PROBLEM SOLVING**

<b>Course</b>	Engineering Science	<b>Credits:</b>	3
<b>Category:</b>			
<b>Course Type:</b>	Theory	<b>Lecture-Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	--	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Understand the different types of problem solving approaches
<b>CO2</b>	Apply the selections, loops, arrays, and string concepts in C to solve problems.
<b>CO3</b>	Apply functions and pointer concepts in C to solve problems.
<b>CO4</b>	Apply enum, structures, unions, and file handling functions to Solve problems

**Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSC 2</b>
<b>CO1</b>	3	1												
<b>CO2</b>		2	3										2	
<b>CO3</b>		2	3										3	
<b>CO4</b>		2	3										3	

**COURSE CONTENT****UNIT I**

**Introduction to computer-based problem solving:** Requirement of problem

solving by computers, problem definition, Use of examples for problem solving similarities between problems, Problem solving strategies, steps involved in problem solving.

**Program design and implementation issues:** programs and algorithms, top-down design and step-wise refinement, construction of loops-basic programming constructs, Implementation, programming environment.

**Algorithms for problem solving:** Exchanging values of two variables, Summation of a set of numbers, decimal to binary base conversion, reversing the digit of an integer, to find greatest common divisor (GCD) of two numbers, to verify whether an integer is prime or not, organize a given set of numbers in ascending order, find the square root of an integer, factorial of a given number, generate the Fibonacci sequence for n terms, evaluate  $\sin(x)$  as sum of series, to find the value of the power of a number raised by another integer, reverse order elements of an array, find largest number in an array, print elements of upper triangular matrix, multiplication of two matrices, to compute roots of a quadratic equation  $ax^2+bx+c=0$ .

## UNIT II

**Introduction to the C Language:** Background of C program, Identifiers, Types Variables, Constants, Memory Layout, Input/Output, Programming Examples.

**Structure of a C Program:** Logical Data and Operators, Expressions, Precedence and Associativity, Evaluating Expressions, Type Conversion, Statements, Storage Class.

**Selection:** Two-way Selection, Multiway Selection, More Standard Functions.

**Repetition:** Concept of a Loop Loops In C, Loop Examples, Recursion, The Calculator Program.

**Arrays:** Array Concepts in C, Inter-Function Communication, Array Applications Two Dimensional Arrays, Multidimensional Arrays.

## UNIT III

**Strings:** String Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions, String- Data Conversion.

**Functions:** Functions in C, User Defined Functions, Call by Value, Call Value Reference, Inter-Function Communication, Standard Functions, Scope.

**Pointers:** Introduction to Pointer, Pointers for Inter-Function Communications Pointers to Pointers, Compatibility, Lvalue and Rvalue.

**Pointer Applications:** Arrays and Pointers, Pointer Arithmetic and Arrays Passing an Array to a Function, Memory Allocations Functions, Array of Pointers.

## UNIT IV

**Enumerations:** The Type Definition(Typedef), Enumerated Types: Declaring an Enumerated Type , Operations on Enumerated Types, Enumeration Type Conversion, Initializing Enumerated Constants, Anonymous Enumeration Constants, Input/Output Operators.

**Structures:** Structure Type Declaration, Initialization, Accessing Structures Operations on Structures, Complex Structures, Structures and Functions, Sending the Whole Structure, Passing Structures through Pointers.

**Unions:**Referencing Unions, Initializers, Unions and Structures, Internet Address Programming Applications.

**File Handling:**Files, Streams, Standard Library Input/Output Functions Formatting Input/output Functions and Character Input/Output Functions Command-Line Arguments.

## TEXT BOOKS

- [1]. Programming and Problem Solving Through "C" Language By HarshaPriya R. Ranjeet · Firewall media 2006
- [2]. Behrouz A. Forouzan and Richard F. Gilberg, “Computer Science A Structured Programming Approach Using C”, CENGAGE Learning, Third Edition

## REFERENCE BOOKS

- [1] Anil B. Chaudhuri, “Flowchart and Algorithm Basics: The Art of Programming”, Mercury Learning & Information, 2020.
- [2] R.G. Dromey, “How to Solve it By Computer”, Prentice-Hall International Series in Computer Science,1982.
- [3] YashwantKanetkar , “Let us C” , BPB Publications, 16th Edition 2017.
- [4] Kernighan and Ritchie,“The C programming language”, The (Ansi C Version) PHI, second edition.
- [5] Paul J. Dietel and Harvey M. Deitel, “C: How to Program”, Prentice Hall, 8th edition (Jan 19 ,2021).
- [6] K.R.Venugopal, Sundeep R. Prasad, “Mastering C”, McGraw Hill, 2nd Edition 2015.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Computer Science and Engineering - Noc:problem Solving Through Programming in C. [online] <https://nptel.ac.in/courses/106/105/106105171/>
- [2] Computer Science and Engineering - Noc:introduction To Programming in C [online] <https://nptel.ac.in/courses/106/104/106104128/>
- [3] C For Everyone: Structured Programming [online]<https://www.coursera.org/learn/c-structured-programming>
- [4] Advanced C Programming CourseTim Academy-Jason Fedin. [online] <https://www.udemy.com/-course/advanced-c-programming-course/>

**20ES1104**  
**BASICS OF ELECTRICAL ENGINEERING**

<b>Course</b>	Engineering Sciences	<b>Credits:</b>	3
<b>Category:</b>			
<b>Course Type:</b>	Theory	<b>Lecture-Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	--	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Analyze Electric Circuit fundamentals.
<b>CO2</b>	Understand the basic concepts of Alternating Quantities and Magnetic Circuits.
<b>CO3</b>	Analyze the basic concepts of Electric Machines
<b>CO4</b>	Understand Measuring Instruments & Solar Photo Voltaic System concepts

### Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	3			2									
<b>CO2</b>	3	3												
<b>CO3</b>	2	2			2									
<b>CO4</b>	2	2												

### COURSE CONTENT

#### UNIT - I

**Introduction to Electrical Engineering:** Electric Current, Electromotive force, Electric power and energy, Basic circuit components- Resistors-Inductors-Capacitors. Electromagnetic Phenomenon and Related Laws, Kirchhoff's laws.

**Network Analysis:** Network sources-Ideal independent voltage source, Ideal independent current source, Dependent sources, Practical voltage and current sources, Source conversion, Voltage and Current division rule, series and parallel connection of R, L and C, Star-Delta or, Delta- Star transformation. Mesh and Nodal Analysis (with independent sources only).

## UNIT – II

**Alternating Quantities:** Introduction, Generation of a.c. voltages, Waveforms and Basic Definitions, Relationship between frequency, speed and number of poles, Root Mean Square and Average values of alternating current and voltages, Form Factor and Peak Factor, Phasor representation of alternating quantities.

**Magnetic Circuits:** Introduction, Magnetic Circuits, Magnetic Field Strength (H), Magneto motive Force, Permeability, Reluctance, Analogy between Electric and Magnetic Circuits, Magnetic potential drop, Magnetic circuit computations, Self and Mutual Inductance, Energy in Linear Magnetic Systems

(Derivation for pure inductor).

## UNIT - III

**DC Machines:** Introduction, Construction of dc machines, Armature Windings, Generation of dc voltage and torque production in a dc machine, Operation of a dc machine as a generator, Operation of dc machine as a motor.

**Induction Motors:** Introduction, Constructional features of three-phase induction motors, Principle of operation of three-phase induction motor- Slip and rotor frequency, Voltage and current equations and equivalent circuit of an induction motor.

## UNIT - IV

**Measuring Instruments:** Introduction, Classification of instruments, Operating Principles, Essential features of measuring instruments, Ammeters and Voltmeters, Measurement of power.

**Solar photovoltaic Systems:** Solar cell fundamentals, characteristics, classification, module, panel and array construction, Maximizing the solar PV output and load matching, Maximum Power Point Tracker Basic Algorithm and Flowchart, PV system components, solar PV systems and solar PV applications.



**TEXT BOOKS**

[1] T.K. Nagasarkar and M.S. Sukhja, “Basic Electric Engineering”, 2nd ed., Oxford University press 2011.

**REFERENCE BOOKS**

[1] B.H.Khan, ”Non Conventional Energy Resources”, 2nd ed., Mc.Graw Hill Education Pvt Ltd., New Delhi, 2013.

[2] Ashfaq Hussain, Haroon Ashfaq, “ Fundamentals of Electric Engineering” 4th ed., Dhanpat Rai & Co, 2014.

[3] I.J. Nagarath and Kothari, “Theory and Problems of Basic Electric Engineering”, 2<sup>nd</sup> ed., PHI Pvt. Ltd., 2016.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1]. <http://nptel.ac.in/courses/108108076/>

**20HS1105****TECHNICAL ENGLISH AND COMMUNICATION SKILLS**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	2
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 0
<b>Prerequisites:</b>	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

**COURSE OUTCOMES**

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

<b>CO1</b>	Develop administrative and professional compilations with felicity of expression
<b>CO2</b>	Demonstrate Proficiency in advanced reading and context oriented writing
<b>CO3</b>	Apply the elements of functional English with sustained understanding for authentic use of language in any given academic and/or professional environment
<b>CO4</b>	Execute tasks in Technical communication with competence

**Contribution of Course Outcomes towards achievement of Program Outcomes**

**(L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>						2				3		
<b>CO2</b>						2			2	3		
<b>CO3</b>						2			2	3		
<b>CO4</b>										3		

## COURSE CONTENT

### UNIT I

#### **Professional Writing Skills:-**

##### ➤ **Professional Letters:**

Business, Complaint and Transmittal – Purpose, Style and format with special reference to

Block Format and Modified Block Format

##### ➤ **Paragraph and Essay Writing:**

Linkers, Descriptive and Analytical with illustrations

##### ➤ **Effective writing Practice-**

Appropriateness, Brevity, clarity, cogency and coherence with guided and semi-controlled

compilations including the use of Idiomatic expressions

### UNIT II

#### **Reading comprehension and Discourse development Skills**

➤ **Analytical and critical reading** - critical, creative and lateral thinking-language and thinking – thinking process and language development.

➤ **Effective reading Strategies** - Skimming, Scanning, Eye span, fixation, taming Regression, and Issues and Challenges of Vocalization and sub-vocalization.

➤ **Context-oriented Dialogue/ Argument writing** - Extending Invitation, Reciprocation, Acceptance,

Concurrence, Disagreeing without being disagreeable- Discourse/dialogue

Development and identification of inconsistencies in pre-prepared dialogues

### UNIT III

#### **Vocabulary and Functional English**

➤ **Vocabulary for Competitive examinations** ( A list of 500 High frequency words) Synonyms,

Antonyms, Matching Homonyms, Homophones and nearer words along with Root words

➤ **Verbal analogies**(Single Unit) – Synonym Relation, Antonym relation, Object- Operator relation, Object-Obstacle/obstruction relation, Sequence Relation, Place-Monument Relation, Science- area of activity relation, Profession- Tool relation, Gender relation, Diminutive relation, etc

➤ **Functional Grammar** with special reference to Tense, Concord, Article pronoun-referent,

Prepositions, use of Gerund, Parallelism, etc ( A Representative collection of 100 sentences)

**UNIT IV****Technical Communication skills:**

- **Technical Proposal writing-** Characteristics, Proposal Superstructure, Checklist, Formal Proposal
- **Technical Vocabulary-** Basic explanations and Description
- **Technical Report writing-** Informational Reports and Feasibility Report-Types, Components, Style and Formats

**TEXT BOOKS**

- [1] Martin Cutts, Oxford guide to Plain English, 7<sup>th</sup> Impression, Oxford University Press, 2011
- [2] M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.
- [3] John Langan, College Writing Skills, McGraw Hill, IX Edition, 2014.
- [4] Eclectic Learning materials offered by the Department

**REFERENCE BOOKS**

- [1] Randolph Quirk, Use of English, Longman, I Edition (1968) Reprinted 2004.
- [2] Thomson A.J & A.V, Martinet, Practical English Grammar, III Edition, Oxford University Press, 2001
- [3] V.Sethi and P.V. Dhamija, A Course in Phonetics and Spoken English, II Edition, PHI, 2006

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] <https://www.britishcouncil.org/english>
- [2] [www.natcorp.ox.ac.uk/Wkshops/Materials/specialising.xml?ID=online](http://www.natcorp.ox.ac.uk/Wkshops/Materials/specialising.xml?ID=online)
- [3] [https://www.uni-marburg.de/sprachenzentrum/selbstlernzentrum/.../apps\\_for\\_esl.pdf](https://www.uni-marburg.de/sprachenzentrum/selbstlernzentrum/.../apps_for_esl.pdf)

**20MC1106**  
**TECHNOLOGY AND SOCIETY**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	--
<b>Course Type:</b>	Mandatory Learning	<b>Lecture -Tutorial-Practice:</b>	1 - 0 - 0
<b>Prerequisites:</b>		<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	--
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Understand the origins of technology and its role in the history of human progress.
<b>CO2</b>	Know the Industrial Revolution and its impact on Society
<b>CO3</b>	Interpret the developments in various fields of technology till Twentieth Century.
<b>CO4</b>	Distinguish the impacts of Technology on the Environment and achievements of great scientists.

**Contribution of Course Outcomes towards achievement of Program Outcomes**  
(L – Low, M - Medium, H – High)

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>	3							1				
<b>CO2</b>	3				2		1					
<b>CO3</b>	3							1				
<b>CO4</b>	3				2		1					

**COURSE CONTENT**

**UNIT – I**

**(4 lectures)**

**Introduction:** Origins of technology, The Agriculture revolution, Technological contributions of ancient civilizations- Mesopotamians, Egyptians, Greeks, Romans, Indians and Chinese.

**UNIT – II****(4 lectures)**

**Industrial revolution:** The social and political background, The technical background, Steam: The power behind the Industrial Revolution, The revolution in Textile Industry, The Impact of Industrial Revolution on Society.

**UNIT – III****(4 lectures)**

**The Flowering of modern technology:** Manufacturing Technologies, Prime Movers, Internal Combustion Engines, Production of Metals and Alloys, The Birth of Electrical Technology, Twentieth Century: The Flowering of modern technology like information technology and biotechnology, and its implications on society.

**UNIT – IV****(4 lectures)**

**Technology, Science and Society:** Impact of technology on society, The Impacts of Technology on the environment, Sustainable development.

**Achievements of famous scientists:**

**(World):** Einestein, Newton, Faraday, Graham Bell, Edison, S.Hawking.

**(India):** CV Raman, S.Chandrasekhar, Aryabhatta, Homi J Bhabha, Vikram Sarabhai, APJ Abdulkalam, S.Ramanujan, M.Visweswarayya.

**TEXT BOOKS**

[1] Dr. R.V.G Menon, “Technology and Society”, Pearson Education, 2011

**REFERENCE BOOKS**

[2] Quan-Haase, A., “ Technology and Society: Inequality, Power, and Social Networks”, Oxford University Press, 2013.

**20BS1151A**  
**ENGINEERING PHYSICS LABORATORY**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Lab	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Use function generator, spectrometer and travelling microscope in various experiments
<b>CO2</b>	Test optical components using principles of interference and diffraction of light
<b>CO3</b>	Determine the V-I characteristics of solar cell and photo cell and appreciate the accuracy in measurements

### Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>				3								
<b>CO2</b>				3								
<b>CO3</b>	2			3								

### COURSE CONTENT

1. Photo cell-Study of V-I Characteristics, determination of work function
2. Newton's Rings-Radius of curvature of plano convex lens.
3. Compound pendulum-Measurement of 'g'
4. LCR circuit- Study of Resonance
5. AC Sonometer –Verification of vibrating laws

6. Solar cell–Determination of Fill Factor
7. Diffraction grating-Wavelength of laser light
8. Optical fiber-Study of attenuation and propagation characteristics
9. Diffraction grating-Measurement of wavelength of mercury source
10. Hall effect –Hall coefficient measurement
11. Figure of merit of a galvanometer
12. Variation of magnetic field along the axis of current-carrying circular coil

### **TEXT BOOKS**

- [1] Madhusudhan Rao, “Engineering Physics Lab Manual”, Isted., Scitech Publications, 2015
- [2] Ramarao Sri, Choudary Nityanand and Prasad Daruka, ”Lab Manual of Engineering Physics”., Vth ed., Excell Books, 2010

### **E-RESOURCES**

- [1] <http://plato.stanford.edu/entries/physics-experiment>
- [2] <http://www.physicsclassroom.com/The-Laboratory>
- [3] <http://facstaff.cbu.edu/~jvarrian/physlabs.html>

### **VIRTUAL LAB REFERENCES**

- [1] <http://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1>
- [2] <http://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1>
- [3] <http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1>



## 20ES1152

### PROGRAMMING FOR PROBLEM SOLVING LABORATORY

<b>Course Category:</b>	Engineering Science	<b>Credits:</b>	1.5
<b>Course Type:</b>	Lab	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	---	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

#### COURSE OUTCOMES

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

<b>CO1</b>	Implement the use of programming constructs in a structural programming language.
<b>CO2</b>	Apply the selections, loops, arrays, and string concepts in C to solve problems.
<b>CO3</b>	Apply functions, pointer, and Enum concepts in C to solve problems.
<b>CO4</b>	Solve problems using structures, Unions, and file handling functions.

**Contribution of Course Outcomes towards achievement of Program Outcomes**  
(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1		3											
<b>CO2</b>		1	3										1	
<b>CO3</b>		1	3										3	
<b>CO4</b>		1	3										3	

#### COURSE CONTENT

##### WEEK – 1 : Introduction to C Programming

- a) The Structure of C Program with a sample program.

- b) Use identifiers, data types, format specifiers, constants, and variables declaration and initialization to write simple C programs.
- c) Write simple C programs using preprocessor commands and simple I/O statements.

## **WEEK – 2 : Data Types and Variable Declarations**

- a) Use void, integral and floating point data types in different scenarios to write programs.
- b) Use various primitive data types for performing different mathematical operations.
- c) Programs to perform mathematical operations using various operators in C

## **WEEK – 3 : Selection – Making Decisions**

- a) Write programs using the if...else selection statements.
- b) Use nested if...else statement to solve problems that need multi-level selection making decisions.
- c) Write programs that use switch...case and else...if multi way statements to select one out of several options.

## **WEEK – 4 : Looping Constructs and Their Applications**

- a) To have a clear idea on loop initialization, validation and updation.
- b) Write programs using the while, for, or do...while loops.
- c) To understand the logic and adopt best looping construct for different kinds of problems.
- d) Design and develop programs based on Iterative loops using While, Do While, For, Nested For.

## **WEEK – 5 : Unconditional Control Transfer Statements**

- a) Write programs using of (break, and continue) unconditional control transfer statements.
- b) Use the goto statement to transfer the control from one part to another part of a program and the use of return statement to end the execution of a called function.

## **WEEK – 6 : Arrays and Their Applications**

- a) To utilize one dimensional and multi-dimensional arrays to solve problems that use set(s) of similar type input data.
- b) To write programs that perform multiple classical operations like searching,

sorting, updation, or deletion on array elements.

### **WEEK – 7 : Strings, String I/O and Manipulation Functions**

- a) To write programs that work on read, write and manipulate fixed length and variable-length strings and/or arrays of strings
- b) To write programs that use predefined string I/O functions.
- c) To write programs that use string manipulation functions from the string library.

### **WEEK – 8 : Concepts of User Defined Functions**

- a) Design and develop programs depending on functions both user defined and standard library functions in C with different approaches.
- b) To write a program using more than one function with or without parameters and function return type.

### **WEEK – 9 : Pointers and Their Applications**

- a) Programs on declaration of pointers and their usage in C.
- b) Programs to relate between arrays and pointers and use them efficiently in a program.
- c) To pass pointers as an argument to a function, and use it efficiently in a program.
- d) To write programs using static and dynamic memory allocation.

### **WEEK – 10 : Structure, Union, and Enumeration**

- a) Programs to define, declare and access structure and union variables
- b) Design and develop programs to work with pointers to access data within a structure
- c) Programs to pass structure as an argument to a function
- d) To write C programs using enumeration data types, an easiest way of mapping symbolic names to integer values.

### **WEEK – 11 : File Handling Operations**

- a) Programs to open and close text and binary files using file I/O commands.
- b) Write programs to perform read and write operations using the formatting I/O and character I/O functions.
- c) Apply file positioning, status and system commands based on a problem requirements.

**WEEK – 12 : Command Line Arguments**

- a) To use command line arguments to pass inputs in a single line while executing a program through the DOS command prompt or Linux terminal.
- b) To use atoi function to convert a default string value argument to an integer value inside the main function in a program.
- c) To use atof function to convert a default string value argument to a float value inside the main function in a program.

**Text Book(s)**

- [1] Behrouz A. Forouzan and Richard F. Gilberg, “Computer Science A Structured Programming Approach Using C”, CENGAGE Learning, Third Edition.

**REFERENCE BOOKS**

- [1] Anil B. Chaudhuri, “Flowchart and Algorithm Basics: The Art of Programming”, Mercury Learning & Information, 2020.
- [2] R.G. Dromey, “How to Solve it By Computer”, Prentice-Hall International Series in Computer Science, 1982.
- [3] Yashwant Kanetkar, “Let us C”, BPB Publications, 16<sup>th</sup> Edition 2017.
- [4] Kernighan and Ritchie, “The C programming language”, The (Ansi C Version), PHI, second edition.
- [5] Paul J. Dietel and Harvey M. Deitel, “C: How to Program”, Prentice Hall, 8<sup>th</sup> edition (Jan 19, 2021).
- [6] K.R. Venugopal, Sundeep R. Prasad, “Mastering C”, McGraw Hill, 2<sup>nd</sup> Edition, 2015.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- 1] Computer Science and Engineering - Noc:problem Solving Through Programming in C. [online] <https://nptel.ac.in/courses/106/105/106105171/>
- [2] Computer Science and Engineering - Noc:introduction To Programming in C. [online] <https://nptel.ac.in/courses/106/104/106104128/>
- [3] C For Everyone: Structured Programming. [online] <https://www.coursera.org/learn/c-structured-programming>
- [4] Advanced C Programming Course Tim Academy-Jason Fedin. [online] <https://www.udemy.com/-course/advanced-c-programming-course/>

**20HS1153**  
**TECHNICAL ENGLISH AND COMMUNICATION SKILLS**  
**LABORATORY**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Practical	<b>Lecture -Tutorial- Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

### **COURSE OUTCOMES**

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

<b>CO1</b>	Develop active and authentic listening comprehension skills relevant for the professional world.
<b>CO2</b>	Execute web related(On-line) communication with felicity of expression
<b>CO3</b>	Apply relevant speech patterns including standard pronunciation
<b>CO4</b>	Demonstrate Proficiency in Interpersonal Communication with fluency and accuracy

**Contribution of Course Outcomes towards achievement of Program Outcomes**  
**(L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>						3				3		
<b>CO2</b>									2	3		
<b>CO3</b>										3		
<b>CO4</b>									2	3		

## COURSE CONTENT

### UNIT I

#### Listening Skills:

- **Exposure to structured and open talks-** Active listening, Appreciative listening, Biased listening, Critical listening Empathetic listening, Judgmental listening
- **Content-oriented Listening Skills :**  
Short Conversations- 5-10 minute duration- components, statistics, nominal and other references
- **Concept oriented/ purposive Listening skills:**  
Long Conversations- 10-30minute duration -
- **Problems in comprehension & retention** – Note-taking practice – Listening tests-
- **Overcoming Barriers to listening:** Physical & psychological – Steps to overcome them with demonstration and practice

### Unit-II

#### Professional and On-line drafting skills:

- **Professional drafting skills :** Circular, Notice, Executive summary
- **E-mail etiquette-** Awareness with Illustrations and practice
- **Elements of Chat-room interaction-** courtesy, techniques of argumentation
- **Written Response to web-content-** conciseness with accountability
- **Data interpretation-** compiling analytical, comparative and critical observations by interpreting graphs, charts, etc.

### UNIT III

#### Phonetics and Speech patterns:

- **Speech Mechanism** – Organs of speech and patterns of articulation of speech sounds.
- **Vowels, Consonants and Diphthongs-** Transcription using International Phonetic Alphabet
- **Word Stress and Rhythm-** practice
- **Intonation pattern practice-** Tones , Tone group boundaries and Tonal variations
- **Strong forms and weak forms in Connected speech** - Illustrations and Practice

### UNIT IV

#### Interpersonal Spoken communication skills:

- **Fluency & accuracy in speech** –Improving self-expression
- **Listener oriented speaking** - Interpersonal Conversation- Manner and Temper
- **Developing persuasive speaking skills-** Role play
- **Overcoming Barriers to speaking** – Building self-confidence– through Conversation practice
- **Improving responding capacity** - Extempore speech practice

## TEXT BOOKS

1. Garner, Bryan A, HBR Guide to Better Business Writing, Harvard Business Review Press, Boston, Massachusetts, 2013.
2. Exercises in Spoken English, Prepared by Department of Phonetics and Spoken English, CIEFL,(Currently English and Foreign Languages University) OUP, 21<sup>st</sup> Impression, 2003

## REFERENCE BOOKS

- [1] Randolph Quirk, Use of English, Longman, I Edition (1968) Reprinted 2004.
- [2] Thomson A.J & A.V, Martinet, Practical English Grammar, III Edition, Oxford University Press,2001
- [3] V.Sethi and P.V. Dhamija, A Course in Phonetics and Spoken English, II Edition, PHI, 2006

## E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] ODII Language Learner's Software, Orell Techno Systems
- [2] Visionet Spears Digital Language Lab software Advance Pro
- [3] [www.natcorp.ox.ac.uk](http://www.natcorp.ox.ac.uk), *British National Corpus*

**20ES1154**  
**COMPUTING AND PERIPHERALS LABORATORY**

<b>Course Category:</b>	Engineering Sciences	<b>Credits:</b>	1
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Able to assemble a PC and install operating system and other software.
<b>CO2</b>	Able to trouble shoot hardware and software issues.
<b>CO3</b>	Able to configure network settings to connect to internet.
<b>CO4</b>	Able to createdocuments, presentations and spread sheets using office productivity tools.

### Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3											1	
CO2	3	2							3				1	
CO3	3			1	2								1	
CO4	3									2			1	

### COURSE CONTENT

#### PC Hardware/Software

**Week 1 – Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Week 1– Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of



assembling a PC. A video would be given as part of the course content.

**Week 2 – Task 1:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

**Week 2 – Task 2:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

**Week 3 – Task 1: Hardware Troubleshooting:** Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

**Week 3 – Task 2: Software Troubleshooting:** Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

### **Networks, Internet & World Wide Web**

**Week 4:** Types of Network cables, connectors, crimping straight and crossover cables, identification of network devices (Hubs, Switches, Routers).

**Week 5: Orientation & Connectivity Boot Camp:** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email.

**Week 6:** Wifi router configuration, connecting to internet, Static/Dynamic IP address configuration, DNS, Gateway, Security configuration.

### **Productivity tools**

#### **LaTeX and Word**

**Week 7– Word Orientation:** The mentor needs to give an overview of Microsoft (MS) office 2007/ equivalent (FOSS) tool word: Importance of MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that would be covered in word – Accessing, overview of components of toolbars, saving files, Using help and resources, rulers, format painter.

**Week 8- Latex:** Using LaTeX to create project certificate. Features to be covered: Formatting Fonts, Drop Cap, Applying Text effects, Using Character Spacing, Borders and Colours, Inserting Header and Footer, Using Date and Time option in both LaTeX.

**Week 9:** Creating project abstract Features to be covered: Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

### **Excel**

**Week 10 - Task 1 - Excel Orientation:** The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the two tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**Week 10 – Task2:** Calculating GPA -Features to be covered: Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP, Sorting, Conditional formatting

### **Power Point or equivalent (FOSS) tool**

Week 11– Task1: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes: PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and Power point. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

Week 12 - Task 3: Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topics covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide master, notes etc), Inserting – Background, textures, Design Templates, Hidden slides.

### **TEXT BOOKS**

1. LaTeX Companion – Leslie Lamport, PHI/Pearson.
2. Introduction to Computers, Peter Norton, 6/e Mc Graw Hill Publishers.
3. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education

4. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
5. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
6. PC Hardware and A+ Handbook – Kate J. Chase PHI (Microsoft)

### **E-RESOURCES AND OTHER DIGITAL MATERIALL**

1. <https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17-1.pdf>
2. <https://www.protosystech.com/rapid-prototyping.htm>
3. <https://www.arduino.cc/en/Tutorial/Foundations>
4. <https://www.tutorialspoint.com/arduino/>

## **SEMESTER – II**

**20BS2101**  
**LAPLACE TRANSFORMS AND INTEGRAL CALCULUS**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial- Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Vectors, Integration, Curve Tracing.	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Solve the Linear differential equations using Laplace Transforms.
<b>CO2</b>	Evaluate areas and volumes using Double, Triple Integrals.
<b>CO3</b>	Evaluate Grad, Div & Curl of scalar and vector point functions.
<b>CO4</b>	Convert Line Integrals to Area Integrals and Surface Integrals to Volume Integrals.

**Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>	3	2			1							
<b>CO2</b>	3	2			1							
<b>CO3</b>	3	2			1							
<b>CO4</b>	3	2			1							

### COURSE CONTENT

#### UNIT I

**Laplace Transforms:** Introduction, Definition, Conditions for the Existence of Laplace Transforms of Elementary functions, Properties of Laplace Transforms of Periodic functions, Transforms of Derivatives, Transforms of Integrals, Multiplication by  $t^n$ , Division by 't', Inverse Transforms-Method of

partial fractions, Other methods of finding Inverse Transform, Convolution Theorem, Unit Step and Unit Impulse functions.

**Applications:** Evaluation of Integrals, Solving Differential Equations by Laplace Transforms.

## UNIT II

**Integral Calculus:** Double Integrals, Change of Order of Integration, Double Integrals in Polar Coordinates, Triple Integrals, Change of Variables.

**Applications:** Area enclosed by Plane Curves, Volumes of Solids.

## UNIT III

**Vector Differential Calculus:** Scalar and Vector point functions, Del applied to Scalar point functions-Gradient, Del applied to Vector point functions, Physical interpretation of Divergence and Curl, Del applied twice to point functions, Del applied to products of point functions.

## UNIT IV

**Vector Integral Calculus:** Integration of Vectors, Line Integral, Surface Integral, Green's Theorem in the plane, Stokes's Theorem, Volume Integral, Gauss Divergence Theorem, Irrotational Fields.

## TEXT BOOK

[1] B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> Edition, 2019.

## REFERENCE BOOKS

[1] Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10<sup>th</sup> Edition, 2015.

[2] B.V.Ramana, Higher Engineering Mathematics, Tata MC Graw Hill, 1<sup>st</sup> Edition 2007.

[3] N.P.Bali, Dr.Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 9<sup>th</sup> Edition, 2014.

## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] [www.nptel.videos.com/mathematics/](http://www.nptel.videos.com/mathematics/) (Math Lectures from MIT, Stanford, IIT'S)

[2] [nptel.ac.in/courses/122104017](http://nptel.ac.in/courses/122104017)

[3] [nptel.ac.in/courses/111105035](http://nptel.ac.in/courses/111105035)

[4] Engineering Mathematics Open Learning Project.

[www.3.ul.ie/~mlc/support/Loughborough%20website/](http://www.3.ul.ie/~mlc/support/Loughborough%20website/)

**20BS2102**  
**ENGINEERING CHEMISTRY**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture-Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	Chemistry knowledge at Intermediate level	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Analyze various water treatment methods and boiler troubles.
<b>CO2</b>	Apply the concept of phase equilibrium to different materials and the knowledge of working of electrodes and batteries in various technological fields.
<b>CO3</b>	Evaluate corrosion processes as well as protection methods.
<b>CO4</b>	Apply the knowledge of conventional fuels and mechanistic aspects of conducting polymers for their effective and efficient utilisation.

**Contribution of Course Outcomes towards achievement of Program Outcomes**

**(L - Low, M - Medium, H - High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>		3										
<b>CO2</b>	2											
<b>CO3</b>			3									
<b>CO4</b>					2							

**COURSE CONTENT**

**UNIT I**

**(10 hours)**

**Water technology-I:** WHO standards - Water treatment for drinking purpose - sedimentation, coagulation, filtration, disinfection by chlorination, breakpoint chlorination and its significance - Desalination of brackish water - principle and

process of electrodialysis and reverse osmosis, advantages and disadvantages.

**Water technology-II:** Boiler troubles - scales-formation, disadvantages and internal conditioning methods - phosphate conditioning, calgon conditioning and sodium aluminate, caustic embrittlement- reasons, mechanism and its control, and boiler corrosion – causes and control.

## UNIT II

(10 hours)

**Phase rule and applications:** Definition and explanation of the terms – phase, component and degree of freedom, phase rule equation, phase equilibria of single component system – water system, two component system – silver-lead system, applications of phase rule.

**Electrochemistry:** Construction and working of Calomel electrode, silver-silver chloride electrode, and principle, construction and working of glass electrode, determination of pH using glass electrode. Chemistry of modern batteries - Li/SOCl<sub>2</sub> battery and Li<sub>x</sub>C/LiCoO<sub>2</sub> battery – construction, working and advantages.

Fuel cells: General working principle of a fuel cell, examples, chemistry of H<sub>2</sub>-O<sub>2</sub> fuel cell.

## UNIT III

(10 hours)

**Corrosion principles:** Introduction, definition, reason for corrosion, examples – types of electrochemical corrosion - hydrogen evolution and oxygen absorption – corrosion due to dissimilar metals, galvanic series – differential aeration corrosion – pitting corrosion and concept of passivity.

**Corrosion control methods:** Cathodic protection- principle and types - impressed current method and sacrificial anode method, anodic protection-principle and method, corrosion inhibitors – types and mechanism of inhibition – principle, process and advantages of electroplating and electroless plating.

## UNIT IV

(10 hours)

**Conducting polymers:** Definition, examples, classification-intrinsically conducting polymers and extrinsically conducting polymers- mechanism of conduction of undoped polyacetylene, doping of conducting polymers-mechanism of conduction of p-doped and n-doped polyacetylenes – applications of conducting polymers.

**Fuel technology:** Fuel-definition, calorific value- lower and higher calorific values and numericals on calculation of HCV and LCV relation, analysis of coal – proximate analysis and ultimate analysis, flue gas analysis by Orsat's



apparatus, numericals based on calculation of air required for combustion.

### **TEXT BOOKS**

- [1] Shikha Agarwal, “Engineering Chemistry – Fundamentals and Applications”, Cambridge University Press, New Delhi, 1<sup>st</sup> edition (2015).

### **REFERENCE BOOKS**

- [1] Sunita Rattan , “A Textbook of Engineering Chemistry”, S.K. Kataria & Sons, New Delhi, First edition 2012.
- [2] P.C. Jain , “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Limited, New Delhi, 15<sup>th</sup> edition.
- [3] B.S. Bahl, G. D. Tuli and Arun Bahl, “Essentials of Physical Chemistry”, S. Chand and Company Limited, New Delhi.
- [4] O. G. Palanna, “ Engineering Chemistry”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] <http://www.cip.ukcentre.com/steam.htm>
- [2] <http://corrosion-doctors.org/Modi;es/mod-basics.htm>
- [3] <http://nopr.niscair.res.in/bitstream/123456789/5475/1/JSIR%2063%289%29%20715-728.pdf>
- [4] [https://chem.libretexts.org/Core/Analytical\\_Chemistry/Electrochemistry/Basics\\_of\\_Electrochemistry](https://chem.libretexts.org/Core/Analytical_Chemistry/Electrochemistry/Basics_of_Electrochemistry)
- [5] <http://www.filtronics.com/blog/tertiary-treatment/stages-in-typical-municipal-water-treatment/>
- [6] NPTEL online course, "Corrosion Part-I" offered by MHRD and instructed by Prof. Kallol Mondal of IIT Kanpur

**20ES2103A****OBJECT ORIENTED PROGRAMMING USING PYTHON**

<b>Course Category:</b>	Engineering Science	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial- Practice:</b>	3- 0 - 0
<b>Prerequisites:</b>	20ES1103 Programming for Problem Solving	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Understand the python syntax and semantics of control flow statements
<b>CO2</b>	Apply functions, modules and string handling in Python to solve problems
<b>CO3</b>	Analyze the methods to create and manipulate programs with Python data structures
<b>CO4</b>	Analyse the concepts of object oriented approach to solve problems

**Contribution of Course Outcomes towards achievement of Program Outcomes**

**(L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	2	1		2						1		3	
<b>CO2</b>			1		2						1		1	
<b>CO3</b>		1	1		1						1		2	
<b>CO4</b>		3	2		2						2		3	

**COURSE CONTENT****UNIT I**

**Introduction to Object Oriented Programming:** Features of Object Oriented Programming, Merits and demerits of object oriented programming languages, applications of object oriented programming, comparison between commonly used programming languages.

**Basics of Python Programming:** Features, History, future of python, , writing and executing first python program, Literal constants, variables and identifiers, data types, input operation, comments, reserved words, indentation, operators and expressions, expressions, Type conversion

**Decision control statements:** Introduction, Selection/conditional branching statements, Basic loop structures/iterative statements, Nested loops, break, continue and pass statements

## UNIT II

**Functions and Modules:** Introduction, function declaration and definition, function definition, function call, variable scope and lifetime, the return statement, recursive functions, modules, packages in python.

**Strings:** Concatenating, appending and multiplying strings, immutability, String formatting operator, built-in string methods and function, slice operation.

**Lists:** access and update values in lists, nested and cloning lists, basic list operations, List methods, Using lists as Stack and Queues, list comprehensions, looping in lists.

**Tuple:** Creating tuple, utility of tuples, accessing values in a tuple, updating tuple, deleting elements in tuple, basic tuple operations

## UNIT III

**Sets:** Creating a Set and set operations

**Dictionaries:** Creating a dictionary, accessing values, add, modify, delete, sort items in a dictionary, looping over a dictionary.

**Classes and Objects:** Introduction, classes and objects, class method and self argument, init() method, class and object variables, del() method, other special methods, public and private data members, private methods, calling a class method from another class method, built-in class attributes, garbage collection, class and

static methods

**Inheritance:** Introduction, inheriting classes in python, types of inheritance, composition/containership/complex objects, abstract classes and interfaces, Metaclass.

#### UNIT IV

**Operator Overloading:** Introduction, implementing operator overloading, reverse adding, overriding `__getitem__()` and `__setitem__()` methods, overriding the in operator, overriding miscellaneous functions, overriding the `_call__()` method.

**Error and Exception Handling:** Introduction to errors and exceptions, handling exceptions, multiple except blocks, multiple exceptions in a single block, except block without exception, the else clause, raising exceptions, built-in and user-defined exceptions, the finally block.

#### Self-Study:

String functions: `ord()`, `chr()` functions, in and not in operators

Standard Library modules, `Globals()`, `Locals()`, `Reload()`, `date`, `time`, `sys`

Comparing, iterating string, the String module, Regular expressions, meta characters in regular expression.

Re-raising exception, Assertions in python

#### TEXT BOOKS:

[1] ReemaThareja, "Python Programming Using Problem Solving Approach", Oxford University Press, 2019.

#### REFERENCE BOOKS:

[1] Zed Shah, "Learn Python The Hard Way", Third edition, Addison-Wesley, 2013.

[2] Charles Severance, "Python for Informatics- Exploring Information", 1st edition Shroff Publishers, 2017.

[3] John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013

[4] W.Chun , "Core Python Programming", 2nd Edition, Prentice Hall, 2006.

**E-resources and other digital material:**

- [1] Charles Severance: University of Michigan, Python for Everybody [COURSERA]. (05-01-2021), Available: <https://www.coursera.org/>
- [2] Prof. SudarshanIyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, The Joy Of Computing Using Python [NPTEL], (05-01-2021), Available:<https://nptel.ac.in/courses/106/106/106106182/#>
- [3] Prof KannanMoudgalya, Professor, IIT Bombay, Python 3.4.3, [SWAYAM] (05-01-2021), Available: [https://onlinecourses.swayam2.ac.in/aic20\\_sp33/preview](https://onlinecourses.swayam2.ac.in/aic20_sp33/preview)
- [4] Corey Schafer, Python OOP Tutorials - Working with Classes, (05-01-2021), Available: Python OOP Tutorials - Working with Classes - YouTube

**20ES2104A****BASIC ELECTRONICS ENGINEERING**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial- Practice:</b>	3-0-0
<b>Prerequisites:</b>		<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Comprehend the fundamentals of electronic components, devices, transducers
<b>CO2</b>	Understand and apply the principles of digital electronics
<b>CO3</b>	Learn the principles of various communication systems.

**Contribution of Course Outcomes towards achievement of Program Outcomes**

**(L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3	3			2									
<b>CO2</b>	3	3												
<b>CO3</b>	2				2									

**COURSE CONTENT****UNIT I**

**Electronic Components:** Passive components - resistors, capacitors & inductors (properties, common types, I-V relationship and uses). Semiconductor Devices: Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, Zener diode, BJT, JFET, optoelectronic devices (LDR, photodiode, phototransistor, solar cell, photo couplers).

**UNIT II**

**Transducers:** Transducers - Instrumentation - general aspects, classification of transducers, basic requirements of transducers, passive transducers - strain gauge, thermistor, Hall-Effect transducer, LVDT, and active transducers - piezoelectric and thermocouple -DHT, ULTRASONIC , PIR..sensors

**UNIT III**

**Digital Electronics:** Number systems - binary codes - logic gates Boolean algebra, laws & theorems - simplification of Boolean expression - Implementation of Boolean expressions using logic gates – standard forms of Boolean expression.

**UNIT IV**

**Digital Communication:** Block diagram of a basic communication system - frequency spectrum - need for modulation, Types of communication-Analog and Digital communication-Advantages and Disadvantages of Digital Communication, Time and frequency domain representation of signals, Sampling theorem, Nyquist rate and Nyquist interval, Pulse code modulation, Line coding-Variou formats, Generation of digital modulation techniques-ASK,FSK,PSK

**TEXT BOOKS**

- [1] Thyagarajan.T, SendurChelvi.K.P, Rangaswamy, “Engineering Basics: Electrical, Electronics and computer Engineering”, T.R, New Age International, Third Edition, 2007. (UNIT- I&II)
- [2] Thomas L. Floyd, “Electronic Devices”, Pearson Education, 9th Edition, 2011. (UNIT- III)
- [3] Dr. Sanjay Sharma, “Communication Systems(Analog & Digital)”, S.K.Kataria& Sons (KATSON Books), 6<sup>th</sup> edition, 2014 (UNIT- IV)

**REFERENCE BOOKS**

- [1] M. Morris Mano, Michael D. Ciletti, —Digital Design, 4th edition, Prentice Hall, 2007.
- [2] S. Salivahanan, N.Suresh Kumar & A. Vallavaraj, “Electronic Devices & Circuits”, 2nd Edition, Tata McGraw Hill,2008.
- [3] Simon Haykin. —Communication Systems, 4<sup>th</sup> edition, 2000, John Wiley and Sons

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] <https://nptel.ac.in/courses/117/103/117103063/>
- [2] <https://nptel.ac.in/courses/108/105/108105132/>
- [3] <https://nptel.ac.in/courses/108/102/108102096/>

**20ES2105**  
**ENGINEERING GRAPHICS**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory & Practice	<b>Lecture -Tutorial-Practice:</b>	1 - 0 - 4
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Understand the Scales and conics.
<b>CO2</b>	Draw Orthographic projections of points, Lines and Planes.
<b>CO3</b>	Draw Orthographic projections of Solids and to understand basics of Auto CAD.
<b>CO4</b>	Understand the sections, Development of solids and draw isometric views using Auto CAD.

### Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>	3		3				3					
<b>CO2</b>	2		3				3					
<b>CO3</b>	2		3				3					
<b>CO4</b>	1		3				3					

### COURSE CONTENT

#### UNIT – I

**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their Significance

**Scales:** Construction of plain and diagonal Scales

**Conic Sections:** Construction of ellipse, parabola and hyperbola (Treatment is



limited to Eccentricity or General method only)

## UNIT – II

**Orthographic Projections:** Principles of Orthographic Projections –Projections of Points, Lines (Treatment is limited to First Angle Projection) and Projections of Plane regular geometric figures (Up to Plane Inclined to both of the Reference planes)

## UNIT – III

**Projections of Solids:** Projections of simple solids such as Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions (Limited to Solid Inclined to one of the Reference planes)

**INTRODUCTION TO AUTO CAD:** Basic introduction and operational instructions of various commands in AutoCAD. (Internal Evaluation only)

## UNIT – IV

**Sections and Development of Surfaces of Right Angular Solids:**

Sections and sectional views of right angular solids of Prism, Pyramid and Cone, Development of surfaces of Right Regular Solids of Prism, Pyramid and Cone.

**Isometric Projections:** Conversion of isometric views into Orthographic Projections of simple castings using Auto CAD. (Treatment is limited to simple objects only, Internal Evaluation only).

## TEXT BOOKS

[1] Basanth Agrawal & C M Agrawal, "Engineering Drawing", McGraw Hill Education Private Limited, New Delhi.

[2] N.D. Bhatt "Engineering Drawing", Charotar Publishing House, Anand. 53<sup>rd</sup> Edition – 2019.

## REFERENCE BOOKS

[1] K. L. Narayana & P. Kannaiah, "Text Book on Engineering Drawing", Scitech publications (India) Pvt. Ltd., Chennai, 2nd Edition - fifth reprint 2006

[2] K. Venugopal, "Engineering Drawing and Graphics + Auto CAD", New Age International, New Delhi

[3] D M Kulkarni, AP Rastogi, AK Sarkar, "Engineering Graphics with Auto CAD", PHI Learning Private Limited, Delhi Edition – 2013

## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] <http://www.youtube.com/watch?v=XCWJXrkWco>.

[2] <http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html#isodrawing>.

[3] [https://onlinecourses.nptel.ac.in/noc20\\_me79/preview](https://onlinecourses.nptel.ac.in/noc20_me79/preview)

[4] <http://nptel.ac.in/courses/112/103/112103019/>

**20MC2106****PROFESSIONAL ETHICS & PRACTICE**

<b>Course Category:</b>	Mandatory Learning	<b>Credits:</b>	--
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	1 - 0 - 0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	--
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Know the moral autonomy and uses of ethical theories.
<b>CO2</b>	Understand Engineering as Experimentation
<b>CO3</b>	Understand about safety, risk and professional rights.
<b>CO4</b>	Know the ethics regarding Global issues related to Environment, Computers and weapon's development. Understand general principles of contracting.

**Contribution of Course Outcomes towards achievement of Program Outcomes**

(L – Low, M - Medium, H – High)

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>	2							3				
<b>CO2</b>					3			3				
<b>CO3</b>					3			3				
<b>CO4</b>								3				

**COURSE CONTENT****UNIT I****(4 lectures)**

**Engineering Ethics:** Senses of 'Engineering Ethics' - variety of moral issues- types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory -

Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion- uses of ethical theories.

## UNIT II

(4 lectures)

**Engineering as Social Experimentation:** Engineering as experimentation – engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

## UNIT III

(4 lectures)

**Safety, Responsibilities and Rights:** Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk – the three mile island and chernobyl case studies. Collegiality and loyalty – respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

## UNIT IV

(4 lectures)

**Global Issues:** Multinational corporations- Environmental ethics- computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

**General principles of contracts management :** Indian contract act,1972 and amendments covering general principles of contracting.

## TEXT BOOKS

[1] Mike Martin and Roland Schinzinger, “Ethics in engineering”, McGraw Hill, New York (1996).

[2] Govindarajan M, Natarajan S, Senthil Kumar V. S., “Engineering Ethics”, Prentice Hall of India, New Delhi(2004).

## REFERENCE BOOKS

[1] Baum, R.J. and Flores, A., “Ethical Problems in Engineering, Center for the studyof the Human Dimensions of Science and Technology”, Rensellae Polytechnic Institute,Troy, New York, 335 pp. eds. (1978)

[2] Beabout, G.R., Wennemann, D.J. , “Applied Professional Ethics: A Developmental Approach for Use with Case Studies”, University Press of

America Lanham, MD, 175 pp (1994).

[3] Dutt (1994) Indian Contract Act, Eastern Law House.

**20BS2151B**  
**ENGINEERING CHEMISTRY LABORATORY**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	Knowledge of chemistry practicals at Intermediate level	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Analyze ores, commercial samples, quality parameters of water samples from different sources
<b>CO2</b>	Perform quantitative analysis using instrumental methods.
<b>CO3</b>	Apply the knowledge of preparation of polymers, separation of ions, mechanism of corrosion and photochemical reactions.

**Contribution of Course Outcomes towards achievement of Program Outcomes**  
**(L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>		3										
<b>CO2</b>				2								
<b>CO3</b>	2											

### COURSE CONTENT

#### List of Experiments:

1. Determination of MnO<sub>2</sub> in Pyrolusite / Iron in Haematite ore
2. Determination of total alkalinity of a water sample
3. Determination of purity of a boric acid sample
4. Conductometric analysis of a strong base using a strong acid

5. Determination of total hardness of a water sample
6. Determination of copper in a given sample
7. Chemistry of blueprinting
8. Determination of Mohr's salt - Permanganometry
9. Determination of Mohr's salt - Dichrometry
10. Comparison of corrosion rates of different metals
11. Determination of available chlorine in a bleaching powder sample
12. Determination of chlorides in a water sample
13. pH metric analysis of a strong base using a strong acid
14. Preparation of urea-formaldehyde resin
15. Separation of ions by paper chromatography

## REFERENCE BOOKS

- [1] S.K. Bhasin and Sudha Rani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 2<sup>nd</sup> edition.
- [2] Sunitha Rattan, "Experiments in Applied Chemistry", S.K. Kataria & Sons, New Delhi, 2<sup>nd</sup> edition.

**20ES2152A**  
**OBJECT ORIENTED PROGRAMMING USING PYTHON**  
**LABORATORY**

<b>Course Category:</b>	Engineering Science	<b>Credits:</b>	1.5
<b>Course Type:</b>	Lab	<b>Lecture -Tutorial- Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	20ES1152 Programming for Problem Solving Laboratory	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Demonstrate the usage of Python syntax and semantics in solving the problems
<b>CO2</b>	Develop python programs using functions and built in modules
<b>CO3</b>	Implement Python data structures to solve the complex problems
<b>CO4</b>	Apply object oriented concepts to design solution to real world scenarios

### Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2	1		2						1		3	
<b>CO2</b>			1		2						1		1	2
<b>CO3</b>		1	1		1						1		2	2
<b>CO4</b>		2	2		2						2		3	

### COURSE CONTENT

- Week 1: Understanding Object Oriented Programming, Python installation**
- Differentiate procedure oriented and Object Oriented Programming
  - Identify a simple real world scenario using the concept of classes and objects
  - Demonstrate different types of inheritance in the scenario identified

#### d. Practice Python Installation

### **Week 2: Declaration of Variables, identifiers and type conversions**

- a. Write simple programs by defining variables and assigning values of different basic data types
- b. Write programs to know data type of a variable using Type statement
- c. Write programs to do multiple assignments at a time
- d. Write programs for writing multiple statements in a single line
- e. Use Input statement, type conversion
- f. Use different operators in programs

### **Week 3: Python programs on Decision Control Statements**

- a. Write programs using selection statements
- b. Implement programs on and conditional branching statements

### **Week 4: Python programs on looping control structures**

- a. Design and develop programs using Iterative statements- while, for , nested loops
- b. Use Break, continue, pass statements in programs
- c. Understand the usage of else statement in loops with a case study

### **Week 5 & 6: Identify the need and importance in the creation of Python Functions and Modules**

- a. Write programs for defining and calling functions
- b. Understand Scope of a variable and Use global statement
- c. Differentiate fruitful and void functions through a case study
- d. Apply recursive and Lambda functions
- e. Understand different kinds of arguments through a case study
- f. Installing and usage of standard library modules
- g. Use python packages

### **Week 7: Solve the problems using Strings and understanding the methods and operations on Lists**

- a. Apply string formatting operator
- b. Use built in string methods, functions and regular expressions
- c. Define a list and write programs to access and modify elements of a list
- d. Practice basic list operations, methods
- e. Write programs to use list as a stack and queue

### **Week 8: Programs on the implementation of methods and operations of List data structure**



- a. Define a list and write programs to access and modify elements of a list
- b. Practice basic list operations, methods
- c. Write programs to use list as a stack and queue

### **Week 9: Implement programs to solve the problems using Python other data structures:Tuples and Dictionaries**

- a. Write programs to define a dictionary and write programs to modify values, adding new keys
- b. Apply looping over a dictionary
- c. Use built in dictionary methods, functions
- d. Create a tuple and assign values
- e. Use basic tuple operations and comparisons

### **Week 10& 11: Implement the Python Classes and Objects to address the real world scenarios**

- a. Define classes and objects using python for the real world scenario
- b. Defining constructors and using Self
- c. Understand public and private members
- d. Practice calling class methods from another class
- e. Write built in functions to check, get, set and delete attributes

### **Week 12&13: Develop the programs to implement parent-child relationship**

- a. Demonstrate different inheritance types
- b. Apply polymorphism and method overriding
- c. Create abstract classes

### **Week 14: Write the programs to address the exceptions via exception handling in the development of solutions and implement operator overloading**

- a. Write a simple exception handling program with try- except
- b. Write a program for catching multiple exceptions
- c. Demonstrate raising and re raising exceptions
- d. Apply else and finally clauses
- e. Demonstrate the usage of polymorphism in overloading of operators

### **TEXT BOOKS**

[1] ReemaThareja,“Python ProgrammingUsing Problem Solving Approach”, Oxford University Press, 2019.

### **REFERENCE BOOKS**

[1] Zed Shah, “Learn PythonThe Hard Way”, Third edition, Addison-Wesley, 2013.

- [2] Charles Severance, " Python for Informatics- Exploring Information", 1st edition Shroff Publishers, 2017.
- [3] John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013
- [4] W.Chun , "Core Python Programming", 2nd Edition, Prentice Hall, 2006.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Charles Severance: University of Michigan, Python for Everybody [COURSERA]. (05-01-2021), Available: <https://www.coursera.org/>
- [2] Prof. SudarshanIyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, The Joy Of Computing Using Python [NPTEL], (05-01-2021), Available:<https://nptel.ac.in/courses/106/106/106106182/#>
- [3] Prof KannanMoudgalya, Professor, IIT Bombay, Python 3.4.3, [SWAYAM], (05-01-2021), Available: [https://onlinecourses.swayam2.ac.in/aic20\\_sp33/preview](https://onlinecourses.swayam2.ac.in/aic20_sp33/preview)
- [4] Corey Schafer,Python OOP Tutorials - Working with Classes, (05-01-2021) Available: [Python OOP Tutorials - Working with Classes - YouTube](#)

**20ES2153****ENGINEERING WORKSHOP**

<b>Course Category:</b>	Engineering Sciences	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial- Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Understand the basic joints using wood and familiarize with various fundamental aspects of house wiring.
<b>CO2</b>	Prepare basic models using sheet metal and practice joining of metals using arc welding technique.
<b>CO3</b>	Familiarize with various manufacturing processes such as injection moulding and 3D printing
<b>CO4</b>	Understand the preparation of PCB
<b>CO5</b>	Understand simple IOT Applications using Arduino

**Contribution of Course Outcomes towards achievement of Program Outcomes**

**(L – Low, M - Medium, H – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>			2					1			3	2		2
<b>CO2</b>			2					1			3	2	2	2
<b>CO3</b>			2					1			1	2		
<b>CO4</b>						1							1	1

**CO5****2****1****1****COURSE CONTENT****PART-A****Carpentry:**

- a. Demonstration of Cross half lap and T joints.  
(1 class)
- b. Demonstration of power tools.

**Electrical Wiring:**

- a. Fundamentals of Electric wiring and practice of Series wiring.  
(1 class)
- b. Practice of stair case wiring and connecting a fluorescent Tube.

**Sheet metal & soldering:**

- a. Preparation of complete funnel using sheet metal and practice of soldering.  
(2 classes)
- b. Preparation of a square box using sheet metal and practice of soldering.

**Welding:**

- a. Preparation of Corner Joint using arc welding process.  
(1 class)
- b. Preparation of “T” joint using arc welding process.

**Manufacturing processes:**

- a. Preparation of a small plastic part using injection moulding process.  
(1 class)
- b. Demonstration of manufacturing a simple model using 3D printing process.

**Electronic Circuits:****1. To prepare PCB for the given electronic circuit**

- a. To prepare the layout and printing it on copper clad board
- b. To etch and drill the holes on PCB  
(2 classes)

**2. To solder the components on the PCB prepared and test the circuit**

- a. To identify and solder the components on the PCB prepared
- b. To test the operation of the circuit.

**Basic IOT:**

**1. Demonstration of Arduino board**

- a. Demonstrate different components & pin configuration of Arduino
- b. To set up Arduino IDE for programming.

**2.To measure Temperature & Humidity**

- a. Interfacing of temperature & humidity sensor with Arduino.  
(2 classes)
- b. Execute the program on Arduino IDE & display the measured values.

**3. To measure Distance**

- a. Interfacing of Ultrasonic Sensor with Arduino
- b. Execute the program on Arduino IDE & display the measured value.

**PART-B****GROUP ACTIVITY**

(4 classes)

**Students must prepare a Working model / Assembly using the knowledge gained from the above trades.**

**TEXT BOOKS**

- [1] Kannaiah P. & Narayana K. C., “Manual on Workshop Practice”, Scitech Publications, Chennai, 1999.
- [2] Venkatachalapathy, V. S., “First year Engineering Workshop Practice”, Ramalinga Publications, Madurai, 1999.

**REFERENCE BOOKS**

- [1] Gopal, T.V., Kumar, T., and Murali, G., “A first course on workshop practice – Theory, Practice and Work Book”, Suma Publications, Chennai, 2005

**E-RESOURCES AND OTHER DIGITAL MATERIALL**

1. [https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17- 1.pdf](https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17-1.pdf)
2. <https://www.protosystech.com/rapid-prototyping.htm>
3. <https://www.arduino.cc/en/Tutorial/Foundations>
4. <https://www.tutorialspoint.com/arduino/>

## **SEMESTER - III**

**20BS3101A**  
**DISCRETE MATHEMATICS**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Set theory, Basic probability, probability distributions	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Analyze propositional calculus and first order logic	K4	1.2.1, 1.7.1, 2.5.1, 4.6.3
<b>CO2</b>	Apply the basic and advanced counting techniques	K3	1.2.1, 2.5.1, 2.5.3
<b>CO3</b>	Analyze of relations and digraphs and their applications	K4	1.2.1, 2.8.1, 4.4.1,
<b>CO4</b>	Analyze of graphs and their applications	K4	1.2.1, 2.5.3, 4.4.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3	3		1										
<b>CO2</b>	3	3		1										
<b>CO3</b>	3	3		1										
<b>CO4</b>	3	3		1										

**COURSE CONTENT**

**UNIT I: Propositional Calculus****Propositional Calculus**

Fundamentals of Logic: Propositions, Connectives, Propositional functions, Truth Tables, Tautology, Contradiction, Logical equivalences, Normal forms, Logical inferences, Methods of proof of an implication.

**First Order Predicate Logic:** Predicate, Quantifiers, and Rules of inference for Quantified propositions.

**UNIT II: Counting Techniques**

**Basics of Counting:** Sum and product rules, Indirect counting, One to One Correspondence, Combinations and permutations, Enumerating Combinations and Permutations with and without repetitions.

**Advanced Counting Techniques:** Generating function of sequences, Recurrences relations, Solving recurrences relations – substitution- Generating functions-The method of characteristic roots, Solution of Inhomogeneous recurrences relations.

**UNIT III: Relations and Digraphs**

Relations and basic graphs, Special properties of binary relations, Equivalence relation, Partially ordered sets, Hasse diagrams, Lattices, Operations on relations, Paths and closures, Directed graphs and Adjacency matrices, Transitive closure, Warshall's algorithm

**UNIT IV: Graph Theory**

Introduction(graphs, sub graphs, circuits, trees) Sum of degrees theorem, Isomorphism and sub graphs, planar graphs, Euler's formula, Multi graphs and Euler's circuits, Hamiltonian graphs, Grin-berg's theorem, Graph coloring, Chromatic numbers.

**TEXT BOOKS**

- [1] Mott, J. L., Kandel, A., & Baker, T. P. (2008). Discrete mathematics for computer scientists & mathematicians (2nd ed.). Prentice-Hall, Inc..

**REFERENCE BOOKS**

- [1] Trembly & Manohar.; Discrete Mathematical structures with applications to computer science.  
 [2] Rosen, TMH; Discrete Mathematics and its Applications.  
 [3] Malik & Sen Thomson Discrete Mathematical Structures: Theory and applications

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof. Arindama Singh Department of Maths IIT Madras, Last accessed on 15-02-2022,



<https://nptel.ac.in/courses/111/106/111106052/>

[2] Prof Soumen Maity, Department of Maths, IISER Pune, Last accessed on 15-02-2022,

<https://nptel.ac.in/courses/111/106/111106102/>

[3] Dr.L.Sunil Chandran, Department of Computer Science and Automation, IISc Bangalore, Last accessed on 15-02-2022,

<https://nptel.ac.in/courses/106/108/106108051/>

**20ES3102**  
**JAVA PROGRAMMING**

<b>Course Category:</b>	Engineering Science	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the basic concepts of object oriented programming.	K2	1.7.1,2.5.1, ,2.5.2,2.7.1
<b>CO2</b>	Apply multiple inheritance through interfaces for a given application.	K3	1.7.1,2.5.1,2.5.2,2.6.3, 2.7.1,3.5.1,3.8.2
<b>CO3</b>	Apply exceptions, thread capabilities and handling files on a given application.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,3.8.2
<b>CO4</b>	Apply functional programming and Collections framework for a given application.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,3.6.2,3.8.2,5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	3												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	3										2	2
<b>CO4</b>		2	3		2								2	2

## COURSE CONTENT

### UNIT I

**Introduction, The History and Evolution of Java:** Java history and evolution, Java features, Java's Magic: Byte Code, How Java differs from C and C++.

**An Overview of Java:** Object Oriented Programming: Two paradigms, Principles of OOP, A First simple Program and Control statements.

**Data Types, Variables and Arrays:** Java keywords, Primitive types, Integers, Floating-Point Types, Characters, Booleans, Variables, Operators, Type Conversion, Casting and Arrays.

**Introducing Classes and Objects:** Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, Garbage collection, overloading methods, using objects as parameters, returning objects, static and final keywords, nested and inner classes.

### UNIT II

**String Handling:** The String Constructors, String Buffer Class, String Tokenizer class.

**Inheritance:** Inheritance basics, using super, multilevel hierarchy, method overriding, dynamic method dispatch, using abstract classes, final with inheritance.

**Packages & Interfaces:** Defining a package, finding package and CLASSPATH. Access protection, importing packages, Defining an interface, implementing interfaces, nested interfaces, applying interfaces, variables in interfaces.

### UNIT III

**Exception handling:** Exception handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, throw, throws, finally, creating your own exception subclasses.

**I/O streams:** Byte Streams- InputStream, OutputStream, FileInputStream, FileOutputStream, Character Streams- Reader, Writer, FileReader, FileWriter.

**Multithread Programming:** The Java Thread Model, Creating a thread: Implementing Runnable, Extending Thread, creating multiple threads, Thread Priorities, Synchronization: Using Synchronized methods, The synchronized

Statement.

## UNIT IV

**Pragmatic Functional Programming using Lambdas:** Introduction to Functional programming, Functional Programming concepts and terminology, Functional Interfaces, Working with Lambda Expressions and Method References.

**Collections Framework:** Collections overview, Collection interfaces: Collection, List, and Set. Collection Classes: ArrayList, LinkedList, HashSet. Map Classes: HashMap, TreeMap

**The Stream API:** Stream basics, Reduction operations, Using parallel streams, Mapping, Collecting, Iterators and Streams.

## TEXT BOOKS

[1] Herbert Schildt, “Java The Complete Reference”, Eleventh Edition, Oracle Press, . 2019.

## REFERENCE BOOKS

[1] Herbert Schildt, Dale Skrien, “Java Fundamentals A Comprehension Introduction”, Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2017.

[2] E Balaguruswamy, "Programming with Java", 4th Edition, Mc Graw Hill , 2020.

[3] Paul J. Dietel and Dr. Harvey M. Deitel, “Java How to Program”, Eleventh Edition, Deitel & Associates, Inc.1 , 2018.

[4] Timothy Budd, “Understanding Object Oriented Programming with Java “, Updated edition, Pearson Education, 2013.

[5] Kathy Sierra & Bert Bates, "Head First Java", 2nd Edition, Oreilly.

## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Prof. Debasis Samanta. (14th, July, 2021), Department of Computer Science & Engineering, I.I.T., Kharagpur, Swayam, NPTEL.

[https://onlinecourses.nptel.ac.in/noc21\\_cs03/preview](https://onlinecourses.nptel.ac.in/noc21_cs03/preview).

[2] Evan Jones, Adam Marcus, Eugene Wu "Introduction to Programming in Java", MIT OpenCourseWare, Massachusetts Institute of Technology, May 28, 2021. <https://ocw.mit.edu/courses>

[3] Prof. Owen Astrachan, "Object Oriented Programming in Java", Duke University, 21st May 2021. [coursera.org](https://www.coursera.org)

<https://www.coursera.org/specializations/object-oriented-programming>

- [4] Dheeru Mundluru, "Java In-Depth: Become a Complete Java Engineer", Udemy, 14th May 2021.

<https://www.udemy.com/course/java-in-depth-become-a-complete-java-engineer/>

- [5] Prof. Olufisayo Omojokun, "Introduction to Object-Oriented Programming with Java I: Foundations and Syntax Basics", Georgia Institute of Technology, edX, May 2021.

<https://www.edx.org/course/introduction-to-java-programming-i-foundations-and-syntax-basics>

## 20CS3303 OPERATING SYSTEMS

<b>Course Category:</b>	Program Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	understand the basic components of an Operating System	K2	1.7.1
<b>CO2</b>	Apply CPU Scheduling and disk scheduling algorithms to achieve specific criteria	K3	1.7.1,2.6.3, 2.6.4, 2.8.3, 2.8.4
<b>CO3</b>	Analyze the mechanisms used for process synchronization and handling deadlocks	K4	1.7.1,2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1
<b>CO4</b>	Analyze virtual memory techniques & File system Implementation techniques	K4	1.7.1,2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3												2	
<b>CO2</b>	3	3											2	
<b>CO3</b>	3	2	1										2	
<b>CO4</b>	3	3	1										2	

### COURSE CONTENT

#### UNIT I

**Operating-System Structures:** Operating-System Services, User and Operating-System Interface, System Calls: Example, Application Programming Interface,

## Types of System Calls, System Services

**Processes:** Process Concept: The Process, Process State, Process Control Block, Threads, Process Scheduling: Scheduling Queues, CPU Scheduling, Context Switch, Operations on Processes: Process Creation, Process Termination, Interprocess Communication, IPC in Shared-Memory Systems, IPC in Message-Passing Systems: Naming, Synchronization, Buffering.

## UNIT II

**CPU Scheduling:** Basic Concepts: CPU-I/O Burst Cycle, CPU Scheduler, Preemptive & Nonpreemptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling, Thread Scheduling: Contention Scope, Pthread Scheduling, Multiple-Processor Scheduling: Approaches, Multicore Processors, Load Balancing, Processor Affinity, Heterogeneous Multiprocessing, Real-Time CPU Scheduling: Minimizing Latency, Priority-Based, Rate-Monotonic, Earliest-Deadline-First, Proportional Share Scheduling.

**Process Synchronization:** Background, The Critical-Section Problem, Peterson's Solution, Hardware Support for Synchronization, Mutex Locks, Semaphores: Semaphore usage, Semaphore Implementation, Monitors: Usage, Implementing using Semaphores, Resuming a Process, Liveness: Deadlock, Priority Inversion, Classic Problems of Synchronization: The Bounded-Buffer Problem, The Readers-Writers Problem, The Dining-Philosophers Problem

## UNIT III

**Deadlocks:** System Model, Deadlock in Multithreaded Applications: Livelock, Deadlock Characterization: Necessary conditions, Resource-Allocation Graph, Methods for Handling Deadlocks, Deadlock Prevention: Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait, Deadlock Avoidance: Safe State, Resource-Allocation-Graph Algorithm, Bankers Algorithm, Deadlock Detection: Single Instance of Each Resource type, Several Instances, Detection Algorithm Usage, Recovery from Deadlock: Process and Thread Termination, Resource Preemption.

**Main Memory:** Background: Basic Hardware, Address Binding, Logical Vs Physical Address Space, Dynamic Loading, Dynamic Linking & Shared Libraries,

Contiguous Memory Allocation: Memory Protection, Memory Allocation, Fragmentation, Paging : Basic Method, Hardware Support, Protection, Shared Pages, Structure of the Page Table: Hierarchical, Hashed Page Tables, Inverted Page Tables, Swapping: Standard Swapping, Swapping with Paging, Swapping on Mobile Systems.

#### UNIT IV

**Virtual Memory:** Background, Demand Paging: Basic Concepts, Free-Frame List, Performance, Copy-on-Write, Page Replacement: Basic Page Replacement, FIFO, Optimal, LRU, LRU Approximation, Counting Based, Page Buffering, Allocation of Frames: Minimum Number of Frames, Allocation Algorithms, Global vs Local Allocation, Non Uniform Memory Access, Thrashing: Cause of Thrashing, Working-Set Model, Page-Faulty Frequency, Memory Compression

**Mass-Storage Structure:** HDD Scheduling: FCFS, SCAN, C-SCAN Scheduling, Disk Management: Disk Formatting, Boot Block, Bad Blocks, Swap-Space Management: Swap-Space Use, Location, RAID Structure- RAID Levels

**File -System Implementation:** Directory Implementation: Linear List, Hash Table, Allocation Methods: Contiguous, Linked, Indexed Allocation, Free-Space Management: Bit Vector, Linked List, Grouping, Counting, Space Maps, Efficiency and Performance, Recovery: Consistency Checking, Log-Structured File Systems.

#### TEXT BOOKS

[1] Abraham Silberschatz, Peter B. Galvin and Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley & Sons Pvt. Ltd, 2018.

#### REFERENCE BOOKS

[1] William Stallings, “Operating System: Internals and Design Principles”. 6th ed 2009.

[2] Andrew S.Tanenbaum, “Modern Operating Systems”. 3rd ed, PHI, 2008.

#### E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Prof Santanu Chattopadhyay - NPTEL Course on Operating Systems @ <https://nptel.ac.in/courses/106/105/106105214/> Available from 25-7-19

[2] Stanford University - Lecture Notes on Operating Systems @ <https://www.scs.stanford.edu/21wi-cs140/notes/> Available on 21-05-21



- [3] IIT Bombay – Lecture Notes on Operating Systems @  
<https://www.cse.iitb.ac.in/~mythili/os/> Available on 21-05-21

## **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof Santanu Chattopadhyay - NPTEL Course on Operating Systems @  
<https://nptel.ac.in/courses/106/105/106105214/> Available on 25-7-19
- [2] Stanford University - Lecture Notes on Operating Systems @  
<https://www.scs.stanford.edu/21wi-cs140/notes/> Available on 21-05-21
- [3] IIT Bombay – Lecture Notes on Operating Systems @  
<https://www.cse.iitb.ac.in/~mythili/os/> Available on 21-05-21

**20CS3304****DIGITAL LOGIC AND COMPUTER DESIGN**

<b>Course Category:</b>	Program Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply simplification techniques to minimize the Boolean functions.	K3	1.2.1, 1.7.1
<b>CO2</b>	Apply concepts of combinational logic to design MSI and LSI circuits.	K3	1.7.1,2.7.1,2.7.2,3.7.1,3.8.1
<b>CO3</b>	Apply sequential logic techniques to design Counters and Registers.	K3	1.7.1,2.7.1,2.7.2,3.7.1,3.8.1
<b>CO4</b>	Understand the organization and design of a basic computer.	K2	2.7.1,2.7.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2												1	
<b>CO2</b>	1	2	2										1	
<b>CO3</b>	1	2	2										1	
<b>CO4</b>	1	2	2										1	

## COURSE CONTENT

### UNIT I

#### **Boolean Functions**

Introduction to Boolean Functions, Boolean Functions Simplification- The Map Method, Two and three variable Maps, Four-variable Map, Five variable Map, Product of Sums Simplification, Don't care conditions, The Tabulation Method, Determination of Prime Implicants, Selection of Prime-Implicants.

**Combinational Logic:** Introduction, Design Procedure, Adders, Subtractors, Code Conversions, Exclusive-or Gates, Parity Generators and Checkers.

### UNIT II

**Combinational Logic with MSI and LSI:** Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Decoders, Demultiplexers, Encoders, Multiplexers.

**Programmable Logic:** Read only memory (ROM), Programmable read only memory (PROM), Programmable Logic Array (PLA), Programmable Array Logic (PAL), Introduction to FPGA.

### UNIT III

**Sequential Logic:** Sequential circuits, Classification, Latches, Flip Flops, Triggering of Flip-Flops, Master slave flip-flop, Flip-Flop Excitation tables, flip-flop direct inputs. Analysis of Clocked Sequential Circuits, State table, State diagram, state equations, State Reduction and Assignment, Design Procedure, design with unused states.

**Registers, Counters:** Registers, Shift Registers, Asynchronous Counters, Synchronous Counters, Ring Counter, Johnson Counter, Timing Sequences.

### UNIT IV

**Register Transfer and Micro-Operations:** Register Transfer Language, Register Transfer, Bus and memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.

**Basic Computer Organization and Design:** Instruction codes, Computer Registers, Computer Instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input-Output and Interrupt, Design of Basic Computer, Design of Accumulator Logic.

**TEXT BOOKS**

- [1] M.Morris Mano, Digital Logic & Computer Design 1 e/d reprint, Pearson education, 2016.
- [2] Morris M. Mano, Computer System Architecture, 3/e, Pearson/PHI ,2007

**REFERENCE BOOKS**

- [1] A. Anand Kumar, Switching Theory and Logic Design, 2nd Edition, PHI,2013
- [2] M.Morris Mano, Michael D Ciletti Digital Design with an Introduction to Verilog HDL 5th e/d, Pearson education, 2013
- [3] Charles H.Roth , Fundamentals of Logic Design, 6/e, Cengage learning,2010

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof. Neeraj Goel IIT Ropar, 20th May 2021, Digital Systems, NPTEL VIDEO, Available: <https://nptel.ac.in/courses/108/106/108106177/>
- [2] Prof. N.J. Rao, IISc Bangalore, 20th May 2021, Digital systems, NPTELWEB Notes , Available at: <https://nptel.ac.in/courses/106/108/106108099/>

## 20CS3305 DATA STRUCTURES

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply different techniques to evaluate algorithms	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO2</b>	Apply linear data structures to given applications.	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO3</b>	Understand the operations on tree and heap non-linear data structures.	K2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO4</b>	Apply different kinds of linear data structures to solve problems.	K3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3, 2.6.4, 2.8.4

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2											2	
<b>CO2</b>	2	2											2	
<b>CO3</b>	2	2											2	
<b>CO4</b>	2	3											2	

### COURSE CONTENT

#### UNIT I

**Introduction:** Basic concepts, algorithm specification, randomized algorithm, data

abstraction, performance analysis-time complexity, space complexity, asymptotic notations, linear and binary searches complexity analysis.

**Stacks:** Definition, representing stacks, ADT stack and its operations: algorithms and their complexity analysis, Applications of stacks: expression conversion and evaluation – corresponding algorithms. recursion, Towers of Hanoi problem.

**Queues:** Queue and its sequential representation, queue as an abstract data type, types of queue: simple queue, circular queue, operations on each types of queues: algorithms.

## UNIT II

**Linked lists:** Representation in memory, singly linked lists: operations and algorithms; linked list representation of stack and queue, doubly linked list: operations and algorithms; circular linked lists: all operations their algorithms. applications: polynomials addition and multiplication.

## UNIT III

**Trees:** Introduction: terminology, representation of trees, binary Tree, complete binary tree, applications of binary trees, expression trees construction and evaluation; binary tree traversals: inorder, preorder and postorder – recursive and non-recursive, binary search trees, operations on binary search trees, threaded binary trees, operations on threaded binary trees.

**Heap:** Min heap and max heap, operations on min Heap and max Heap, priority queue.

## UNIT IV

**Sorting:** Merge Sort, quick sort, radix sort, heap sort, shell sort, tree sort, comparison of sorting algorithms, external Sorting.

**Hashing and Collision:** Introduction, hash tables, hash functions, different hash functions, collisions: collision resolution by open addressing, collision resolution by chaining, pros and cons of hashing, applications of hashing.

## TEXT BOOKS

- [1] Horowitz Sahni and Anderson-Freed “Fundamentals of Data Structures in C”. 2nd Edition, Universities Press, 2008. (Unit I, II, III)
- [2] Reema Thareja, “Data Structures using C”, Second Edition, Oxford University Press, 2011. (Unit IV)

**REFERENCE BOOKS**

- [1] Richard F. Gilberg & B. A. Forouzan “Data Structures A Pseudocode Approach with C”, Second Edition, CENGAGE Learning.
- [2] Mark Allen Weiss, “Data structure and Algorithm Analysis in C”. Addison Wesley Publication. 2006.
- [3] Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, McGraw Hill, 1984.
- [4] Thomas Cormen, C.Leiserson, R. L.Rivest & C.Stein, “Introduction to Algorithms”. 3rd Edition, The MIT Press, 2009.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Dr.P.P. Chakraborty, IIT Kharagpur, May 19, 2010, Data Structures, NPTEL, Available: [www.youtube.com/watch?v=S47aSEqm\\_0I](http://www.youtube.com/watch?v=S47aSEqm_0I)
- [2] Dr. Naveen Garg, IIT Delhi, Sep 24, 2008, Data Structures, NPTEL, Available: <http://nptel.iitm.ac.in>, <http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms>
- [3] Shai Simonson, Jun 16, 2014, Data Structures, NPTEL, Available: <http://nptel.ac.in/video.php?subjectId=106102064>

**20ES3151****JAVA PROGRAMMING LABORATORY**

<b>Course Category:</b>	Engineering Science	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0 -0- 3
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply the concepts of object oriented programming to solve problems	K3	1.7.1, 2.5.1, 2.5.2, 2.7.1, 5.4.1, 5.4.2, 11.4.1
<b>CO2</b>	Apply multiple inheritance through interfaces.	K3	2.5.1, 2.5.2, 2.6.3, 2.7.1, 3.5.1, 3.8.2, 5.4.1, 5.4.2
<b>CO3</b>	Apply exceptions, thread capabilities and handling files.	K3	3.5.1, 3.8.2, 5.4.1, 5.4.2, 9.6.1, 11.4.1
<b>CO4</b>	Analyze the use of functional programming and Collections framework	K4	3.8.2, 5.4.1, 5.4.2, 9.6.1, 11.4.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2			1						1		1	
<b>CO2</b>		2	1		2								2	1
<b>CO3</b>			2		2				1		1		2	
<b>CO4</b>			3		3				2		2		3	3



## COURSE CONTENT/TASKS

### Task 1

Apply fundamentals of java data types, variables, operators and control statements to a given application.

### Task 2

Implementation of classes and objects concepts.

### Task 3

Implement Arrays to a given application

### Task 4

Implementation of Inheritance and types of Inheritance

### Task 5

Use String and String Tokenizer classes and develop a java application.

### Task 6

Use interfaces and develop a java application

### Task 7

Create a package and access members from a package

### Task 8

Develop a java Application using Method overloading and Method overriding

### Task 9

Create a java application to copy content from one file to another file using I/O Streams

### Task 10

Implement Handling Exceptions to a given application.

### Task 11

Apply Thread Capabilities on a given application

### Task 12

Use Collections framework and create a java application

### Task 13

Apply Lambda functions and Streams API to a given application

### Projects:

Design and develop an automated ballot vote system.

Design and develop a banking application.

**TEXT BOOKS**

- [1] Herbert Schildt, “Java The Complete Reference”, Eleventh Edition, Oracle Press, . 2019.

**REFERENCE BOOKS**

- [1] Herbert Schildt, Dale Skrien, “Java Fundamentals A Comprehension Introduction”, Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2017.
- [2] E Balaguruswamy, "Programming with Java", 4th Edition, Mc Graw Hill , 2020.
- [3] Paul J. Dietel and Dr.Harvey M. Deitel, “Java How to Program”, Eleventh Edition, Deitel & Associates, Inc.1 , 2018.
- [4] Timothy Budd, “Understanding Object Oriented Programming with Java “, Updated edition,Pearson Education, 2013.
- [5] Kathy Sierra & Bert Bates, "Head First Java", 2nd Edition, Oreilly.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof. Debasis Samanta. (14th,July, 2021), Department of Computer Science & Engineering, I.I.T.,Kharagpur, Swayam, NPTEL.  
[https://onlinecourses.nptel.ac.in/noc21\\_cs03/preview](https://onlinecourses.nptel.ac.in/noc21_cs03/preview).
- [2] Evan Jones, Adam Marcus,Eugene Wu "Introduction to Programming in Java", MIT OpenCourseWare, Massachusetts Institute of Technology, May 28, 2021.  
<https://ocw.mit.edu › courses>
- [3] Prof. Owen Astrachan, "Object Oriented Programming in Java", Duke University, 21st May 2021. coursera.org  
<https://www.coursera.org/specializations/object-oriented-programming>
- [4] Dheeru Mundluru, "Java In-Depth: Become a Complete Java Engineer", Udemy, 14th May 2021.  
<https://www.udemy.com/course/java-in-depth-become-a-complete-java-engineer/>
- [5] Prof. Olufisayo Omojokun,"Introduction to Object-Oriented Programming with Java I: Foundations and Syntax Basics", Georgia Institute of Technology, edX, May 2021.  
<https://www.edx.org/course/introduction-to-java-programming-i-foundations-and-syntax-basics>

**20CS3352**  
**DIGITAL LOGIC DESIGN LABORATORY**

<b>Course Category:</b>	Program Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0- 0-3
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply Boolean functions to minimum number of literals.	K3	1.2.1, 1.7.1
<b>CO2</b>	Analyze different combinational logic circuits.	K4	1.7.1, 2.7.1, 2.7.2, 3.7.1, 3.8.1
<b>CO3</b>	Analyze clocked sequential logic circuits using flip flops.	K4	1.7.1, 2.7.1, 2.7.2, 3.7.1, 3.8.1
<b>CO4</b>	Analyze different Counters and Registers.	K4	1.7.1, 2.7.1, 2.7.2, 3.7.1, 3.8.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2												1	
<b>CO2</b>	1	2	2										1	
<b>CO3</b>	1	2	2										1	
<b>CO4</b>	1	2	2										1	

**COURSE CONTENT/TASK**

**Laboratory Experiments with Standard ICS and FPGA**

**1. Realization of All logic gates using universal gates.**

- Verification of logic gates from DIGITAL IC'S.
- Realization of logic gates using NAND and NOR.

**2. Design and Implementation of Arithmetic circuits.**

- a) Design and Implementation of half adder and half sub tractor.
- b) Design and Implementation of full adder and full sub tractor.

**3. Design and implement different types of code converters.**

- a) Design and implement i) Binary to Gray ii) Gray to Binary code converters
- b) Design and implement i) BCD to EX-3 ii) EX-3 to BCD code converters.

**4. Design and implementation of magnitude comparators.**

- i. Design and Implement single bit comparator.
- ii. Design and Implement two bit comparator.

**5. Implementation of Decoders and encoders.**

- i. Implementation of i) 2X4 Decoder ii) 3X8 Decoder iii) BCD to Decimal Decoder iv) BCD to 7segment Display
- ii. Implementation of i) 4x2 Encoder ii) Octal to Binary encoder iii) Decimal to BCD encoder.

**6. Implementation of Multiplexer and De Multiplexer.**

- i. Implementation of i) 2X1 MUX ii) 4X1 MUX
- ii. Implementation of i) 1X2 De MUX ii) 1X4 De MUX

**7. Implementation of all types of FLIP-FLOPS using gates.**

- i. Implementation of SR latch using NAND & NOR
- ii. Implementation of SR, JK, D, T flip flops.
- iii. Implementation of Master-Slave JK Flip flop

**8. Design of Synchronous counters.**

- i. Design and implementation of synchronous up, synchronous down counter and Up-down Counters .
- ii. Design and implementation of synchronous MOD counters.

**9. Design of Asynchronous counters.**

- i. Design of Asynchronous up and down counters.
- ii. Design and implementation of Asynchronous Mod counters.

**10. Design of Ring-counter and Johnson counter.**

- i. Design and implementation of 4-bit Ring counter.
- ii. Design and implementation of 4-bit Johnson counter.

Laboratory Projects

Reading and Writing data to EEPROM

### **TEXT BOOKS**

- [1] M.Morris Mano, Digital Logic & Computer Design 1 e/d reprint, Pearson education, 2016.
- [2] M.Morris Mano, Michael D Ciletti Digital Design with an Introduction to Verilog HDL 5<sup>th</sup> e/d, Pearson education, 2013.

### **REFERENCE BOOKS**

- [1] A. Anand Kumar, Switching Theory and Logic Design, 2nd Edition, PHI, 2013
- [2] Charles H. Roth, Fundamentals of Logic Design, 6/e, Cengage learning, 2010
- [3] A. P. Malvino, D. P. Leach and G. Saha, Digital Principles and Applications 7/e, McGraw Hill, 2010.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof. Neeraj Goel IIT Ropar, 20th May 2021, Digital Systems, NPTEL VIDEO, Available: <https://nptel.ac.in/courses/108/106/108106177/>
- [2] Prof. N.J. Rao, IISc Bangalore, 20th May 2021, Digital systems, NPTEL WEB Notes, Available at: <https://nptel.ac.in/courses/106/108/106108099/>

**20CS3353****DATA STRUCTURES LABORATORY**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0-0-3
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply stack and queue data structures to different applications	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO2</b>	Apply linked list data structures to solve problems	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO3</b>	Implement operations on different tree and heap data structures.	K2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO4</b>	Apply sorting algorithms to arrange a set of data items.	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2											2	
<b>CO2</b>	2	2											2	
<b>CO3</b>	2	2											2	
<b>CO4</b>	2	2											2	

**COURSE CONTENT/TASK**

**Task 1:** Operations on a stack data structure.

**Task 2 and 3:** Stack applications (expression conversion and evaluation, Tower of Hanoi problem).

**Task 4:** Operations on queues and circular queues.

**Task 5:** Operations on singly linked list and doubly linked list.

**Task 6:** Operation on circular linked list and circular doubly linked list.

**Task 7:** Linked list applications : polynomial addition and multiplications

**Task 8:** Binary search tree operations and tree traversal techniques using recursion.

**Task 9:** Binary search tree traversal techniques using non recursion.

**Task 10:** Operations on threaded binary trees and priority Queues

**Task 11:** Sorting techniques: Merge sort, quick sort, and radix sort.

**Task 12:** Sorting techniques: Heap sort, shell sort, and tree sort.

### TEXT BOOKS

- [1] Horowitz Sahni and Anderson-Freed “Fundamentals of Data Structures in C”. 2nd Edition, Universities Press, 2008. (Unit 1, 2, and 3).
- [2] Reema Thareja, “Data Structures using C”, Second Edition, Oxford University Press, 2011. (Unit 4)

### REFERENCE BOOKS

- [1] Richard F. Gilberg & B. A. Forouzan “Data Structures A Pseudocode Approach with C”, Second Edition, CENGAGE Learning.
- [2] Mark Allen Weiss, “Data structure and Algorithm Analysis in C”. Addison Wesley Publication. 2006.
- [3] Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, McGraw Hill, 1984.
- [4] Thomas Cormen, C.Leiserson, R. L.Rivest & C.Stein, “Introduction to Algorithms”. 3rd Edition, The MIT Press, 2009.

### E- RESOURCES AND OTHER DIGITAL MATERIAL

- [1] Dr. P. P. Chakraborty, IIT Kharagpur, May 19, 2010, Data Structures, NPTEL, Available: [www.youtube.com/watch?v=S47aSEqm\\_0I](http://www.youtube.com/watch?v=S47aSEqm_0I)
- [2] Dr. Naveen Garg, IIT Delhi, Sep 24, 2008, Data Structures, NPTEL, Available: <http://-nptel.iitm.ac.in>, <http://freevidelectures.com/Course/2279/Data-Structures-And-Algorithms>
- [3] Shai Simonson, Jun 16, 2014, Data Structures, NPTEL, Available: <http://nptel.ac.in/video.php?-subjectId=106102064>

**20TP3106**  
**LOGIC AND REASONING**

<b>Course Category:</b>	Soft Skills - 1	<b>Credits:</b>	1
<b>Course Type:</b>	Learning by Doing	<b>Lecture -Tutorial-Practice:</b>	0-0-2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL**

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

<b>CO1</b>	Think reason logically in any critical situation	K2
<b>CO2</b>	Analyze given information to find correct solution	K4
<b>CO3</b>	To reduce the mistakes in day to day activities in practical life	K2
<b>CO4</b>	Develop time-management skills by approaching different shortcut methods	K3
<b>CO5</b>	Use mathematical based reasoning to make decisions	K3
<b>CO6</b>	Apply logical thinking to solve problems and puzzles in qualifying exams in any competitive exam.	K3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3	3												
<b>CO2</b>	3	3												
<b>CO3</b>	3	3			1									
<b>CO4</b>	3	3		2										
<b>CO5</b>	3	2												



**CO6****3****3****COURSE CONTENT****UNIT I :**

1. Series Completion,
2. Coding-Decoding,
3. Blood Relations,
4. Puzzles test

**UNIT II:**

1. Direction sense test,
2. Logical Venn diagrams,
3. Number test, ranking test,
4. Mathematical operations

**UNIT III:**

1. Arithmetical Reasoning,
2. Inserting missing character,
3. Syllogism.

**UNIT IV: Non – Verbal:**

1. Water images,
2. Mirror images,
3. Paper folding,
4. Paper cutting,
5. Embedded Figures,
6. Dot situation,
7. Cubes & Dice

**TEXT BOOKS**

- [1] R. S. Aggarwal, “ Verbal and non-verbal reasoning”, Revised Edition, S Chand publication, 2017 ISBN:81-219-0551-6

**20MC3107A**  
**ENVIRONMENTAL STUDIES**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	-
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL**

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

<b>CO1</b>	Identify various factors causing degradation of natural resource and control measures	K2
<b>CO2</b>	Identify various ecosystem and need for biodiversity	K2
<b>CO3</b>	Realize and explore the problems related to environmental pollution and its management	K2
<b>CO4</b>	Apply the information and technology to analyze social issues, use acts associated with environment	K3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1							1					1	
<b>CO2</b>		1	1							1			1	
<b>CO3</b>				1	1							1	1	
<b>CO4</b>						1	1	1					1	

## COURSE CONTENT

### UNIT I

The Multidisciplinary Nature of Environmental Studies Definition, scope and importance Need for public awareness.

#### Natural Resources :

**Renewable and Non-renewable Resources:** Natural resources and associated problems.

**(a) Forest resources:** Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people.

**(b) Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

**(c) Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources.

**(d) Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

**(e) Energy resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

**(f) Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

### UNIT II

#### Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

#### Biodiversity and Its Conservation

Introduction, definition: genetic, species and ecosystem diversity. Biogeographically classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of

biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

### **UNIT III**

#### **Environmental Pollution**

Definition ,Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards

**Solid waste management:** Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

**Disaster management:** Floods, earthquake, cyclone and landslides.

### **UNIT IV**

#### **Social Issues and the Environment:**

From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns.

**Environmental ethics** Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation.Consumerism and waste products.

#### **Environment Protection Act**

Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation.

#### **Public awareness**

Human Population and the Environment,Population growth, variation among nations, Population explosion—Family Welfare Programme.

#### **Environment and human health**

Human rights, Value education,HIV/AIDS,Women and Child Welfare,Role of Information Technology in environment and human health.

#### **Field Work/ Case Studies**

Visit to a local area to document environmental assets—river/forest/grassland/hill/mountain. Visit to a local polluted site—Urban/Rural/Industrial/Agricultural.Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc.

**Self Study:**

Water resources, Threats to biodiversity, Solid waste management, Role of Information Technology in environment and human health.

**TEXT BOOKS**

[1] Erach Bharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, Bharati Vidyapeeth Institute of Environment Education and Research

**REFERENCE BOOKS**

[1] Anjaneyulu Y. Introduction to Environmental sciences, B S Publications PVT Ltd, Hyderabad

[2] Anjireddy. M Environmental science & Technology, BS Publications PVT Ltd, Hyderabad

[3] Benny Joseph, 2005, Environmental Studies, The Tata McGraw- Hill publishing company limited, New Delhi.

[4] Principles of Environmental Science. & Engg. P.Venu Gopala Rao, 2006, Prentice-Hall of India Pvt. Ltd., New Delhi.

[5] Ecological and Environmental Studies – Santosh Kumar Garg, Rajeswari Garg (or) Rajani Garg, 2006, Khanna Publishers, New Delhi.

[6] Essentials of Environmental Studies, Kurian Joseph & R Nagendran, Pearson Education publishers, 2005

[7] A.K Dee – Environmental Chemistry, New Age India Publications

[8] Bharucha Erach- Biodiversity of India, Mapin Publishing Pvt.Ltd.

**E RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Erach Bharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, Bharati Vidyapeeth Institute of Environment Education and

Research. <https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf>

[2] NPTEL Courses - Environmental Studies By Dr.Tushar Banerjee | Devi Ahilya Viswavidyalaya, Indore.

## **SEMESTER - IV**

**20BS4101**  
**PROBABILITY AND STATISTICS**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Set theory, Basic probability, Probability distributions.	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Examine probability distributions with random variables	K3	1.2.1, 1.2.2, 2.6.3, 4.6.1
<b>CO2</b>	Apply random phenomena of sample to test the Hypothesis concerning means.	K3	1.2.2, 2.6.3, 4.6.1, 4.6.3
<b>CO3</b>	Analyze the Hypothesis concerning variance and proportions.	K4	1.2.2, 2.6.3, 4.6.1, 4.6.3
<b>CO4</b>	Apply Quality improvement, control charts and reliability to improve Statistical skills.	K3	1.2.2, 2.6.3, 4.6.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3	3		2										
<b>CO2</b>	3	3		2										
<b>CO3</b>	3	3		2										
<b>CO4</b>	3	3		2										

**COURSE CONTENT**

**UNIT I: Probability Distributions:** Random Variables (discrete and continuous), Expectation, Variance and Standard deviation of discrete random variable, Binomial distribution, Poisson distribution. Expectations, Variance and standard deviation of continuous random variables, Normal distribution, Normal approximation to the Binomial distribution

**Joint distribution:** Joint distributions-Discrete and Continuous.

**UNIT II: Sampling Distributions:** Introduction, Populations and Samples

Inferences Concerning Mean: Point Estimation- Interval Estimation

Test of Hypothesis – Null Hypothesis and Tests of Hypothesis – Hypothesis concerning one mean – Relation between tests and Confidence intervals – Operating characteristic curves - Inferences concerning two means.

**UNIT III: Inferences Concerning Variances:** Estimation of variances- Hypothesis concerning one variance- Hypothesis concerning two variances.

Inference Concerning Proportions: Estimation of Proportions- Hypothesis concerning one Proportion- Hypothesis concerning several Proportions – The Analysis of  $r \times c$  Tables- Goodness of fit.

**UNIT IV: The Statistical Content of Quality Improvement Programs:** Quality Control- Control Charts for Measurements - Control Charts for Attributes.

Applications to Reliability and Life Testing: Reliability - Failure – Time Distributions – The Exponential Model in Reliability.

**TEXT BOOKS**

- [1] Probability and Statistics for Engineers Eighth edition by Richard A. Johnson  
Prentice Hall of India.

**REFERENCE BOOKS**

- [1] Probability & Statistics for Engineers & Scientist by R.E. Walpole, R.H.Myers&S.L.Myers, Sixth Edition, Prentice Hall of India / Pearson Education.
- [2] Probability and Statistics, Purna Chandra Biswal, Pearson Education Prentice Hall of India 2007.
- [3] Probability and Statistics by T.K.V.Iyengar, B.Krishna Gandhi, S.Ranganatham, M.V.S.S.N.PrasadS.Chand.



**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] [probweb.berkeley.edu/teaching.html](http://probweb.berkeley.edu/teaching.html)
- [2] [statsci.org/teaching.html](http://statsci.org/teaching.html)
- [3] [video.lectures.nptel.iitm.ac.in](http://video.lectures.nptel.iitm.ac.in)

**20CS4302****ADVANCED DATA STRUCTURES AND ALGORITHMS**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	20CS3305 Data Structures	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL****POI****Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the functions of different non-linear data structures – binary trees, search trees and graphs. Apply graph-based algorithms.	K2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3, 2.6.4
<b>CO2</b>	Apply the algorithm design technique - divide and conquer, and greedy methods for solving complex problems.	K3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3, 2.8.4
<b>CO3</b>	Apply dynamic programming and backtracking design techniques to solve complex problems.	K3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3, 2.8.4
<b>CO4</b>	Apply the concepts of Branch and Bound techniques to solve complex problems; Understand NP-Hard, and NP-Complete problems.	K3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3, 2.8.4

**Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	2											2	
<b>CO2</b>	2	3											2	
<b>CO3</b>	2	3											2	
<b>CO4</b>	2	3											2	

**COURSE CONTENT**

## UNIT – I

**Efficient Binary Trees:** AVL trees, Red-Black trees, Splay trees: bottom up splay trees

**Multi-way Search Trees:** Introduction, B Trees, B+ trees, operations on B and B+ trees.

**Graphs:** Introduction, graph terminology, representation of graphs, graph traversal algorithms: breadth-first search, depth first search; topological sorting, Warshall, applications of graphs.

## UNIT – II

**Divide and conquer:** General method, Finding the maximum and minimum, applications: binary search, strassen's matrix multiplication.

**Greedy method:** General method, Applications-Job sequencing with deadlines, knapsack problem, minimum cost spanning trees, optimal storage on tapes, optimal merge patterns, single source shortest path problem.

## UNIT - III

**Dynamic Programming:** General method, applications: matrix chain multiplication, multi stage graph problem, optimal binary search trees, 0/1 knapsack problem, all pairs shortest path problem, Traveling sales person problem.

**Backtracking:** General method, applications- n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles, 0/1 knapsack problem.

## UNIT - IV

**Branch and Bound:** General method, applications - Traveling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

**NP-Hard and NP-Complete problems:** Basic concepts, non deterministic algorithms, classes NP Hard and NP Complete, Cook's theorem

## TEXT BOOKS

[1] Reema Thareja, "Data Structures using C", Second Edition, Oxford University Press, 2011. (Unit I)

[2] Ellis Horowitz, SatrajSahni and Rajasekharan, "Fundamentals of Computer Algorithms", Galgotia Publications Pvt. Ltd, 2008. (Unit II, III, and IV)

**REFERENCE BOOKS**

- [1] Horowitz Sahni and Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, Universities Press, 2008.
- [2] Richard F. Gilberg & B.A. Forouzan "Data Structures A Pseudo code Approach with C", 2nd Edition, CENGAGE Learning, 2013
- [3] M.T. Goodrich and R. Tomassia, “Algorithm Design: Foundations, Analysis and Internet examples”, John Wiley and sons, 2006.
- [4] T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, “Introduction to Algorithms”, 2/e, PHI Pvt. Ltd., Pearson Education, 2009.
- [5] Allen Weiss, “Data structures and Algorithm Analysis in C++”, Third Edition, Pearson Education, 2007.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] N. Garg, IIT Delhi, Dec 31, 2009, Data Structures and Algorithms, NPTEL, Available: <http://nptel.ac.in/courses/106102064/25>.
- [2] A. G. Ranade, S. Viswanathan, and A. A. Diwan, IIT Bombay, Dec 31, 2009, Design and Analysis of Algorithms, NPTEL, Available: <https://nptel.ac.in/courses/106/101/106101060/>
- [3] E. Demaine, S. Devadas, and N. Lynch, MIT, Design and Analysis of Algorithms, MIT OpenCourseWare, Available: <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/>
- [4] Timroughgarden.org. Tim Roughgarden's Online Courses. Available : <http://timroughgarden.-org/videos.html>.

**20CS4303****COMPUTER ORGANIZATION AND MICROPROCESSOR**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	20CS3304	<b>Continuous Evaluation:</b>	30
	Digital Logic and Computer Design	<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand microprogramming and organization of CPU.	K2	1.6.1, 1.7.1
<b>CO2</b>	Apply algorithms to perform arithmetic operations on fixed point and floating point data.	K3	1.6.1,1.7.1 ,2.7.1, 2.8.1,
<b>CO3</b>	Understand Memory Hierarchy and I/O Organization.	K2	1.6.1,1.7.1,2.7.1, 2.7.2
<b>CO4</b>	Understand the concepts of 8086 microprocessor interrupts and interfacing.	K2	1.6.1, 1.7.1,2.7.1,2.7.2, 3.6.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2													2
<b>CO2</b>	1	2											1	
<b>CO3</b>	1	2											1	
<b>CO4</b>	2	2	2										1	

**COURSE CONTENT****Unit I:**

**Micro Programmed Control:** Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

**Central Processing Unit:** General register Organization, Stack Organization,

Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC)

## Unit II

**Computer Arithmetic:** Addition and Subtraction, Multiplication Algorithms – Signed Magnitude Multiplication, Booth Multiplication(Signed 2's Complement Multiplication), Array Multipliers, Division Algorithm, Floating-point Arithmetic operations.

**Memory and I/O Organization:** Memory Hierarchy, Main Memory, Auxiliary memory, Associative Memory, Cache Memory, Input-output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor.

## Unit III

### **The 8086 Microprocessor:**

Overview of microcomputer structure & operation, overview of 8086 microprocessor family, 8086 internal architecture, Machine language Vs assembly language. 8086 pin diagram, 8086 minimum mode and maximum mode

### **8086 Instruction Set & Programming:**

Data transfer instructions, arithmetic instructions, bit manipulation instructions, string instructions, program execution transfer instructions, and processor control instructions, Assembler directives.

## Unit IV

**Interrupts:** 8086 interrupts and interrupt responses, 8259A priority interrupt controller

### **Interfacing With 8086 Microprocessor**

Programmable parallel ports and hand shake input/output, the programmable peripheral interface 8255A: modes of operation and initialization, Basics of D/A and A/D converters. Interfacing of DAC and ADC to 8086 microprocessor.

## TEXT BOOKS

- [1] Morris M. Mano, Computer System Architecture, 3/e, Pearson/PHI ,2007
- [2] Douglas V Hall, "Microprocessor and Interfacing", 3rd edition, McGraw Hill, 2016

**REFERENCE BOOKS**

- [1] Computer Architecture and Organization Designing for Performance, William Stallings, Ninth edition, Pearson Education series, 2014.
- [2] K M Bhurchandi, A.K.Ray, “Advanced Microprocessors and Peripherals”, 3rd edition, McGraw Hill, 2014

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] [Prof. Krishna Kumar](#), IISc Bangalore “Microprocessors and Microcontrollers” [Web Content]. Available: <http://nptel.ac.in/courses/106108100/> ( Accessed on 25.05.2020)
- [2] Prof. S.Raman Department of Computer Science & Engineering, IIT Madras “Introduction to Digital Computer Organization” NPTEL  
<http://www.nptel.iitm.ac.in/video.php?subjectId=117105078>

## 20CS4304 COMPUTER NETWORKS

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS3303 Operating Systems	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand fundamentals of concepts of computer networks and reference models	K2	1.7.1, 2.6.4
<b>CO2</b>	Analyze error and flow control mechanisms in data link layer	K4	1.7.1, 2.5.2, 2.6.2
<b>CO3</b>	Analyse subnetting and various routing protocols of network layer	K4	1.7.1, 2.5.2, 2.6.4
<b>CO4</b>	Analyze transport layer and application layer protocols for specific applications.	K4	1.7.1, 2.6.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	2											2	
<b>CO2</b>	3	2											2	
<b>CO3</b>	3	2											2	
<b>CO4</b>	3	2											2	

### COURSE CONTENT



## UNIT – I

**Introduction:** Uses of Computer Networks, Network Topology, Network Hardware: LANs, MANs, WANs, Connection oriented vs Connection less.

**Reference Models:** The OSI Reference Model, TCP/IP Reference Model, the comparison of the OSI and TCP/IP reference models.

**Physical Layer:** Guided transmission media: Magnetic Media, Twisted Pair, Coaxial Cable, and Fiber Optics, Wireless Transmission: Radio transmission, Infrared and Light Transmission

## UNIT - II

**Data Link Layer:** Design issues - Framing, Error Detection and Correction- Hamming Code , CRC, Checksum, Sliding Window Protocols – One bit sliding window, GoBack – N, Selective Repeat.

**Medium Access Control Sub layer:** Multiple access protocols- Aloha - Slotted Aloha -CSMA, CSMA/CD, Collision Free Protocols, Ethernet: Architecture, Frame Formats – DIX, IEEE 802.3, Wireless LAN: Architecture and Protocol stack, IEEE 802.11 format

## UNIT – III

**Network Layer:** Design Issues: Store and forward, Services to transport layer, Implementation of connection less and connection oriented, VC and Datagram Networks, **Routing Algorithms:** Shortest Path, Flooding, DVR, and Link State routing algorithm, Congestion Control Algorithms. IPv4 Protocol, IP address- Classful Addressing – Classless Addressing – Network Address Translation, IPv6- Header, Extension Header

## UNIT – IV

**Transport Layer:** UDP Header, TCP Header, Connection establishment, Connection Release, Connection Management, Congestion Control. **Application Layer:** The Domain Name System (DNS), and E-Mail- Architecture, Message Format – RFC 5322, MIME, SMTP

## TEXT BOOKS

[1] Andrew S Tanenbaum, David J Wetherall “Computer Networks”, 5th Edition, Pearson Education

**REFERENCE BOOKS**

- [1] Behrouz A.Fourozan, “Data Communications and Networking”. 4<sup>th</sup> Ed, TATA McGraw Hill.
- [2] J.F. Kurose and K.W.Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, 6<sup>th</sup> Ed., Pearson Education, 2017
- [3] Larry L. Peterson, Bruce S. Davie, "Computer Networks - A Systems Approach", 5th Edition, Morgan Kaufmann Publications, 2011
- [4] William Stallings, "Data and Computer Communications", 10<sup>th</sup> Edition, Pearson Education, 2013

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof Sowmya Kanti Ghosh, IIT Kharagpur, NPTEL Lectures, 18th April 2018, Video Lectures, Available: <https://nptel.ac.in/courses/106/105/106105183/>
- [2] MIT Open Courseware, MIT, 14th May 2015, Video Lectures, Available: <http://ocw.mit.edu/courses/electricalengineering-and-computer-science/6-033-computer-systemengineering-spring-2009/video-lectures/>
- [3] Dheeraj, IIT Kharagpur, 14th May 2015, Lecture Notes, Available: <http://www.cse.iitk.ac.in/users/dheeraj/cs425>

**20HS4105****UNIVERSAL HUMAN VALUES – II : UNDERSTANDING HARMONY**

<b>Course Category:</b>	Humanities and Social Sciences	<b>Credits:</b>	3
<b>Course Type:</b>	Mandatory Course (Suggested by AICTE)	<b>Lecture -Tutorial-Practice:</b>	3 – 0 – 0
<b>Prerequisites:</b>	Universal Human Values - I desirable.	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

**COURSE OUTCOMES**

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

<b>CO1</b>	Understand and aware of themselves and their surroundings (family, society and nature).	K2
<b>CO2</b>	Handle problems with sustainable solutions, while keeping human relationships and human nature in mind.	K2
<b>CO3</b>	Exhibit critical ability and become sensitive to their commitment towards their understanding of human values, human relationship and human society.	K2
<b>CO4</b>	Apply what they have learnt to their own self in different day-to-day settings in real life.	K3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>						1			2					
<b>CO2</b>			3											
<b>CO3</b>						2								
<b>CO4</b>								3				2		

## COURSE CONTENT

### **UNIT – I: Course introduction, need, basic guidelines, content and process for value education:**

**Part-1:** Purpose and motivation for the course, recapitulation from UHV-I, Self-exploration: what is it?, its content and process, ‘Natural acceptance’ and experiential validation- as the process for self-exploration. Continuous Happiness and Prosperity – A look at basic Human Aspirations.

**Part-2:** Right understanding, Relationship and Physical Facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

(Practice sessions are to be included to discuss 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:**

**Part-1:** Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’. Understanding the needs of Self (‘I’) and ‘Body’ – happiness and physical facility, Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer).

**Part-2:** Understanding the characteristics and activities of ‘I’ and harmony in ‘I’. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.

(Practice sessions are to be included to discuss 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).

### **UNIT – III: Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:**

**Part-1:** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.

**Part-2:** Understanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society–Undivided Society, Universal Order–from family to world family.

(Practice sessions are to be included to reflect 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:**

**Part-1: Understanding Harmony in Nature & Existence – Whole existence as Coexistence:** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of Nature – recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

**Part-2: Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for humanistic education, humanistic constitution and humanistic universal order, 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, Case studies of typical holistic technologies, management models and production systems, 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.

(Part-1: Practice sessions are to be included to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology, etc. Part-2: Practice exercises and case studies are to be taken up in practice (tutorial) sessions eg. to discuss the conduct as an engineer or scientist, etc.)

### **TEXT BOOKS**

[1] Human values and professional ethics, R. R. Gaur, R. Sangal and G. P. Bagaria, Excel Books Private Limited, 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 International Publishers, New Delhi (2004).

[3] The Story of Stuff: The impact of overconsumption on the planet, our communities, and our health and how we can make it better, Annie Leonard, Free Press, New York (2010).

[4] The story of my experiments with truth: Mahatma Gandhi Autobiography, Mohandas Karamchand Gandhi, B. N. Publishing (2008).

[5] Small is beautiful: A study of economics as if people mattered, E. F. Schumacher, Vintage Books, London (1993).

[6] Slow is beautiful: New Visions of Community, Cecile Andrews, New Society Publishers, Canada (2006).

[7] Economy of Permanence, J. C. Kumarappa, Sarva-Seva-Sangh Prakashan, Varanasi (2017).

[8] Bharat Mein Angreji Raj, Pandit Sunderlal, Prabhath Prakashan, Delhi (2018).

- [9] Rediscovering India, Dharampal, Society for Integrated Development of Himilayas (2003).
- [10] Hind Swaraj or Indian Home Rule, M. K. Gandhi, Navajivan Publishing House, Ahmedabad (1909).
- [11] India Wins Freedom: The Complete Version, Maulana Abul Kalam Azad, Orient Blackswan (1988).
- [12] The Life of Vivekananda and the Universal gospel, Romain Rolland, Advaita Ashrama, India (2010).
- [13] Mahatma Gandhi: The Man who become one with the Universal Being, Romain Rolland, Srishti Publishers & Distributors, New Delhi (2002).

### **E RESOURCES AND OTHER DIGGITAL MATERIAL**

- [1] AICTE – SIP Youtube Channel:  
[https://www.youtube.com/channel/UCo8MpJB\\_aaVwB4LWLAX6AhQ](https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAX6AhQ)
- [2] AICTE – UHV Teaching Learning Material:  
<https://fdp-si.aicte-india.org/download.php#1>

**20CS4351**  
**ADVANCED DATA STRUCTURES AND ALGORITHMS**  
**LABORATORY**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Labratory	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Pre - requisites:</b>	20CS3305 Data Structures	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

Upon successful completion of the course, the student will be able to:		BTL	POI
<b>CO1</b>	Implement efficient binary trees, M-way search trees, graph traversal and shortest path algorithms.	3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3
<b>CO2</b>	Use divide and conquer, and greedy methods for implementing solutions for problems.	3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3
<b>CO3</b>	Implement solutions for problems using dynamic programming and backtracking.	3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3
<b>CO4</b>	Apply Branch and Bound techniques to write programs for different problems.	3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2											3	
<b>CO2</b>	2	3											3	
<b>CO3</b>	2	3											3	
<b>CO4</b>	2	3											3	



**COURSE CONTENT**

**WEEK 1:** Implement operations on efficient binary trees.

**WEEK 2:** Implement operations on multi-way search trees: B and B+ Trees.

**WEEK 3:** Implement breath first search and depth first search for a connected graph.

**WEEK 4:** Implement Warshall's and Dijkstra's single source shortest path algorithms.

**WEEK 5:** Programs to find minimum spanning tree using Kruskal and Prim algorithms.

**WEEK 6:** Perform strassen's matrix multiplication using divide and conquer technique.

**WEEK 7:** Design programs to solve Job sequencing and Knapsack problems using greedy method.

**WEEK 8:** Implement shortest path algorithms using greedy methods.

**WEEK 9:** Implement matrix chain multiplication and optimal binary tree algorithms using dynamic programming.

**WEEK 10:** Implement graph algorithms using dynamic programming.

**WEEK 11:** Implement solutions for traveling sales person and 0/1 knapsack problems using dynamic programming.

**WEEK 12:** Implement solutions for n-queen and subset subset sum problems using backtracking technique.

**WEEK 13:** Implement graph coloring and hamiltonian cycle algorithms for a connected graph using backtracking technique.

**WEEK 14:** Implement solutions for traveling sales person and 0/1 knapsack problems using branch and bound technique.

**TEXT BOOKS**

[1] Reema Thareja, "Data Structures using C", Second Edition, Oxford University Press, 2011. (Unit I)

- [2] Ellis Horowitz, SatrajSahni and Rajasekharan, “Fundamentals of Computer Algorithms”, Galgotia Publications Pvt. Ltd, 2008. (Unit II, III, and IV)

## REFERENCE BOOKS

- [1] Horowitz Sahni and Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, Universities Press, 2008.
- [2] Richard F. Gilberg & B.A. Forouzan "Data Structures A Pseudo code Approach with C", 2nd Edition, CENGAGE Learning, 2013
- [3] M.T. Goodrich and R. Tomassia, “Algorithm Design: Foundations, Analysis and Internet examples”, John Wiley and sons, 2006.
- [4] T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, “Introduction to Algorithms”, 2/e, PHI Pvt. Ltd., Pearson Education, 2009.
- [5] Allen Weiss, “Data structures and Algorithm Analysis in C++”, Third Edition, Pearson Education, 2007.

## E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] N. Garg, IIT Delhi, Dec 31, 2009, Data Structures and Algorithms, NPTEL, Available: <http://nptel.ac.in/courses/106102064/25>.
- [2] A. G. Ranade, S. Viswanathan, and A. A. Diwan, IIT Bombay, Dec 31, 2009, Design and Analysis of Algorithms, NPTEL, Available: <https://nptel.ac.in/courses/106/101/106101060/>
- [3] E. Demaine, S. Devadas, and N. Lynch, MIT, Design and Analysis of Algorithms, MIT OpenCourseWare, Available: <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/>
- [4] Timroughgarden.org. *Tim Roughgarden's Online Courses*. Available : <http://timroughgarden.-org/videos.html>.

## 20CS4352

### MICROPROCESSOR LABORATORY

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	20CS3304 Digital Logic and Computer Design	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand microprogramming and organization of CPU.	K2	1.6.1, 1.7.1
<b>CO2</b>	Apply algorithms to perform arithmetic operations on fixed point and floating point data.	K3	1.6.1,1.7.1 ,2.7.1, 2.8.1,
<b>CO3</b>	Understand Memory Hierarchy and I/O Organization.	K2	1.6.1,1.7.1,2.7.1, 2.7.2
<b>CO4</b>	Understand the concepts of 8086 microprocessor interrupts and interfacing.	K2	1.6.1, 1.7.1,2.7.1,2.7.2, 3.6.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>														2
<b>CO2</b>	1	2												
<b>CO3</b>	1	2												
<b>CO4</b>	2	2	2											

### COURSE CONTENT

Programming on

Task 1: Data transfer instructions (With different Address Modes).

Task 2: Demonstration on 8086  $\mu$ P Flag Register with operations.

Task 3: Arithmetic instructions (8-bit /16-bit Data Size With different Address Modes)

Task 4: Loop instructions

Task5: Jump instructions

Task 6: Logical/ rotate/ shift instructions

Task 7: String instructions.

Task 8: Demonstration of subroutines Execution

Task 9: ADC interfacing

Task 10: DAC interfaces

Task 11: Stepper motor interfacing

Task12:Complete study of ARM Cortex processor

### **TEXT BOOKS**

- [1] Douglas V Hall, “Microprocessor and Interfacing”, 3rd edition, McGraw Hill, 2016.
- [2] Kenneth J. Ayala, “8051 MICRO CONTROLLER ARCHITECTURE” 3rd edition, Thomson Delmar Learning, 2007

### **REFERENCE BOOKS**

- [1] K M Bhurchandi, A.K.Ray, “Advanced Microprocessors and Peripherals”, 3rd edition, McGraw Hill, 2014
- [2] Microprocessors and Microcomputer-Based System Design , Mohamed Rafiquzzaman , 2nd Edition , CRS press,1995.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof. Krishna Kumar, IISc Bangalore “Microprocessors and Microcontrollers” [Web Content]. Available: <http://nptel.ac.in/courses/106108100/> (Accessed on 10-8-18)

**20CS4353**  
**COMPUTER NETWORKS LABORATORY**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Co - requisites:</b>	20CS3305 Data Structures	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Understand fundamental concepts of computer networks and reference models
<b>CO2</b>	Analyze data link layer mechanisms for error control, flow control and multiple access
<b>CO3</b>	Analyze functioning of routing algorithms, congestion control & QoS techniques used at network layer
<b>CO4</b>	Analyze the different protocols used at transport layer and Application layer.

### Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	2											2	
<b>CO2</b>	3	2											2	
<b>CO3</b>	3	2											2	
<b>CO4</b>	3	2											2	

### COURSE CONTENT/TASKS

#### Task 1:

Installation of Packet Tracer & environment  
Network Representation (PT 1.5.5)

**Task 2:**

Investigate OSI and TCP reference models in action

Part 1: Examine HTTP Web Traffic (PT 3.5.5)

Part 2: Display Elements of the TCP/IP Protocol Suite

**Task 3:**

Basic Switch and End Device Configuration

Configure Initial Switch Settings (PT 2.5.5)

Basic Switch and End Device Configuration (PT 2.9.1)

**Task 4:**

Physical Layer

Connect a Wired and Wireless LAN (PT 4.6.5)

Connect the Physical Layer (PT 4.7.2)

**Task 5:**

Basic Router Configuration

Configure Initial Router Settings (PT 10.1.4)

Connect a Router to a LAN (PT 10.3.4)

Troubleshoot Default Gateway Issues (10.3.5)

Basic Device Configuration (PT 10.4.3)

**Task 6:**

Data Link Layer Protocols

Identify MAC and IP Addresses (PT 9.1.3)

Examine the ARP Table (PT 9.2.9)

**Task 7:**

IPv4 Addressing

Subnet an IPv4 Network (PT 11.5.5)

Subnetting Scenario (PT 11.7.5)

**Task 8:**

VLSM

VLSM Design and Implementation Practice (PT 11.9.3)

Design and Implement a VLSM Addressing Scheme (PT 11.10.1)

**Task 9:**

IPv6 Addressing

Configure IPv6 Addressing (PT 12.6.6)

Implement a Subnetted IPv6 Addressing Scheme (PT 12.9.1)

**Task 10:**

ICMP for network testing

Verify IPv4 and IPv6 Addressing (PT 13.2.6)

Use Ping and Traceroute to Test Network Connectivity (PT 13.2.7)

Use ICMP to Test and Correct Network Connectivity (PT 13.3.1)

### **Task 11:**

Transport Layer

TCP and UDP Communications (PT 14.8.1)

### **Task 12:**

Device Security

Configure Secure Passwords and SSH (PT 16.4.6)

Secure Network Devices (PT 16.5.1)

Installing Wireshark & Using Wireshark to View Network Traffic

### **Supplementary Coding Tasks:**

1. Compute Cyclic Redundancy Check (CRC) for a given data frame using the three CRC polynomials – CRC 12, CRC 16 & CRC CCITT.
2. Implement Dijkstra's algorithm to compute the Shortest path for a given graph
3. Obtain Routing table at each node using Distance Vector Routing (DVR) algorithm for a given subnet

### **TEXT BOOKS**

[1] Andrew S Tanenbaum, David J Wetherall "Computer Networks", 5th Edition, Pearson Education

### **REFERENCE BOOKS**

[1] Kurose and Ross, "Computer Networks – A Top-down Approach Featuring the Internet", Pearson Education.

[2] Behrouz A. Ferozan, "Data Communications and Networking". 4th Ed, TATA McGraw Hill.

[3] Nader F. Mir, Computer and Communication Networks. PHI Publications

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Prof Sowmya Kanti Ghosh, IIT Kharagpur, NPTEL Lectures, 18th April 2018, Video Lectures, Available: <https://nptel.ac.in/courses/106/105/106105183/>

[2] MIT Open Courseware, MIT, 14th May 2015, Video Lectures, Available: <http://ocw.mit.edu/courses/electricalengineering-and-computer-science/6-033-computer-systemengineering-spring-2009/video-lectures/>

[3] Dheeraj, IIT Kharagpur, 14th May 2015, Lecture Notes, Available: <http://www.cse.iitk.ac.in/users/dheeraj/cs425>

**20TP4106****ENGLISH FOR PROFESSIONALS**

<b>Course Category:</b>	Soft Skills - 2	<b>Credits:</b>	1
<b>Course Type:</b>	Learning by Doing	<b>Lecture -Tutorial-Practice:</b>	0 – 0 – 2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL**

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

<b>CO1</b>	How conversations are made.	K3
<b>CO2</b>	Usage of grammar.	K3
<b>CO3</b>	Etiquettes and manners.	K3
<b>CO4</b>	Speaking Skills.	K3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>									3	3				
<b>CO2</b>										3				
<b>CO3</b>										3				
<b>CO4</b>									3	3				

**COURSE CONTENT****UNIT-I**

Beginners, Functional, Situational Conversations: Introduction: Importance of spoken English in the placements and Group Discussion, Beginners Conversation: Self Introduction - Introducing Self, Introducing each other in a team (Pair Activity), Functional Conversation: Seeking Permission from Seniors Teachers and other superiors (Team Activity), Asking Direction - Direction from stranger or from Helpline, Making Requests - Requests for borrowing books, applications, or any other help from office staff in college or outside.

Just a minute: Give a topic and ask the student to talk impromptu, To present the



topic in a structured manner.

## **UNIT-II**

Structuring and forming sentences: Structure of mother tongue and pit falls in translation to English, Formation of sentences in English.

Errors in Usage: Difficulty in right usage of words, Difficulty in Pronunciation - Phonetic differences in mother tongue and English – areas to improve, Idioms and Phrase – Frequently used Idiom and Phrases which help to enhance the quality of presentation and make the presentation meaningful, Meaning of frequently used Idioms and Phrases.

## **UNIT-III**

Introduction to different ways of speaking: Elocution, Debate and Extempore, Principles of Elocution and its challenges practice in session, Principles of Debates and its challenges –practice session, Principles of Extempore - its pitfalls – practice sessions.

## **UNIT-IV**

Etiquette: Need of Etiquette in Social arena, Dining Etiquette, Social Etiquette in conversation - formal and informal gathering, Book a table etc. Versant Test: Mode of versant Test, Aim of the test and various methods it follows, Practice session.

## **TEXTBOOKS**

Audio—visuals / hand outs (compiled/ created by training division, T&P cell, VR Siddhartha Engineering College).

## **REFERENCE BOOKS**

1. Sadanand, K. & Punitha, S. (2014). Spoken English: A Foundation Course (Part 1 & 2) (Rev. ed.). Orient BlackSwan Pvt. Ltd.
2. Bhatnagar, N., & Bhatnagar, M. (2010). Communicative English for Engineers and Professionals. Pearson Education India.

## **E-RESOURCES AND OTHER DIGITAL MATERIALS**

- [1] Chaudhary, S. (2015, April 30). Better Spoken English. NPTEL. <https://nptel.ac.in/courses/109106067>. Last accessed on June 6, 2022.
- [2] Roy, A. G. (2019, September 5). Speaking Effectively. NPTEL Online Courses. <https://onlinecourses.nptel.ac.in/noc20hs14/preview>. Last accessed on June 6, 2022.
- [3] UsingEnglish.com: English Language (ESL) Learning Online. (2002). UsingEnglish- .Com. <https://www.usingenglish.com/>. Last accessed on June 6, 2022.
- [4] Goodreads. (n.d.). Goodreads | Meet your next favorite book. <https://www.goodreads.com/>. Last accessed on June 6, 2022.

**20CS4607****INDUSTRY STANDARD CODING PRACTICE – I**

<b>Course Category:</b>	Skill Oriented Course - 1	<b>Credits:</b>	2
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	1-0-2
<b>Prerequisites:</b>	20CS3305 Data Structures	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

<b>Upon successful completion of the course, the student will be able to:</b>		<b>BTL</b>	<b>POI</b>
<b>CO1</b>	Understand test and development aspects of programming by solving problems at Industry standards.	K2	1.2.1, 1.7.1, 2.5.1, 4.6.3
<b>CO2</b>	Apply domain skills and mathematical knowledge to solve any given problem.	K3	1.2.1, 2.5.1, 2.5.3, 4.4.1
<b>CO3</b>	Apply methods to optimize solutions for any given problem.	K3	1.2.1, 2.5.3, 4.4.1
<b>CO4</b>	Apply elementary data structures to solve problems with test driven development	K3	1.2.1, 2.5.3, 4.4.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3	3		2										
<b>CO2</b>	3	3		2									2	2
<b>CO3</b>	3	3		2									2	2
<b>CO4</b>	3	3		2									2	2

**COURSE CONTENT**

**UNIT I**

Problem solving through Competitive Coding, Problem solving using control structures, Numeric series and patterns, Code Complexity analysis, Linear/ Logarithmic/ Super linear/ Polynomial/ Exponential/ Factorial Algorithms, Problem solving on rotations of data, Problem solving on Order statistic problems, Problem Solving Examples Problem solving on matrix data, Memory manipulation techniques using pointers. Memory Arithmetic, Problem solving implementing pointer to an array, Memory Layout, overcoming the segmentation faults, Run-time memory allocation, Coding comparisons of Linear list data structure and Pointers, examples and Practice problems.

**UNIT II**

Problem solving on string data, Problem solving on String manipulations, coding problems using string handling functions, Problem solving on Multi-String Problems, Problem Solving for long strings, Examples, Practice problems. Problem solving using modular programming, Inter module communications, scopes of data in the code, Problem solving approaches using recursions, Evaluation of Recursive algorithms, Significance of mathematical Recurrence Relations, Evaluation of recurrence relations, Time Analysis, Examples, Practice problems.

**UNIT III**

Problem solving on operational and traversal logics on linked lists, Problem solving to compare linked lists, detection of a cycle/ merge point, Merging sorted linked lists, coding problems on circular linked lists/Double linked lists, Examples, Practice problems. Problem Solving Problem solving through Linked list coding, traversals, Problem solving to compare linked lists, detection of a cycle/ merge point, Merging sorted linked lists, Circular linked list formation, Double linked list formation, Examples, Practice problems.

**UNIT IV**

Problem solving through testing, implementing various testing approaches: Test strategy, Test development, Test execution, Bug fixing, Examples, Practice problems, Problem solving Methods and techniques. Understanding the problem as math abstract, formation of the logic, Identifying the corner cases, Examples, Practice problems, Version control systems, Git repositories and working trees, adding new version of the files to a Git repository, Examples, practice problems.

**TEXT BOOKS**

- [1] Halim, Steven and Halim, Felix, Competitive Programming 3, 2013.
- [2] Ahmed Shamsul Arefin, Art of Programming Contest, ACM Solver, Second Edition, 2012

**REFERENCE BOOKS**

- [1] Programming Challenges: The Programming Contest Training Manual By

Steven S Skiena, Miguel A. Revilla

- [2] Guide to Competitive Programming: Learning and Improving Algorithms Through Contests By Antti Laaksonen

### **E- RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Topcoder tutorials - <https://www.topcoder.com/community/data-science/data-science-tutorials/>
- [2] Nite Nimajneb's site - <http://comscigate.com/Books/contests/icpc.pdf>
- [3] Slides from a Stanford Course - <http://web.stanford.edu/class/cs97si/>
- [4] Halim, Steven and Halim, Felix, Competitive Programming 3, 2013. Ebook available at lulu.com. Site associate with with the book is <http://cpbook.net>

**20MC4108B**  
**INDIAN CONSTITUTION**

<b>Course Category:</b>	Mandatory Course	<b>Credits:</b>	-
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial- Practice:</b>	2-0- 0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Understand the fundamental law of the land	K2
<b>CO2</b>	Understand how fundamental rights are protected	K2
<b>CO3</b>	Understand the structure and formation of the Indian Government System	K2
<b>CO4</b>	Understand when and how an emergency can be imposed and what are the consequences.	K2

### Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>						3	2							
<b>CO2</b>						2	3							
<b>CO3</b>						1								
<b>CO4</b>						2	1							

### COURSE CONTENT

#### UNIT I

**Introduction to Constitution of India:** Meaning of the Constitution Law and Constitutionalism, Historical perspective of constitution of India, Salient features of Constitution of India.

**UNIT II**

**Fundamental Rights:** Scheme of the fundamental rights, scheme of the fundamental right to equality, scheme of the fundamental right to certain freedoms under Article 19, scope of the right of life and personal liberty under Article 21, writs jurisdiction

**UNIT III**

**Nature of the Indian Constitution:** Federal structure and distribution of legislative and financial powers between the Union and states

**Parliamentary form of Government in India:** The Constitution powers and status of the President of India, Amendment of the Constitutional powers and Procedure, Historical Perspectives of the constitutional amendments in India

**Local Self Government:** Constitutional Scheme in India

**UNIT – IV**

**Emergency Provisions:** National Emergency, President rule, Financial Emergency

**TEXT BOOKS**

[1] Dr. J.N. Pandey, Constitutional Law of India published by Central law Agency, Allahabad, Edition 2018

**REFERENCE BOOKS**

- [1] V.N Shukla's, Constitution of India Eastern Book Company, Lucknow.
- [2] M.P. Jain, Indian Constitution Law, Wadhwa and Company, Nagpur.
- [3] D.D. Basu, Constitution of India, Wadhwa and Company, Nagpur

## **SEMESTER V**

**20CS5301**  
**DATABASE MANAGEMENT SYSTEMS**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Data Structures: 20CS3305 Discrete Mathematics : 20BS3101A	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the concepts of database systems	K2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO2</b>	Analyse the Entity-Relationship models, intern develop the Relational models that leads to database design	K4	2.5.2, 2.5.3, 2.6.3, 2.7.2, 3.5.6, 3.6.2
<b>CO3</b>	Apply various normalization techniques to relational models in order to improve database design quality	K3	2.5.2, 2.5.3, 2.6.3, 2.7.2, 3.5.6, 3.6.2
<b>CO4</b>	Understand database transactions processing, protocols for Concurrency control and Recovery techniques in database	K2	1.7.1, 2.5.2, 2.6.3, 2.7.2
<b>CO5</b>	Implement database management techniques using relational SQL database to real world applications	K5	2.5.2, 2.5.3, 2.6.3, 2.6.4, 2.8.4, 5.4.2, 5.5.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1	2											1	1
<b>CO2</b>		2	3										1	1
<b>CO3</b>		2	3										1	1
<b>CO4</b>	1	2											1	1



<b>CO5</b>		<b>2</b>	<b>3</b>		<b>3</b>								<b>2</b>	<b>2</b>
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## **COURSE CONTENT**

### **UNIT I**

Introduction to Database Systems -Databases and Database users: Introduction, An example, Characteristics of Database Approach, Actors on the scene, Workers behind the scene.

Database System—Concepts and Architecture: Data Models, Schemas and Instances, Three-schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment.

SQL Schema Definition, Basic Constraints and Queries- SQL: SQL Data Definition and Data Types specifying basic constraints in SQL, Basic retrieval queries in SQL, Insert, Delete and Update statements in SQL, Additional features of SQL ,More complex SQL Queries, Specifying Constraints as Assertions and Triggers, Views (Virtual Tables) in SQL,Schema Change Statement in SQL.

### **Unit II**

Data Modeling Using the Entity-Relationship Model-Using High-Level Conceptual Data Models for Database Design; A Sample Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types;

Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship Types of Degree Higher than two, Relational Database Design using ER-to-Relational Mapping.

### **Unit III**

Relational Model and Relational Algebra- Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations.

Relational Algebra: Unary Relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory Binary Relational Operations: JOIN and DIVISION, Additional

Relational Operations, Examples of Queries in Relational Algebra.

Relational Database Design - Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Properties of Relational Decompositions; Multivalued Dependencies, Fourth Normal Form and Fifth Normal Form.

#### **Unit IV**

Transaction Processing, Concurrency Control, and Recovery: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control, Recovery Concepts ,NO-UNDO/REDO Recovery Techniques based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm.

#### **TEXT BOOKS**

- [1] Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 7<sup>th</sup> edition, Pearson Education Ltd, 2016.

#### **REFERENCE BOOKS**

- [1] Raghu Rama Krishnan, Johannes Gehrke, “*Database Management Systems*”, 3<sup>rd</sup> Edition, McGraw Hill Education, 2014
- [2] Abraham Silberschatz, Henry F.Korth, S.Sudarshan, “*Database System Concepts*”, 6<sup>th</sup> edition, McGraw-Hill Education, 2013

#### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

1. Dr S.Srinath IIT-Madras “Conceptual design process “  
<https://nptel.ac.in/courses/106/106/106106093/> Last accessed on 10/02/2022
2. Prof P.Srinivasa Kumar IIT-Madras “Normalization process”  
<https://nptel.ac.in/courses/106/106/106106095/> Lecture 7, Last accessed on 10/02/2022
3. Prof D.Janakiram IIT-Madras “Concurrency Control techniques”  
<https://nptel.ac.in/courses/106/106/106106093/> Lecture 20,21,22,23 Last accessed on 10/02/2022
4. Andy Pavlo, Carnegie Mellon University, Relational model concepts,  
<https://15445.courses.cs.cmu.edu/fall2017/slides/01-introduction.pdf>

**20CS5302**  
**ADVANCED JAVA PROGRAMMING**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Java Programming: 20ES3102	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply Java concepts to Create GUI application.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4
<b>CO2</b>	Apply Java concepts to Create distributed application.	K3	1.7.1,2.5.1,2.5.2,2.6.3, 2.7.1, 3.5.1,3.8.2
<b>CO3</b>	Apply Java concepts to Develop web application	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,3.8.2
<b>CO4</b>	Apply Java concepts to Develop enterprise application	K3	2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,3.6.2,3.8.2, 5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	3												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	3										2	2
<b>CO4</b>		2	3		2								2	2

## COURSE CONTENT

### UNIT I

**Event Handling :** The Delegation Event Model, Event Classes, Event Listener Interfaces, Handling Mouse Events, Handling Keyboard Events.

**GUI Programming:** Introduction to Swings, JLabel and ImageIcon, JTextField, The Swing Buttons: JButton, Checkboxes, RadioButtons, JTabbedPane, JList, JComboBox, JTable, JMenu Bars and JMenus.

**Java Database Connectivity:** JDBC Connectivity, Types of JDBC drivers, Connecting to the database, JDBC Statements, JDBC Exceptions, Manipulations on the database.

### UNIT II

**Network Programming:** Introduction, InetAddress, Client/Server Interaction with Stream Socket Connections, Client/Server Interaction with Datagrams socket connections.

**Remote Method Invocation:** Introduction to RMI, RMI Architecture, Defining the Remote Interface, Implementing the Remote Interface, Compiling and Executing the Server and the Client.

### UNIT III

**Servlets:** Introduction to servlets, Lifecycle of a Servlet, Simple servlet, the Servlet API, the javax.servlet package, Reading Servlet parameters, the javax.servlet.http package, Handling Http Request & Responses, Using Cookies, Session Tracking.

**Java Server Pages:** Introduction to JSP, The Problem with Servlet, the Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC architecture.

### UNIT IV

**JSP Application Development:** Generating Dynamic Content, Using Scripting Elements, Implicit JSP Objects, Conditional Processing, Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing data between JSP pages, Requests and Users, Passing Control and Data between Pages, Sharing Session and Application Data.

**Microservices for Java Developers:** What is a Microservice Architecture?, Challenges, Technology Solutions.

**Spring Boot for Microservices:** Getting Started, Hello World, Calling Another Service.

### TEXT BOOKS

- [1] Herbert Schildt, "Java The Complete Reference", Eleventh Edition, Oracle Press, . 2019. [Unit I Chapter 1&2, Unit II Chapter 1, Unit III Chapter 1].
- [2] H. M. Deitel, P.J. Deitel, S.E. Santry, "Advanced Java 2 Platform How to Program", 3rd Edition, 2016, Prentice Hall Publications. [Unit I Chapter 2, Unit- II Chapter 2]
- [3] Hans Bergsten, "JavaServer Pages", 3rd Edition 2017, O'Reilly Media. [Unit III Chapter 2 , Unit- IV Chapter 1 ].
- [4] Christian Posta, "Microservices for Java Developers", O'Reilly Media Inc., September 2016. [Unit IV Chapter 2 & 3 ]

### REFERENCE BOOKS

- [1] Paul J. Dietel and Dr. Harvey M. Deitel, "Java How to Program", 9th Edition, Prentice-Hall, Pearson Education, 2016.
- [2] David Geary, Cay S. Horstmann "Core JavaServer Faces" Third edition, 2016, Prentice Hall.
- [3] Jim Keogh, "The Complete reference to J2EE", reprint 2017, Tata McGraw-Hill

### E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] AbhayRedkar, JSF Developer, "Java Micro services", Udemy. Last accessed on 10-02-2022 .  
<https://www.udemy.com/course/microservices-with-spring-boot-and-spring-cloud/>

**20HS5103****ENGINEERING ECONOMICS AND MANAGEMENT**

<b>Course Category:</b>	Humanities and Social Sciences	<b>Credits:</b>	2
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

<b>CO1</b>	Understand various forms of organizations and principles of management
<b>CO2</b>	Understand the various aspects of business economics.
<b>CO3</b>	Acquire knowledge on Human resources and Marketing functions
<b>CO4</b>	Understand different methods used in calculating depreciation and evaluating alternatives economically.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2							2						2
<b>CO2</b>	2				3			2						2
<b>CO3</b>	2							2						2
<b>CO4</b>	2				3			2						2

**COURSE CONTENT****UNIT - I**

**Forms of Business Organization:** Salient Features of Sole Proprietorship, Partnership, Joint Stock Company, Co-operative Society and Public Sector.

**Management:** Introduction to Management, Functions of Management, Principles

of Scientific Management, Modern Principles of Management.

## UNIT - II

**Introduction to Economics:** Introduction to Basic Economic Concepts, Utility Analysis: Marginal Utility and Total Utility, Law of Diminishing Marginal Utility, Law of Equi Marginal Utility.

**Demand Analysis:** Theory of Demand: Demand Function, Factors Influencing Demand, Demand Schedule and Demand Curve, Shift in Demand, Elasticity of Demand: Elastic and Inelastic Demand, Types of Elasticity.

**Supply Analysis:** Supply Schedule and Supply Curve, Factors Influencing Supply, Supply Function.

## UNIT – III

**Human Resource Management:** Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management.

**Marketing Management:** Concept of Selling And Marketing – Differences, Functions of Marketing, Product Life Cycle, Concept of Advertising, Sales Promotion, Types of Distribution Channels, Marketing Research, Break-Even Analysis.

## UNIT – IV

**Financial Management:** Functions of Financial Management, Time value of money with cash flow diagrams, Concept of Simple and Compound Interest.

**Depreciation:** Causes of depreciation, Factors influencing depreciation, common methods of Depreciation: Straight Line Method, Declining Balance Method, Sum of Year's Digits Method –Problems.

**Economic Alternatives:** Methods of Evaluating Alternatives under Present worth method, Future worth method, Annual Equivalent method - Problems.

## TEXT BOOKS

- [1] M. Mahajan Industrial Engineering and Production Management Dhanpat Rai Publications 2nd Edition.
- [2] Martand Telsang” Industrial & Business Management” S.Chand publications

## REFERENCE BOOKS

- [1] R.Paneer selvam “Production and Operations Management” PHI
- [2] Philip Kotler & Gary Armstrong “Principles of Marketing” ,pearson prentice

Hall, New Delhi, 2012 Edition.

[3] IM Pandey, “Financial Management” Vikas Publications 11th Edition

[4] B.B Mahapatro, “Human Resource Management”, New Age International, 2011

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] <https://www.toppr.com/guides/fundamentals-of-economics-and-management/supply/supply-function/>

[2] <https://keydifferences.com/difference-between-personnel-management-and-human-resource-management.html>

[3] <http://productlifecyclestages.com/>

[4] <https://speechfoodie.com/cash-flow-diagrams/>



## 20CS5404A APPLIED STATISTICS

<b>Course Category:</b>	Programme Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 -0- 0
<b>Prerequisites:</b>	20BS4101 Probability and Statistics	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the role of statistics in engineering	K2	1.2.1, 1.6.1
<b>CO2</b>	Analyze Discrete Random variables and Continuous Random variables	K4	1.2.1, 2.7.1, 2.8.1
<b>CO3</b>	Apply random sampling and point estimations to real world problems.	K3	1.2.1, 1.7.1, 2.7.1, 2.8.1, 4.4.2
<b>CO4</b>	Analyze Simple Linear Regression and Multiple Linear Regression	K4	2.8.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2													
<b>CO2</b>	2	3												2
<b>CO3</b>	2	2		2										2
<b>CO4</b>		2												2

### COURSE CONTENT

#### UNIT I

**The Role Of Statistics In Engineering :** The Engineering Method and Statistical Thinking, Collecting Engineering Data ,Mechanistic and Empirical Models,

Probability and Probability models.

**Discrete Random Variables and Probability Distributions:** Discrete Random Variables, Probability Distributions and Probability Mass functions, Cumulative Distribution Functions, Mean and Variance of a Discrete Random Variable, Discrete Uniform Distribution, Binomial Distribution, Geometric and Negative Binomial Distributions, Hypergeometric Distribution, Poisson Distribution .

## UNIT II

**Continuous Random Variables And Probability Distributions:** Continuous Random Variables, Probability Distributions and Probability Density Functions, Cumulative Distribution Functions, Mean and Variance of a Continuous Random Variable, Continuous Uniform Distribution, Normal Distribution, Normal Approximation to the Binomial and Poisson Distributions, Exponential Distribution Erlang and Gamma Distribution, Weibull Distribution, Lognormal Distribution

## UNIT III

**Random Sampling and Data Description:** Data Summary and Display, Random Sampling, Stem-and-leaf Diagrams, Frequency Distributions and Histograms, Box Plots, Time sequence Plots, Probability Plots.

**Point Estimation of Parameters:** Introduction, General Concepts of Point Estimation, Methods of Point Estimation, Sampling Distributions, Sampling Distributions of Means

## UNIT IV

**Simple Linear Regression:** Empirical Models, Simple Linear Regression, Properties of the Least square Estimators, Hypothesis Tests in Simple Linear Regression, Confidence Intervals, Prediction of New Observations, Adequacy of the Regression Model, Transformation to a straight line, Correlation.

**Multiple Linear Regression:** Multiple Linear Regression Model, Hypothesis Tests in Multiple Linear Regression, Confidence Intervals in Multiple Linear

Regression, Prediction of New Observations, Model Adequacy Checking, Aspects of Multiple Regression Modelling

### **TEXT BOOKS**

[1] Douglas C. Montgomery, George C. Runger (2018), Applied Statistics and Probability for Engineers, Wiley

### **REFERENCE BOOKS**

[1] Härdle, Wolfgang; Okhrin, Ostap; Okhrin, Yarema (2017), Basic Elements of computational Statistics, Springer

[2] Sheldon M. Ross (2006) : Introductory Statistics , 2/e, Elsevier Publications

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Introduction to computational statistics

<https://www.coursera.org/specializations/compstats>

**20CS5404B**  
**PRINCIPLES OF CLOUD COMPUTING**

<b>Course Category:</b>	Programme Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Computer Networks: 20CS4304	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand Cloud Computing concepts, technologies, architecture and applications	K1	1.7.1,2.5.1
<b>CO2</b>	Understand the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.	K2	1.7.1, 2.6.3, 2.6.4, 2.8.3, 2.8.4
<b>CO3</b>	Analyze the different Cloud Platforms and Cloud Applications	K4	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1
<b>CO4</b>	Apply the security issues and legal issues in cloud computing	K3	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	2												
<b>CO2</b>	3	2												
<b>CO3</b>	1	3	2										1	2
<b>CO4</b>	3	2	3										1	2

## COURSE CONTENT

### UNIT I

**Introduction to Cloud Computing** - Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks

**Migrating into a Cloud** - Introduction, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud

### UNIT II

**Virtualization:** Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques - Execution Virtualization, Other types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples – Xen, VMware, Microsoft Hyper-V. **Virtual Machines Provisioning and Migration Services** - Introduction, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context

### UNIT III

**Cloud Platforms in Industry:** Amazon web services - Compute services, Storage services, Communication services and Additional Services. Google AppEngine - Architecture and core concepts, Application life cycle, Cost model, Observations. Microsoft Azure – Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.

**Cloud Applications:** Scientific Applications – Healthcare, Biology, Geoscience, Business and Consumer Applications – CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming. **Features of Cloud and Grid Platforms** - Cloud Capabilities and Platform Features, Traditional Features Common to Grids and Clouds, Data Features and Databases, Programming and Runtime Support. **Programming Support of Google App Engine** - Programming the Google App Engine, Google File System (GFS), BigTable, Google's NOSQL System, Chubby, Google's Distributed Lock Service. Programming on Amazon AWS and Microsoft Azure - Programming on Amazon EC2, Amazon Simple Storage Service (S3), Amazon Elastic Block Store (EBS) and SimpleDB, Microsoft Azure Programming Support.

### UNIT IV

**Data Security in the Cloud** - Introduction, Current State, Homo Sapiens and

Digital Information, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security  
**Legal Issues in Cloud Computing** - Introduction, Data Privacy and Security Issues, Cloud Contracting models, Jurisdictional Issues Raised by Virtualization and Data Location

### **TEXT BOOKS**

- [1] Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "**Cloud Computing: Principles and Paradigms**", Wiley, 2013
- [2] Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "**Mastering Cloud Computing**", McGraw Hill, 2013

### **REFERENCE BOOKS**

- [1] Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishers, 2012.
- [2] Kai Hwang, Geoffrey C Fox, Jack J Dongarra, "Distributed and Cloud Computing - From Parallel Processing to the Internet of Things", Morgan Kaufman Publishing, 2012
- [3] Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", 1<sup>st</sup> Ed, Pearson, 2014

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] [https://cs.uwaterloo.ca/~a78khan/courses-offered/cs446/2010\\_05/lecture-slides/16\\_CloudComputing.pdf](https://cs.uwaterloo.ca/~a78khan/courses-offered/cs446/2010_05/lecture-slides/16_CloudComputing.pdf)
- [2] <http://www.cs.iit.edu/~iraicu/teaching/CS553-S12/index.html>
- [3] <https://www.youtube.com/user/arch4cloud/playlists>

**20CS5404C****INFORMATION SECURITY AND RISK MANAGEMENT**

<b>Course Category:</b>	Programme Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Computer Networks 20CS4304	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL****POI**

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

<b>CO1</b>	Understand the fundamentals of Information Security	K1	2.6.3, 2.6.4
<b>CO2</b>	Analyse the threats and attacks on information systems	K3	3.7.1
<b>CO3</b>	Understand the need for risk management and risk control	K2	2.5.2, 2.6.3, 2.6.4, 2.8.4
<b>CO4</b>	Understand the importance of security planning and education	K2	2.5.2, 2.6.3, 2.6.4, 2.8.4

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>		3											1	
<b>CO2</b>			3										1	
<b>CO3</b>		2											1	
<b>CO4</b>		2											1	

## **COURSE CONTENT**

### **UNIT I: Introduction to Information Security**

The History of Information Security, What Is Security?, CNSS Security Model, Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Systems Development Life Cycle, The Security Systems Development Life Cycle, Security Professionals and the Organization, Communities of Interest, Information Security: Is it an Art or a Science?

### **UNIT II: The Need for Security**

Introduction, Business Needs First, Threats, Attacks, Secure Software Development.

Law and Ethics in Information Security, International Laws and Legal Bodies, Ethics and Information Security, Codes of Ethics and Professional Organizations

### **UNIT III: RISK MANAGEMENT**

An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative Versus Qualitative Risk Control Practices, Risk Management Discussion Points, Recommended Risk Control Practices.

### **UNIT IV: Planning for Security**

Information Security Planning and Governance, Information Security Policy, Standards, and Practices, The Information Security Blueprint, Security Education, Training, and Awareness Program, Continuity Strategies

## **TEXT BOOKS**

[1] Michael E Whitman, Herbert J Mattord, "Principles of Information Security", 4th Edition, Cengage Learning, 2012

## **REFERENCE BOOKS**

[1] Steven Hernandez, Corey Schou, "Information Assurance Handbook: Effective Computer Security and Risk Management Strategies", 1st Edition, McGrawHill, 2014.

[2] William Stallings, "Cryptography and Network Security- Principles and Practice", 6<sup>th</sup> Edition, Pearson Education, 2013.



**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] nptelonlinecourse.com, “Cryptography and network Security”, 2021. [Online].

Available: <https://nptel.ac.in/courses/106/105/106105162/> Accessed on 02/12/2021.

[2] cybrary.com, “Cryptography”, 2021, [Online].

Available: <https://www.cybrary.it/course/fundamental-cryptography-data-protection/>. Accessed on 02/12/2021

**20CS5404D**  
**PROGRAMMING FOR GAMES**

<b>Course Category:</b>	Programme Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	20ES3102 Java Programming	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

**COURSE OUTCOMES****BTL****POI**

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

<b>CO1</b>	Understand the Overview of Unity 3D & C# programming.	K2	1.6.1,3.5.6,5.4.1
<b>CO2</b>	Understand the Unity 3D Architecture & develop game code.	K2	1.7.1,3.8.3,5.4.2
<b>CO3</b>	Apply the game programming fundamentals & Unity 3D execution order.	K3	3.8.2,5.5.2
<b>CO4</b>	Apply the advanced concepts of C# for game programming	K3	1.7.1,5.5.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3		2		2									
<b>CO2</b>	1		2		3									3
<b>CO3</b>			2		3								2	3
<b>CO4</b>	2				3									3

**COURSE CONTENT**

**UNIT 1**

Introduction to C#: A Flexible Programming Language, Overview of C#, Compiling, Unity 3D Overview: The Main Panel, Creating a New Project, A New Unity 3D Project, Sample Code , Working with C#: Game Engines

**UNIT 2**

Tokens, Statements and Expressions, Keywords, White Space, Code Blocks, Classes, Variables, Variable Names

Basics Building Blocks of Code, Building Up a Game Idea, Creating a Class, Directives, Functions, Order of Operation, Logic and Operators, Loops.

**UNIT 3**

Fundamentals: Inheritance, Instancing, Static, Turning Ideas into Code, Jump Statements, Operators and Conditions, Arrays, Jump Statements, Multidimensional Arrays, Array List, Strings.

Class Constructors, Using Arrays in Unity 3D, Enums, Switch, Structs, Class Data, Namespaces, Functions Again, Unity 3D Execution Order, Type Casting, Working with Vectors, Out Parameter, Ref Parameter, Type Casting Numbers, Types and Operators, Operator Overloading, Controlling Inheritance.

**UNIT 4**

Function Overloading, Accessors (or Properties), Base Classes, Optional Parameters, Delegate Functions, Interface, Preprocessor Directives, Exceptions, IEnumerator.

Generics, Events, Unity-Friendly Classes, Destructors, Concurrency or Coroutines, Dictionary, Stacks, and Queues, Callbacks, Lambda Expressions.

Debugging, Recursion, Reflection, LINQ, Bitwise Operators, Bitwise Math, Attributes, Architectures and Organization, Design Patterns.

**TEXT BOOKS**

[1] Alex Okita, Learning C# Programming with Unity 3D, CRC Press, Taylor & Francis Group, 2020

**REFERENCE BOOKS**

[1] Balagurusamy, Emir. Programming in C#: A Primer. McGraw-Hill Education, 2010.

[2] Norton, Terry. Learning C# by developing games with unity 3D. Packt

Publishing Ltd, 2013.

## **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Intro to C# Programming and Scripting for Games in Unity, <https://www.udemy.com/course/3dmotive-intro-to-c-programming-and-scripting-for-games-in-unity/> accessed on 13.05.2022.
- [2] Coding in C# in Unity for beginners, <https://unity.com/how-to/learning-c-sharp-unity-beginners>. Accessed on 13.05.2022.
- [3] Scripting in Unity for experienced programmers, <https://unity.com/how-to/programming-unity> accessed on 13.05.2022.

**20CS5404E**  
**NETWORK PROGRAMMING**

<b>Course Category:</b>	Programme Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	20CS4304 - Computer Networks	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply socket API based programs.	3	1.2.1, 1.7.1, 2.5.1
<b>CO2</b>	Analyze client-server applications using TCP and UDP sockets.	4	1.2.1, 2.5.1, 2.5.3
<b>CO3</b>	Analyse network programs.	4	1.2.1, 2.5.3
<b>CO4</b>	Apply raw sockets for network communication.	3	1.2.1, 2.5.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	3											1	
<b>CO2</b>	3	3											1	
<b>CO3</b>	3	3											1	
<b>CO4</b>	3	3											1	

## **COURSE CONTENT**

### **UNIT I**

**Introduction to Network Programming:** OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

**Sockets :** Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function.

## UNIT II

**TCP client server :** Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host. **Elementary UDP sockets:** Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. **I/O Multiplexing:** I/O Models, select function, Batch input, shutdown function, poll function, TCP Echo server,

## UNIT -III

**Socket options:** getsockopt and setsockopt functions. Socket states, Generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options. **Advanced I/O Functions**-Introduction, Socket Timeouts, recv and send Functions, readv and writev Functions, recvmsg and sendmsg Functions, Ancillary Data, How Much Data Is Queued?, Sockets and Standard I/O, T/TCP: TCP for Transactions.

## UNIT -IV

**Elementary name and Address conversions:** DNS, gethost by Name function, Resolver option, Function and IPV6 support, uname function, other networking information.

**Raw Sockets:** Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program, An ICMP Message Daemon, Datalink Access-Introduction, BPF: BSD Packet Filter, DLPI: Data Link Provider Interface, Linux: SOCK\_PACKET, libpcap: Packet Capture Library, Examining the UDP Checksum Field. Remote Login: Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.

## TEXT BOOKS

[1] UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew

M. Rudoff, Pearson Education

[2] UNIX Network Programming, 1st Edition, -W. Richard Stevens. PHI.

### **REFERENCE BOOKS**

[1] UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education

[2] Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

**20CS5404F****OBJECT ORIENTED ANALYSIS AND DESIGN**

<b>Course Category:</b>	Programme Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	20CS3303 Operating Systems	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the basic concepts of object oriented analysis and design.	K1	1.7.1, 2.5.1, 2.5.2
<b>CO2</b>	Apply object oriented methodologies for a given application.	K3	1.7.1, 2.5.1, 3.5.2, 3.5.6
<b>CO3</b>	Apply object oriented analysis process for any given application.	K3	1.7.1, 2.5.1, 3.5.2, 3.5.6
<b>CO4</b>	Apply object oriented design process concepts for a given application.	K3	1.7.1, 2.5.1, 3.5.2, 3.5.6

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	3												
<b>CO2</b>	2	2	3										2	
<b>CO3</b>	2	2	3										2	
<b>CO4</b>		2	3										2	

**COURSE CONTENT**



**UNIT I**

Introducing UML and UP. What is UML?, What is Unified Process?, Requirements, Requirements Workflow, Use Case Modelling, Advanced use case modelling,

**Unit II**

Analysis, The analysis workflow, Objects and Classes, Finding analysis classes, Relationships, Inheritance and Polymorphism.

**Unit III**

Analysis Packages, Use Case realization, Advanced Use Case realization, Activity Diagrams, Advanced activity Diagrams.

**Unit IV**

Design, The Design workflow, Design Classes, Refining analysis relationships, Interfaces and components, Use case realization- Design, State Machines. Implementation, The Implementation work flow, Deployment

**TEXT BOOKS**

[1] Jim Arlow, Ila Neustadt, UML2 and the Unified Process Second Edition, Practical Object Oriented Analysis and Design, Addison- Wesley Publication. 2015.

**REFERENCE BOOKS**

[1] Object Oriented Analysis Design and Implementation, An integrated approach, Second Edition, Springer University Press.2015.

[2] R. S.Pressman, and Bruce Maxim Software Engineering A Practitioner's approach, Eighth Edition, Tata McGraw Hill, 2015.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

## 20CS5205A WEB PROGRAMMING

<b>Course Category:</b>	Open Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	<b>20ES3102</b> <b>Java</b> <b>Programming</b>	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the concepts of Web designing	K2	1.3.1, 2.1.1
<b>CO2</b>	Apply the concepts of HTML5 and CSS to design static web pages	K3	2.2.3, 3.2.1, 3.2.2
<b>CO3</b>	Apply client side technologies to design interactive Web interfaces using	K3	2.2.3, 2.2.4, 3.3.1, 3.2.1, 3.2.2
<b>CO4</b>	Apply the concepts to Design and validate XML Documents	K3	2.2.3, 2.4.2 3.2.1, 3.2.2
<b>CO5</b>	Apply interactive server side scripting for a web application	K3	2.2.3, 3.2.1, 3.2.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	2												
<b>CO2</b>		2	3										2	
<b>CO3</b>		2	3										2	
<b>CO4</b>		2	3										3	
<b>CO5</b>		2	3										3	

## COURSE CONTENT

### UNIT I

**Introduction** : Concept of WWW, Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0

**Web Design**: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

### UNIT II

**HTML** : Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5

**Style sheets** : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

### UNIT III

**JavaScript**: Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and Javascript, Events and buttons

**XML**: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT

### UNIT IV

**PHP** : Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP

**PHP and MySQL** : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs

### **TEXT BOOKS**

Moseley, R., & Savaliya M. T. (2011). Developing Web Applications. Wiley India Pvt. Limited.

### **REFERENCE BOOKS**

1. Sklar, J. (2012). Web design principles. Course Technology Cengage Learning.
2. Deitel, H. M., Deitel, P. J., & Nieto, T. R. (2004). Internet world wide web: how to program. Pearson/Prentice Hall
3. Harwani, B. M. (2010). DevelopingWeb Applications in PHP and AJAX. McGraw Hill Education.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

1. Sengupta, I. (2014, June 28). Internet Technology. NPTEL. <https://nptel.ac.in/courses/106105084>. Last accessed on June 5, 2022.
2. PHP Group. (n.d.). PHP: MySQL (Original) - Manual. PHP: Hypertext Preprocessor. <https://www.php.net/manual/en/book.mysql.php>. Last accessed on May 13, 2022.

## 20CS5205B LINUX ESSENTIALS

<b>Course Category:</b>	Open Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	---	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand and work confidently in Linux Environment	K2	1.6.1,1.7.1, 2.5.1
<b>CO2</b>	Apply the security and administration mechanisms for user or group management and permissions	K3	1.7.1,2.5.2,2.7.1, 2.7.2,3.5.1
<b>CO3</b>	Apply shell scripts for solving problems	K3	2.6.3,2.7.1, 2.7.2,2.8.1,2.8.2, 3.5.1,3.8.2
<b>CO4</b>	Analyse client/server communication using IPC mechanisms	K4	2.6.2,2.7.1,3.6.2, 3.6.3 3.8.2,3.8.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	2												
<b>CO2</b>	1	3	2										1	1
<b>CO3</b>		2	3										1	1
<b>CO4</b>		2	3										1	1

### COURSE CONTENT

#### UNIT I

**Selecting an Operating System:** What Is an OS, Investigating User interfaces.

**Using Common Linux Programs:** Using a Linux Desktop Environment,

Working with Productivity Software, Using Server Programs, Managing Programming Languages, Handling Software Packages.

## UNIT II

**Managing Hardware:** Learning about Your CPU, Understanding Disk Issues, Managing Displays, Handling USB Devices, Managing Drivers.

**Getting to Know the Command Line:** Starting a Command Line ,Running Programs ,Using Shell Features ,Getting Help Using man Pages ,Getting Help Using info Pages.

## UNIT III

**Managing Files:** Navigating Files and Directories, Manipulating Files, Manipulating Directories.

**Searching, Extracting, and Archiving Data:** Using Regular Expressions Searching for and Extracting Data, Redirecting Input and Output, Archiving Data.

**Exploring Processes and Process Data:** Understanding Package Management, Understanding the Process Hierarchy, Identifying Running Processes, Using Log Files.

## UNIT IV

**Creating Scripts:** Beginning a Shell Script, Using Commands, Using Arguments Using Variables, Using Conditional Expressions, Using Loops, Using Functions.

**Understanding Basic Security:** Understanding Accounts, Using Account Tools, Working as root.

**Managing Network Connections:** Understanding Network Features, Configuring a Network Connection, Testing Your Network Connection, Protection.

## TEXT BOOKS

[1] Christine Bresnahan, Richard Blum,” Linux Essentials”, 2nd Edition, September 2015

## REFERENCE BOOKS

[1] Richard Petersen, ”Linux:The Complete Reference”, 6th edition, Tata McGraw-Hill, 2007.

[2] Mc Kinnon, Mc Kinnon, “Installing and Administrating Linux“, 2nd edition, Wiley, 2004.

## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] NDG Linux Essentials, <https://www.netacad.com/courses/os-it/ndg-linux->

[essentials](#) last accessed on 10-02-2022.

- [2] O'Reilly Network: Directory of Linux Commands  
<http://www.oreillynnet.com/linux/cmd/> last accessed on 10-02-2022.

**20CS5205C**  
**FUNDAMENTALS OF DATA STRUCTURES**

<b>Course Category:</b>	Open Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL****POI**

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

<b>CO1</b>	Understand different approaches to evaluate algorithms and linear data structures - stack and queues.	K2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO2</b>	Understand different types of linked list data structures.	K2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO3</b>	Understand the operations on tree and Sorting.	K2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
<b>CO4</b>	Apply various design techniques of greedy and dynamic programming.	K3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3, 2.6.4, 2.8.4

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2											2	
<b>CO2</b>	2	2											2	
<b>CO3</b>	2	2											2	
<b>CO4</b>		3	3										2	

**COURSE CONTENT**



**UNIT 1**

Introduction: Basic concepts, algorithm specification, randomized algorithm, data abstraction, performance analysis-time complexity, space complexity, asymptotic notations, linear and binary searches complexity analysis.

Stacks: Definition, representing stacks, ADT stack and its operations: algorithms and their complexity analysis, Applications of stacks: expression conversion and evaluation – corresponding algorithms. Recursion, Towers of Hanoi problem.

Queues: Queue and its sequential representation, queue as an abstract data type, types of queue: simple queue, circular queue, operations on each types of queues: algorithms.

**UNIT II**

Linked lists: Representation in memory, singly linked lists: operations and algorithms, doubly linked list: operations and algorithms; circular linked lists: all operations their algorithms.

**UNIT III**

Trees: Introduction: terminology, representation of trees, binary Tree, complete binary tree, applications of binary trees, expression trees construction and evaluation; binary tree traversals: inorder, preorder and postorder.

Sorting: Insertion sort, Shell sort, and quick sort and External sorting.

**UNIT IV**

Algorithm Design Techniques: Divide and Conquer: Running time of divide and conquer approach, Greedy Algorithm: Simple scheduling Problem – Dynamic Programming: Random number generator – Backtracking: Min max strategy.

**TEXT BOOKS**

- [1]Horowitz Sahni and Anderson- Freed “Fundamentals of Data Structures in C”. 2<sup>nd</sup> Edition, Universities Press, 2008. (Unit I, II, and III).
- [2]EllisHorowitz,SatrajSahniandRajasekharan,“FundamentalsofComputerAlgorithms”,GalgotiaPublications Pvt. Ltd, 2008. (Unit IV)

**REFERENCE BOOKS**

- [1] Richard F. Gilberg & B. A. Forouzan “Data Structures A Pseudocode Approach with C”, Second Edition, CENGAGE Learning.
- [2] Thareja, R. (2011). Data structures using C (2nd ed.). Oxford University Press, Inc..
- [3] Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, McGraw Hill, 1984.
- [4] Thomas Cormen, C.Leiserson, R. L.Rivest & C.Stein, “Introduction to Algorithms”. 3rd Edition, The MIT Press, 2009

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Dr.P.P. Chakraborty, IIT Kharagpur, May 19, 2010, Data Structures, NPTEL, Available: [www.youtube.com/watch?v=S47aSEqm\\_0I](http://www.youtube.com/watch?v=S47aSEqm_0I)
- [2] Dr. Naveen Garg, IIT Delhi, Sep 24, 2008, Data Structures, NPTEL, Available: <http://nptel.iitm.ac.in>, <http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms>
- [3] Shai Simonson, Jun 16, 2014, Data Structures, NPTEL, Available: <http://nptel.ac.in/video.php?subjectId=106102064>

**20CS5205D****DATA MINING & DATA WAREHOUSING**

<b>Course Category:</b>	Open Elective I	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the fundamentals of Data mining	K2	1.2.1, 1.7.1
<b>CO2</b>	Apply various pre-processing techniques in Data mining	K3	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1
<b>CO3</b>	Apply various schemas and operations of the Data Warehouse.	K3	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1 3.6.1
<b>CO4</b>	Analyze different types of data science algorithms to solve real life problems.	K4	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1 3.5.1, 3.6.1, 3.7.1 9.4.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3												1	
<b>CO2</b>	1	3											1	
<b>CO3</b>	1	3	2										1	
<b>CO4</b>	1	2	3						1				1	

<b>COURSE CONTENT</b>
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**UNIT I**

**Introduction to Data Mining:** Why Data Mining?, What Is Data Mining?, What Kinds of Patterns Can Be Mined?, Which Technologies Are Used?, Which Kinds of Applications Are Targeted?, Major Issues in Data Mining.

**Getting to Know your data:** Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity

**UNIT II**

**Data Preprocessing:** An Overview; **Data Cleaning-** Missing Values, Noisy data;

**Data Integration-** Entity Identification problem, Redundancy and Correlation Analysis;

**Data Reduction-** Overview of Data Reduction Strategies, Wavelet Transformation, Principal Components Analysis; Attribute Subset selection;

**Data Transformation and Data Discretization-** Data Transformation Strategies Overview, Data Transformation by Normalization, Discretization by Binning.

**UNIT III**

**Data Warehouse Basic Concepts-** What Is a Data Warehouse, Differences between Operational Database Systems and Data Warehouses, Data Warehousing: A Multitiered Architecture, Data Warehouse Models: Enterprise Warehouse, Data Mart, and Virtual Warehouse, Extraction, Transformation, and Loading, Metadata Repository

**Data Warehouse Modeling: Data Cube and OLAP -** Data Cube: A Multidimensional Data Model, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Data Models, Dimensions: The Role of Concept Hierarchies, Measures: Their Categorization and Computation, Typical OLAP Operations

**UNIT IV**

**Mining Frequent Patterns, Associations-** Market Basket Analysis: A Motivating Example, Frequent Item sets, Closed Item sets, and Association, Apriori Algorithm: Finding Frequent Item sets by Confined Candidate Generation, Generating Association Rules from Frequent Item sets.

**Classification:** What Is Classification, Decision Tree Induction, Attribute Selection Measures.

**Cluster Analysis:** What Is Cluster Analysis?, Requirements for Cluster Analysis, k-Means Algorithm

**TEXT BOOKS**

[1] Jiawei Han, Micheline Kamber, Jian Pei , Data mining : concepts and techniques, 2012. Third edition

**REFERENCE BOOKS**

[1] Joel Grus , Data Science from Scratch, 2019, 2nd Edition

[2] Emily Robinson and Jacqueline Nolis, Build a Career in Data Science, Manning, 2020

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Google's Machine Learning Crash Course, last accessed on 11-02-2022,  
<https://developers.google.com/machine-learning/crash-course>

[2] IBM's Machine Learning with Python, last accessed on 11-02-2022,  
<https://cognitiveclass.ai/courses/machine-learning-with-python>

**20CS5351****DATABASE MANAGEMENT SYSTEMS LABATORY**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	20CS3305 Data Structures 20BS3101A Discrete Mathematics	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

**COURSE OUTCOMES****BTL****POI**

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

<b>CO1</b>	Demonstrate DDL, DML and DCL statements with integrity constraints	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3, 3.5.1, 3.6.2, 5.4.2
<b>CO2</b>	Design relational database and manipulate the same using simple and complex queries in SQL	K6	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3, 3.5.1, 3.6.2, 5.4.2, 5.5.2
<b>CO3</b>	Develop Entity Relationship and the corresponding Relational models for the given real-world application	K6	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3, 3.5.1, 3.6.2, 5.4.2, 5.5.2
<b>CO4</b>	Illustrate database objects like Procedure, Functions, Triggers and Package using PL/SQL	K4	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3, 3.5.1, 3.6.2, 5.4.2
<b>CO5</b>	Apply transactions processing, Concurrency control and Recovery techniques on relational database	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3, 3.5.1, 3.6.2, 5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1	2	2		2								1	1
<b>CO2</b>	1	3	3		3								1	1
<b>CO3</b>	1	3	3		3								1	1
<b>CO4</b>	1	2	2		2								1	1
<b>CO5</b>	1	2	2		2								2	2

## TASKS

Task 1: Execute DDL, DML and DCL Commands on the suitable database.

Task 2: Implement the following Integrity Constraints on relevant Database

- a. Primary Key    b. Foreign Key    c. Unique
- d. Not NULL      e. Check

Task 3: Execute the aggregate functions like count, sum, avg etc on the suitable database. Make use of built-in functions according to the need of database chosen. Retrieve data from the database based on date function.

Task 4: Apply Set operations (UNION, UNION ALL, INTERSECT and MINUS), Sub-queries,

Group by, Order by clause and Pattern Matching operators (LIKE, %, \_) on fine-tuned Database

Task 5: Implementation of different types of Joins, Views and Ranks.

Task 6: Draw ER diagram for an application with at least 3 entities and establish relationships between them using a tool. Perform ER to Relational mapping to derive Relational database.

Task 7: Write PL/SQL procedure for an application using exception handling for the following

- a. Predefined exceptions.
- b. User defined exceptions.

Task 8: Write a PL/SQL block for transaction operations of a typical application using triggers.

Task 9: create concurrent transactions and obtain concurrency control using SSMS

Task 10: Utilizing recovery management, restore the database in case a catastrophic disk loss occurred.

(DBMS LAB PROJECT)

Design and Implement the given Database Application using the following requirements

- **Database Analysis and Design**

- ✓ Build Conceptual schema using tools
- ✓ Apply Normalization process for relational database design
- ✓ Relational Model Database

- **Implementation:**

- ✓ Front End: Java/Perl/PHP/Python/Ruby/.net

- ✓ Backend: SQL/MySQL/SQLite
- ✓ Database Connectivity: ODBC/JDBC/Servlets

Testing: Data Validation

### **TEXT BOOKS**

[1] Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, 7th edition, Pearson Education Ltd, 2016.

### **REFERENCE BOOKS**

[1] Gordon S Linnoff Data Analysis Using SQL and Excel, 2nd Edition Wiley 2016

[2] Joan Casteel, Oracle 12c:SQL, Cengage Learning, 2017

[3] J D Ullman, —Principles of database systems, Computer Science Press, 2001.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Prof Arnab Bhattacharya IIT Kanpur, SQL Introduction

<https://nptel.ac.in/courses/106104135/10>

[2] Prof Arnab Bhattacharya IIT Kanpur SQL: Updates, Joins, Views and Triggers

<https://nptel.ac.in/courses/106104135/11>

[3] Geoff Allix and Graeme Malcolm: Microsoft , Querying with Transact-SQL (edX) <https://www.mooc-list.com/course/querying-transact-sql-edx>



**20CS5352****ADVANCED JAVA PROGRAMMING LABORATORY**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 3
<b>Prerequisites:</b>	20ES3151	<b>Continuous Evaluation:</b>	30
	Java	<b>Semester end Evaluation:</b>	70
	Programming Lab	<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL****POI**

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

<b>CO1</b>	Create GUI application.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,3.6.2,3.8.2, 4.6.2,5.4.2
<b>CO2</b>	Create distributed application.	K3	1.7.1,2.5.1,2.5.2, 2.6.3,2.7.1,3.5.1,3.8.2
<b>CO3</b>	Develop web application	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,3.8.2
<b>CO4</b>	Develop enterprise application	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,3.6.2,3.8.2, 4.6.2,5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	3												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	3										2	2
<b>CO4</b>		2	3	2	2								2	2

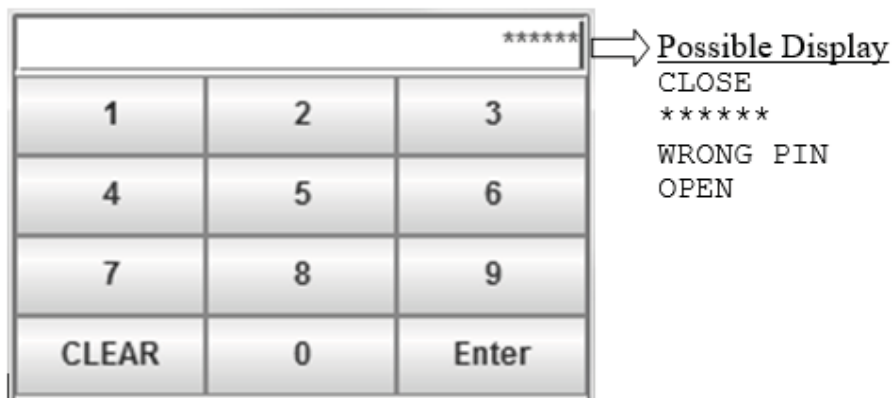
**COURSE CONTENT****Task 1:**

Create a GUI application in java using Swing components, which enter the details of an Employee and on the submit display the details of the Employee (Employee details is like contains name, code, address, phone, joining details,

blood group etc.)

### Task 2:

Create a Java Swing GUI application for an electronic lock as shown below. The display shall show the state of either "CLOSE" or "OPEN". In the "CLOSE" state, the user types his PIN followed by the "Enter" key to unlock the system. The display shall show an asterisk (\*) for each number entered. The display shall show "WRONG PIN" if the PIN is incorrect. The "Clear" button clears the number entered (if any), locks the system and sets the display to "CLOSE". Assume the methods that to be defined: `public boolean checkPIN(String PIN); // return true for correct PIN` `public void unlock(); // Unlock the system` `public void lock(); // Lock the system`



### Task3:

Design Employee Database for company or Organization (Employee Personal Details, Department, Salary (basic, DA, HRA.,) Details) and develop JDBC based java application for following tasks:

1. Insert Records into respective table
2. Select records of particular table of database
3. Delete Records from table.

Connect GUI application to database and perform SQL commands via JDBC API.

### Task 4:

Write a client server program using TCP where client sends 10 numbers to server program and server program responds with the numbers in ascending order to respective client.

### Task 5:

Create Application for Datagram server and Client interaction as per given below. i] Datagram server to send a message to client. ii] Datagram client to receive the message sent by the server. Create a simple UDP chat application

where client and server can chat with each other.

**Task 6:**

Design an RMI client/server application to implement the Bank Transactions. RMI server provides three remotely accessible methods to perform deposit, withdrawal and balance enquiry transactions. So that the Client can access the methods.

**Task 7:**

Verify installation and setting of Web container/Web Server/Tomcat and prepare an installation report, which contains setting of class path, server port, starting and shutting down of server. Develop Web Application to display a greeting message in the browser by using HttpServlet.

**Task 8:**

Create a simple Sign in and Signup web application using HTTPServlet class.

**Task 9:**

Create a simple vehicle registration form web page using servlet that receives all the data entered by user and search for the record whether it is existed into the database using JDBC API.

**Task 10:**

Create JSP to output, "Welcome to JSP world. The time now is: system current time.", Use a scriptlet for the complete string, including the HTML tags.

**Task 11:**

Create a simple JSP application for online poll application that prompts the user to answer a question and display the results in bar graph representation.

**Task 12:**

Design a Web application to read Product information from user and compute the bill amount and discount using JSP.

**Lab Projects:**

1. Apply the concepts of Java Swings, JDBC Connectivity and Networking programming to develop any real-time GUI based application. Ex. e-Shopping cart application.
2. Apply the key concepts of Servlets, JSP and EJB to develop web based application. Ex. interactive online-based quiz application.

**TEXT BOOKS**

- [1] Herbert Schildt, “Java The Complete Reference”, Eleventh Edition, Oracle Press, . 2019.
- [2] H. M. Deitel, P.J. Deitel, S.E. Santry, “Advanced Java 2 Platform How to Program”, 3rd Edition, 2016, Prentice Hall Publications.
- [3] Hans Bergsten, "JavaServer Pages", 3rd Edition 2017, O'Reilly Media.
- [4] Christian Posta, "Microservices for Java Developers", O'Reilly Media Inc., September 2016.

**REFERENCE BOOKS**

- [1] Paul J. Dietel and Dr. Harvey M. Deitel, “Java How to Program”, 9th Edition, Prentice-Hall, Pearson Education, 2016.
- [2] David Geary, Cay S. Horstmann “Core JavaServer Faces” Third edition, 2016, Prentice Hall.
- [3] Jim Keogh, “The Complete reference to J2EE”, reprint 2017, Tata McGraw-Hill .

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Abhay Redkar, JSF Developer, “Java Micro services”, Udemy. <https://www.udemy.com/topic/Microservices/>  
Available: Last accessed on August 2018.
- [2] Prof. I. Sengupta. (14th , May, 2017), Department of Computer Science & Engineering, I.I.T., Kharagpur, “Internet Technologies”, NPTEL videos.

**20HS5153****ENGLISH COMMUNICATION SKILLS LABATORY**

<b>Course Category:</b>	Institutional Core	<b>Credits:</b>	1
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0- 0-2
<b>Prerequisites:</b>	20TP4106 English for Professionals	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL**

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

<b>CO1</b>	Execute rational pronunciation of speech sounds including accentuation.	K3
<b>CO2</b>	Apply elements of listening comprehension in professional environments.	K4
<b>CO3</b>	Develop the abilities of rational argumentation and skills of public speaking.	K4
<b>CO4</b>	Demonstrate proficiency in the elements of professional communication including the competitive examination	K4

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>										3				
<b>CO2</b>					2					3				
<b>CO3</b>					2					3				
<b>CO4</b>					1					3				

**COURSE CONTENT/TASK**

**UNIT:I :Elements of Spoken Expression and processes of Listening Comprehension:**

- Speech Mechanism
- Articulation of vowels and consonants

- Patterns of Accentuation

Types and processes of Listening comprehension

## **UNIT II: : Patterns of Substantiation and Refutation in Public Speaking:**

- Group Discussion(Open and Monitored)
- Pyramid Discussion
- PNI

Seminar Talk and Power Point Presentation

## **UNIT III: Professional Communication:**

- Self Affirmation
- Advanced Composition including Memo and e-mail
- Résumé Preparation

Corporate ethic of Non-Verbal Communication

## **UNIT IV: Life Skills and Vocabulary for Competitive Examinations:**

- Select Life Skills(50)
- Select Logies, Isms, Phobias and Manias (25 each)
- Sentence Completion and Double Unit Verbal Analogies (50 items)

Fundamentals of Syllogisms(Descriptive and Pictorial)

## **TEXT BOOKS**

- [1] Martin Cutts, Oxford Guide to Plain English, 7<sup>th</sup> Impression, OUP, 2011
- [2] Exercises in Spoken English, Prepared by Department of Phonetics and Spoken English, CIEFL, OUP, 21<sup>st</sup> Impression, 2003

## **REFERENCE BOOKS**

- [1] Stephen R Covey, The 7 Habits of Highly Effective people, II edition, (Pocket Books) Simon & Schuster UK Ltd, 2004
- [2] Eclectic Learning Materials offered by the Department

## **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] ODII Language Learner's Software, 27-6-2012 Orell Techno Systems
- [2] Visionet Spears Digital Language Lab software Advance Pro, 28-01-2015
- [3] [www.natcorp.ox.ac.uk](http://www.natcorp.ox.ac.uk), British National Corpus accessed on 28-11-2017

**20TP5106**  
**PERSONALITY DEVELOPMENT**

<b>Course Category:</b>	Soft Skills - 3	<b>Credits:</b>	1
<b>Course Type:</b>	Learning by Doing	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 2
<b>Prerequisites:</b>	20TP4106 English for Professionals	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL**

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

<b>CO1</b>	Understand the corporate etiquette	K2
<b>CO2</b>	Make presentations effectively with appropriate body language	K3
<b>CO3</b>	Be composed with positive attitude.	K3
<b>CO4</b>	Understand the core competencies to succeed in professional and personal life.	K2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>								2		3				
<b>CO2</b>									2	3				
<b>CO3</b>										3				
<b>CO4</b>									2	3				

**COURSE CONTENT****UNIT I**

Analytical Thinking and Communication Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self-Analysis, Developing Positive Attitude, Perception; Verbal Communication, Non Verbal Communication (Body Language)

**UNIT II**

Self-Management Skills and Etiquette: Anger Management, Stress Management,

Time Management, Six Thinking Hats, Team Building, Leadership Qualities; Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

### **UNIT III**

Standard Operation Methods and Verbal Ability: Note Making, Note Taking, Minutes Preparation, Email Letter Writing; Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of Action -Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work

### **UNIT IV**

Career-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

### **METHODOLOGY**

Audio—Visuals / Hand Outs (Compiled/Created by Training Division, T&P Cell, VR Siddhartha Engineering College), Board & Chalk and Interactive Sessions.

### **REFERENCE BOOKS**

1. Mitra, B. K. (2011). Personality development and soft skills (Vol. 156). Oxford University Press.
2. Dhanavel, S. P. (2011). English and Soft Skills. Orient Blackswan Pvt Limited.
3. Aggarwal, R. S. (2018). A Modern Approach to Verbal & Non Verbal Reasoning. S. Chand.
4. Meenakshi, R. & Sharma, S. (2011). Technical Communication Principles and Practice. Oxford University Press.

### **E-RESOURCES AND OTHER DIGITAL MATERIALS**

1. Aptitude Questions and Answers. (n.d.). IndiaBIX. <https://www.indiabix.com/>. Last accessed on June 5, 2022.
2. Placement Papers of all IT Companies. (n.d.). Freshersworld. <https://placement.freshersworld.com/placement-papers>. Last accessed on June 5, 2022.



**20CS5354****ENGINEERING PROJECT FOR COMMUNITY SERVICES**

<b>Course Category:</b>	Project Work/Internship	<b>Credits:</b>	1.5
<b>Course Type:</b>	<b>Lab</b>	<b>Lecture -Tutorial-Practice:</b>	0-0-3
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

**COURSE OUTCOMES**

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

**CO1** Identify the Societal problems.

**CO2** Solve the problems.

**CO3** Design of the problem/work plan.

**CO4** Design of the prototype/model.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>						2	3						2	2
<b>CO2</b>						3	1			2			2	2
<b>CO3</b>						3			2				2	2
<b>CO4</b>									1	3			2	2

**The students may register**

**EPICS:** Engineering Project for community services will be carried out during summer vacation for a period of six weeks after IV Semester and the report shall be submitted in V Semester. Students will go to the society (Villages/Hospitals/Towns, etc..) to identify the problem and survey the literature for a feasible solution. The student(s) is encouraged to solve real life problems leading to innovative model building.. This can be done in a group of students or as an

individual.

**20CS5607****INDUSTRY STANDARD CODING PRACTICE – II**

<b>Course Category:</b>	Skill Oriented Course - 2	<b>Credits:</b>	1
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	1-0-2
<b>Prerequisites:</b>	20CS4607 Industry Standard coding practice-1	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

**COURSE OUTCOMES**

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

<b>CO1</b>	Able to understand test and development aspects of programming by solving problems at Industry standards.
<b>CO2</b>	Able to interpret any given problem using required domain skills, mathematics.
<b>CO3</b>	Able to learn and apply methods to optimize solutions for any given problem.
<b>CO4</b>	Able to solve problems using elementary data structures with test driven development

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3	2	1											
<b>CO2</b>		3											2	2
<b>CO3</b>		1							2				3	3
<b>CO4</b>	2	3											2	2

**COURSE CONTENT**

**UNIT I**

Problem solving through Competitive Coding, Problem solving using control structures, Numeric series and patterns, Code Complexity analysis, Linear/ Logarithmic/ Super linear/ Polynomial/ Exponential/ Factorial Algorithms, Problem solving on rotations of data, Problem solving on Order statistic problems, Problem Solving Examples Problem solving on matrix data, Memory manipulation techniques using pointers. Memory Arithmetic, Problem solving implementing pointer to an array, Memory Layout, overcoming the segmentation faults, Runtime memory allocation, Coding comparisons of Linear list data structure and Pointers, examples and Practice problems.

**UNIT II**

Problem solving on string data, Problem solving on String manipulations, coding problems using string handling functions, Problem solving on Multi-String Problems, Problem Solving for long strings, Examples, Practice problems. Problem solving using modular programming, Inter module communications, scopes of data in the code, Problem solving approaches using recursions, Evaluation of Recursive algorithms, Significance of mathematical Recurrence Relations, Evaluation of recurrence relations, Time Analysis, Examples, Practice problems.

**UNIT III**

Problem solving on operational and traversal logics on linked lists, Problem solving to compare linked lists, detection of a cycle/merge point, Merging sorted linked lists, coding problems on circular linked lists/Double linked lists, Examples, Practice problems. Problem Solving Problem solving through Linked list coding, traversals, Problem solving to compare linked lists, detection of a cycle/merge point, Merging sorted linked lists, Circular linked list formation, Double linked list formation, Examples, Practice problems.

**UNIT IV**

Problem solving through testing, implementing various testing approaches: Test strategy, Test development, Test execution, Bug fixing, Examples, Practice problems, Problem solving Methods and techniques. Understanding the problem as math abstract, formation of the logic, Identifying the corner cases, Examples, Practice problems, Version control systems, Git repositories and working trees, adding new version of the files to a Git repository, Examples, practice problems.

**TEXT BOOKS**

- [1] Halim, Steven and Halim, Felix, Competitive Programming 3, 2013.
- [2] Ahmed Shamsul Arefin, Art of Programming Contest, ACM Solver, Second Edition, 2012

**REFERENCE BOOKS**

- [1] Programming Challenges: The Programming Contest Training Manual By Steven S Skiena, Miguel A. Revilla
- [2] Guide to Competitive Programming: Learning and Improving Algorithms Through Contests By Antti Laaksonen

**E- RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Topcoder tutorials - <https://www.topcoder.com/community/data-science/data-science-tutorials/>
- [2] Nite Nimajneb's site - <http://comscigate.com/Books/contests/icpc.pdf>
- [3] Slides from a Stanford Course - <http://web.stanford.edu/class/cs97si/>
- [4] Halim, Steven and Halim, Felix, Competitive Programming 3, 2013. Ebook available at lulu.com. Site associate with with the book is <http://cpbook.net>

**20MC5108A**  
**BIOLOGY FOR ENGINEERS**

<b>Course Category:</b>	Humanities Elective	<b>Credits:</b>	-
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Describe the fundamental Principles and methods of engineering
<b>CO2</b>	Identify the functions of different types in bio-molecules
<b>CO3</b>	Describe mechanisms underlying the working of molecular biological processes including enzyme catalysis, metabolic pathways, gene expression.
<b>CO4</b>	Use Excel, MATLAB and other computational tools to quantitatively analyze biological processes.

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	3												
<b>CO2</b>		3												
<b>CO3</b>		2		3										
<b>CO4</b>		1		2	3									

### COURSE CONTENT

#### Unit-I Introduction and Classification of Living organisms

##### Introduction:

Fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Biology as an

independent scientific discipline. Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.

**Classification:**

Classification of living organisms based on (a) Cellularity- Unicellular or multicellular (b) Ultrastructure- prokaryotes or eukaryotes. (c) Energy and Carbon utilization -Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitat- acquatic, terrestrial (e) Molecular taxonomy- three major kingdoms of life.

**Unit-II Biomolecules and Enzymes****Biomolecules:**

Biomolecules: Structures of sugars(Glucose and Fructose), starch and cellulose. Nucleotides and DNA/RNA. Amino acids and lipids. Proteins- structure and functions- as enzymes, transporters, receptors and structural elements.

**Enzymes:**

Enzyme classification. Mechanism of enzyme action.

Enzyme kinetics and kinetic parameters.

**Unit-III Genetics and Gene information Transfer****Genetics:**

“Genetics is to biology what Newton’s laws are to Physical Sciences” Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Concepts of recessiveness and dominance. Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring.

**Information Transfer:**

DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

**Unit-IV Metabolism and Microbiology****Metabolism:**

Exothermic and endothermic versus endergonic and exergonic reactions. Concept of  $K_{eq}$  and its relation to standard free energy. ATP as an energy currency. Breakdown of glucose to  $CO_2 + H_2O$  (Glycolysis and Krebs cycle) and synthesis of glucose from  $CO_2$  and  $H_2O$  (Photosynthesis). Energy yielding and energy consuming reactions.

**Microbiology:**

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Growth kinetics. Ecological aspects of single celled organisms. Microscopy.

**TEXT BOOKS**

- [1] Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
- [2] Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
- [3] Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
- [4] Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher, Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] [https://bee.cals.cornell.edu/sites/bee.cals.cornell.edu/files/shared/documents/Career\\_Bee\\_Final-for-Web.pdf](https://bee.cals.cornell.edu/sites/bee.cals.cornell.edu/files/shared/documents/Career_Bee_Final-for-Web.pdf)
- [2] <https://www.teachengineering.org/subjectareas>



## **SEMESTER VI**

**20CS6301**  
**Machine Learning**

<b>Course Category:</b>	<b>Programme Core</b>	<b>Credits:</b>	<b>3</b>
<b>Course Type:</b>	<b>Theory</b>	<b>Lecture -Tutorial-Practice:</b>	<b>3 - 0 - 0</b>
<b>Prerequisites:</b>	<b>20CS4302 Advanced Data Structures and Algorithms</b>	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	<b>30</b> <b>70</b> <b>100</b>

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the concepts of computational intelligence in machine learning	K2	1.2.1, 1.6.1, 1.7.1, 2.5.3
<b>CO2</b>	Apply dimensionality reduction techniques for feature selection	K3	1.2.1, 1.6.1, 1.7.1, 2.6.2, 2.6.4, 2.7.2, 3.6.2, 4.4.2
<b>CO3</b>	Apply appropriate machine learning techniques to address the real time problems	K3	1.2.1, 1.6.1, 1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.7.2, 3.6.1, 3.6.2, 4.4.2, 4.6.1, 5.4.2
<b>CO4</b>	Analyze ensemble models to solve classification problems	K4	1.2.1, 1.6.1, 1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.7.2, 3.6.1, 3.6.2, 4.4.2, 4.6.1, 5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	1											1	1
<b>CO2</b>	2	2		2									1	1
<b>CO3</b>	2	2	2	2	2								1	2
<b>CO4</b>	1	2	2	2	2								1	2

## COURSE CONTENT

### Unit I

**Introduction to Machine Learning:** Introduction. Different types of learning, Examples of Machine Learning Applications

**Supervised Learning:** Learning a Class from Examples, Probably Approximately Correct Learning, Learning multiple classes, Model selection and generalization

**Regression:** Linear regression, Multiple Linear regression, Logistic Regression

**Dimensionality reduction :** Feature Selection, subset selection, Principal Component Analysis, Linear Discriminant Analysis

### UNIT II

**Decision tree learning:** Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, issues in decision tree learning

**Artificial Neural Networks** – Neural network representation, Appropriate problems for neural network learning, Perceptrons: Gradient descent and the Delta rule, Multilayer networks and the back propagation algorithm

**Basics of Sampling theory:** Error Estimation and Estimating Binomial Proportions, The Binomial Distribution, Mean and Variance, Estimators, Bias, and Variance, Confidence Intervals

### UNIT III

**Bayesian learning:** Introduction , Bayes Theorem, Naïve Bayes Classifier, Bayes optimal classifier, Bayesian Belief networks, Conditional independence, Learning Bayesian belief networks

**Parametric Methods:** Maximum Likelihood Estimation

**Non paramteric methods:** K nearest neighbor

**Support Vector Machine:** Introduction, Optimal Separating Hyperplane , The Nonseparable Case: Soft Margin Hyperplane , Defining Kernels

### UNIT IV

**Ensembles:** Introduction, Bagging and Boosting, Random forest

**Clustering:** Introduction, K-means clustering, Expectation maximization algorithm, Hierarchical clustering, Density based clustering: DBSCAN, Choosing the Number of Clusters

**Algorithm evaluation methods:** Classification Accuracy, Confusion Matrix

## TEXT BOOKS

1. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.
2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

**REFERENCE BOOKS**

1. Stephen Marsland, “Machine learning An algorithmic Perspective”, Second Edition, CRC Press, 2015
2. Jiawei Han, Jian Pei, Hanghang Tong, Data Mining Concepts and Techniques, fourth edition, Elsevier Science, 2022
3. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

1. Prof. Balaraman Ravindran, Introduction to Machine Learning  
[https://onlinecourses.nptel.ac.in/noc22\\_cs29/preview](https://onlinecourses.nptel.ac.in/noc22_cs29/preview) last accessed on 20-12-2022
2. Andrew Ng, Machine Learning Specialization  
<https://www.coursera.org/specializations/machine-learning-introduction> last accessed on 20-12-2022

**20CS6302**  
**CRYPTOGRAPHY AND NETWORK SECURITY**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial- Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	20CS4304 Computer Networks	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand fundamental principles of security and symmetric encryption	K2	1.7.1, 2.6.4
<b>CO2</b>	Apply asymmetric encryption techniques and Cryptographic Hash functions	K3	1.7.1, 2.5.2, 2.6.4, 3.6.2
<b>CO3</b>	Apply Authentication applications and Transport Layer Security mechanisms	K3	1.7.1, 2.5.2, 2.6.4
<b>CO4</b>	Understand the protocols for network security and methods to safeguard the network	K2	1.7.1, 2.5.3, 2.6.3, 3.6.2, 5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	3												
<b>CO2</b>	2	3	3											2
<b>CO3</b>	2	2												
<b>CO4</b>		2	3		3									2

**COURSE CONTENT**

**Unit I:**

**Overview:** Security attacks, Services, A model for network security; Basics of Cryptography, Cryptanalysis. Symmetric cipher model.

**Classical encryption techniques:** Substitution Techniques: Caesar Cipher, Mono alphabet Cipher, Playfair Cipher Transposition Techniques: Rail Fence, Row & Column Transposition,

**Block Cipher:** Stream and Block Cipher, DES, Strength of DES, AES

**Block cipher Operations:** Multiple Encryption, ECM, CBC, CFM, OFM, CTR

## **Unit II:**

**Number Theory:** Prime Numbers, Fermat's theorem, Euler's Theorem

**Public Key Cryptography:** Principles of Public Key Crypto System, RSA algorithm, Diffie-Hellman Key Exchange, Problems, Elliptic Curve Cryptography

**Cryptographic Hash Functions:** Applications-Message Authentication, Digital signatures, SHA- 512 Logic, Round Functions

## **Unit III:**

**Key Management and Distribution:** Distribution of Public Keys, X.509 Certificates,

**User Authentication:** Kerberos: Motivation, Kerberos Version 4, Kerberos Version 5

**Transport Level Security:** Web Security Threats, Web Traffic Security Approaches.

**Transport Layer Security:** TLS - TLS Architecture, Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol, Cryptographic Computations

**HTTPS:** Connection Initiation, Connection Closure

## **Unit IV:**

**Email Security:** S/MIME - Operational Description, S/MIME Message Content Types, Approved Cryptographic Algorithms, PGP

**IP Security:** Overview: Applications, Benefits, IPsec Documents, IPsec Services, Transport and Tunnel Modes, Encapsulating Security Payload - ESP Format, Encryption and Authentication Algorithms, Padding, Anti-Replay Service, Transport and Tunnel Modes

**Malicious Software:** Types – Viruses, Backdoor, Logic Bomb, Trojan Horses

**Firewalls:** The Need for Firewalls, Characteristics, Types of Firewalls - Packet Filtering Firewall, Stateful Inspection Firewalls, Application-Level, Gateway Circuit-Level Gateway, Firewall Basing- Bastion Host, Host-Based Firewalls, Personal Firewall.

**TEXT BOOKS**

- [1] William Stallings, “Cryptography and Network Security: Principles and Practice”. 4<sup>th</sup> & 7<sup>th</sup> Editions, Pearson Education, 2017.
- [2] Rick Lehtinen, G.T. Gangemi, "Computer Security Basics", 2nd Edition, O'Reilly Publishers, 2008

**REFERENCE BOOKS**

- [1] Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 2nd Edition, 2012
- [2] J. Katz and Y. Lindell, “Introduction to Modern Cryptography”, CRC Press, 2008
- [3] Bernard Menezes, “Network Security and Cryptography”, CENGAGE Learning, 2010

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] NPTEL Course Cryptography and Network Security, IIT Kharagpur, available @ <https://nptel.ac.in/courses/106105162>, accessed on 3rd January 2023
- [2] Network and Computer Security - MIT OpenCourseWare, available @ <https://ocw.mit.edu/courses/6-857-network-and-computer-security-spring-2014/pages/lecture-notes-and-readings/>, accessed on 3rd January 2023

## 20CS6303

### SOFTWARE ENGINEERING

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	2
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
------------------------	------------	------------

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

<b>CO1</b>	Understand the different software engineering process models.	K2	1.7.1,2.5.1, 2.5.2, 2.6.4,2.7.1
<b>CO2</b>	Apply analysis model for any given application	K3	1.7.1,2.5.1,2.7.1, 3.5.1,3.5.2,3.5.6
<b>CO3</b>	Apply design model for any given application	K3	1.7.1,2.5.1,2.6.4 3.5.1,3.8.1
<b>CO4</b>	Apply different testing techniques	K3	1.7.1,2.5.1,2.6.4, 3.5.1,3.6.2,3.8.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	3											2	2
<b>CO2</b>	2	2	3										1	2
<b>CO3</b>	2	2	3										1	2
<b>CO4</b>	2	2	3										1	2

### COURSE CONTENT

#### UNIT I

**The Nature of Software:** The Nature of Software, The changing nature of software.

**Software engineering:** The Software Process, Software Engineering Practice,



Software Development Myths.

**The Software Process:** Software Process Structure. A Generic Process Model, Defining a framework activity, identifying a task set, Process patterns, Process Assessment and Improvement.

**Process models:** Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models.

**Agile Development:** What Is Agility? Agility and the Cost of Change, What Is an Agile Process? Extreme Programming (XP) Other Agile Process Models, A Tool Set for the Agile Process.

## UNIT II

**Understanding Requirements:** Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Analysis Model, Negotiating Requirements, Requirements monitoring, and Validating Requirements.

**Requirements Modelling:** Scenario Based Methods: Requirements Analysis, Scenario-Based Modelling, UML Models That Supplement the Use Case.

Requirements Modelling: Class based methods, Identifying Analysis classes, Specifying attributes, Defining operators, Class-Responsibility-Collaborator Modelling, Associates and Dependencies, Analysis Packages

Requirements Modelling: Behaviour, Patterns, And Web apps: Creating a Behavioural Model, Identifying events with Use Cases, State Representations, Patterns for Requirements Modelling, Requirements Modelling for Web and Mobile Apps.

## UNIT III

**Design Concepts:** Design within the Context of Software Engineering, the Design Process, Design Concepts, the Design Model.

**Architectural Design:** Software Architecture, Architectural Genres, Architectural Styles, Architectural Considerations, Architectural Decisions, Architectural Design.

**Component-Level Design:** What Is a Component? Designing Class-Based Components, Conducting Component Level Design, and Component level design for Web Apps, Component Level Design for Mobile Apps.

**User Interface Design:** The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Webapp and Mobile Interface Design.

## UNIT IV

**Software Testing Strategies:** A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Test Strategies for MobileApps, Validation testing, System testing, the art of debugging.

**Testing Conventional Applications:** Software Testing Fundamentals, Internal and External Views of Testing, White Box Testing, Basis Path Testing, Control Structure Testing, Black-Box Testing.

## TEXT BOOKS

[1] Roger S. Pressman, Bruce R. Maxim, "Software Engineering a practitioners approach" 8th edition, McGraw-Hill Publication 2019

## REFERENCE BOOKS

[1] Ian Sommerville, "Software Engineering". 9th ed, Pearson Education. 2011.

[2] Carlo Ghezzi, Mehdi Jazayeri and Dino Mandrioli, "Fundamentals of Software Engineering". 2 ed, PHI. 2009

[3] Rajib Mall, Fundamentals of Software Engineering. 3 ed, PHI. 2009.

## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Lecture Series on Software Engineering by Prof. N. L. Sarda, Prof. Umesh Bellur, Prof. R. K. Joshi and Prof. Shashi Kelkar, Department of Computer Science & Engineering, IIT Bombay <https://nptel.ac.in/courses/106101061/2>

[2] Software Engineering By Dr. B. LAVANYA, Assistant Professor  
University of Madras  
[https://onlinecourses.swayam2.ac.in/cec20\\_cs07/preview](https://onlinecourses.swayam2.ac.in/cec20_cs07/preview).

[3] Software Engineering Basics  
<https://www.youtube.com/watch?v=sB2iQSvrcG0>

**20CS6404A**  
**ARTIFICIAL INTELLIGENCE**

<b>Course Category:</b>	Programme Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	20CS4302 Advanced Data Structures and Algorithms	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the techniques and applications of Artificial Intelligence.	K2	1.2.1,1.6.1,1.7.1,2.5.2
<b>CO2</b>	Apply rules to represent knowledge of real world problems	K3	1.2.1,1.6.1,1.7.1,2.5.2, 2.6.4,3.5.1
<b>CO3</b>	Analyze filler structures for different sentences and know the concepts of Natural Language Processing.	K4	1.2.1,1.6.1,1.7.1,2.5.2, 2.7.1,3.5.1
<b>CO4</b>	Apply the key aspects of Expert Systems and apply the concepts of Connectionist Models for complex problems	K3	1.2.1,1.6.1,1.7.1,2.5.2, 2.6.4,2.7.1,3.5.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1	2											1	1
<b>CO2</b>	1	2	3										1	1
<b>CO3</b>	1	2	3										1	1
<b>CO4</b>	1	2	3										1	1

## COURSE CONTENT

### UNIT I

**Problems, Problem Spaces And Search:** Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics

**Heuristic Search Techniques:** Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

### UNIT II

**Knowledge Representation Issues:** Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation.

**Using Predicate Logic:** Representing Simple Facts in logic, Representing Instance and IS-a Relationships, Computable Functions and Predicates, Resolution

**Representing Knowledge Using Rules** - Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.

### UNIT III

**Weak Slot-and-Fillers Structures:** Semantic Nets, Frames

**Strong Slot-and- Fillers Structures:** Conceptual Dependency, Scripts.

**Natural Language Processing:** Introduction, syntactic processing, Semantic analysis, Discourse and pragmatic processing

### UNIT IV

**Connectionist Models:** Introduction: Hopfield Networks, Learning in Neural Networks, Applications of Neural Networks.

**Expert Systems:** Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition

## TEXT BOOKS

[1] Rich, E., Knight, K., & Nair, S. B. (2008). Artificial Intelligence (3rd ed.). TataMcGraw-Hill Education Pvt. Ltd.

## REFERENCE BOOKS

[1] Winston, P. H. (1992). Artificial intelligence (3rd ed.). Addison-Wesley

Longman Publishing Co., Inc..

- [2] Russell, S., & Norvig, P. (2009). Artificial Intelligence: A Modern Approach (3rd ed.). Prentice-Hall.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Basu, A., & Sarkar, S. (2014, June 29). Artificial Intelligence. NPTEL.

<https://nptel.ac.in/courses/106105077>. (Last accessed on June 2, 2022.)

- [2] Hashimoto, T. (n.d.). CS221: Artificial Intelligence: Principles and Techniques. Stanford University.

<https://stanford-cs221.github.io/spring2022/>. (Last accessed on June 2, 2022.)

**20CS6404B**  
**PROGRAMMING FOR DATA SCIENCE**

<b>Course Category:</b>	Programme Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	20CS5301 Database Management Systems	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the fundamentals of Data Science concepts	K2	1.2.1, 1.7.1
<b>CO2</b>	Apply various pre-processing techniques in Data Science	K3	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1
<b>CO3</b>	Apply various schemas and operations of the Data Warehouse.	K3	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1, 3.6.1
<b>CO4</b>	Analyze different types of data science algorithms to solve real life problems.	K4	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1, 3.5.1, 3.6.1, 3.7.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3												1	
<b>CO2</b>	1	3											1	
<b>CO3</b>	1	3	2										1	
<b>CO4</b>	1	2	3										1	

**COURSE CONTENT**

**UNIT I**

**Introduction:** AI, Machine Learning and Data Science;

**What is data Science:** Extracting Meaningful patterns, Building representative

models, Combination of statistics, Machine learning and Computing, learning algorithms, Associated fields.

**Case for Data Science:** Volume, Dimensions, Complex Questions; **Data Science Classification; Data Science Algorithms**

**Getting to Know your Data:** Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity

## UNIT II

**Data Preprocessing:** An Overview; **Data Cleaning-** Missing Values, Noisy data;

**Data Integration-** Entity Identification problem, Redundancy and Correlation Analysis;

**Data Reduction-** Overview of Data Reduction Strategies, Wavelet Transformation, Principal Components Analysis; **Attribute Subset selection;**

**Data Transformation and Data Discretization-** Data Transformation Strategies Overview, Data Transformation by Normalization, Discretization by Binning.

## UNIT III

**Data Warehouse Basic Concepts-** What Is a Data Warehouse, Differences between Operational Database Systems and Data Warehouses, Data Warehousing: A Multitiered Architecture, Data Warehouse Models: Enterprise Warehouse, Data Mart, and Virtual Warehouse, Extraction, Transformation, and Loading, Metadata Repository

**Data Warehouse Modeling: Data Cube and OLAP -** Data Cube: A Multidimensional Data Model, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Data Models, Dimensions: The Role of Concept Hierarchies, Measures: Their Categorization and Computation, Typical OLAP Operations

## UNIT IV

**Mining Frequent Patterns, Associations-** Market Basket Analysis: A Motivating Example, Frequent Item sets, Closed Item sets, and Association, Apriori Algorithm: Finding Frequent Item sets by Confined Candidate Generation, Generating Association Rules from Frequent Item sets.

**Classification :** What Is Classification, Decision Tree Induction, Attribute Selection Measures.

**Cluster Analysis:** What Is Cluster Analysis?, Requirements for Cluster Analysis, k-Means Algorithm

**TEXT BOOKS**

- [1] Vijay Kotu and Bala Deshpande, Data Science concepts and Practice, 2019, Second Edition
- [2] Jiawei Han, Micheline Kamber, Jian Pei , Data mining : concepts and techniques, 2012. Third edition

**REFERENCE BOOKS**

- [1] Joel Grus , Data Science from Scratch, 2019, 2nd Edition
- [2] Emily Robinson and Jacqueline Nolis, Build a Career in Data Science, Manning, 2020

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Google's Machine Learning Crash Course, last accessed on 11-02-2022, <https://developers.google.com/machine-learning/crash-course>
- [2] IBM's Machine Learning with Python, last accessed on 11-02-2022, <https://cognitiveclass.ai/courses/machine-learning-with-python>



## 20CS6404C INTERNET OF THINGS

<b>Course Category:</b>	Programme Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 - 2
<b>Prerequisites:</b>	20CS3304 Digital logic and Computer Design	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the design concepts and applications of Internet of Things	K2	1.6.1, 1.7.1
<b>CO2</b>	Understand different Standards and Key Technologies in IoT.	K2	1.6.1, 1.7.1
<b>CO3</b>	Apply the steps of the design methodology in developing IoT applications using Raspberry Pi	K3	2.7.1,2.7.2,3.6.2
<b>CO4</b>	Understand the Privacy ,security and Vulnerabilities of internet of Things	K2	1.6.1, 1.7.1 ,5.4.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2												1	2
<b>CO2</b>	2												1	2
<b>CO3</b>		2	2										2	
<b>CO4</b>	1				2									

### COURSE CONTENT

#### UNIT I

**Introduction to Internet of things:** Introduction, Physical design of IoT, Logical Design of IoT, IoT Enabling technologies, IoT levels & Deployment templates.

**Domain Specific IoTs** – Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

## UNIT II

**IoT and M2M:** Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

**IoT Platforms Design Methodology:** Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring.

## UNIT III

**IoT Physical Devices and Endpoints** – What is an IoT Device, Introduction to Raspberry Pi, Board, Linux on Raspberry Pi, Raspberry Pi Interfaces (serial, SPI, I2C)

**Programming Raspberry PI with Python** – Controlling LED with Pi, Interfacing LED and Switch with Pi, Interfacing a light sensor/LDR with Pi.

## UNIT IV

**IoT Privacy, Security and Vulnerabilities Solutions:** Vulnerabilities, Security Requirements and Threat Analysis – Privacy, Vulnerabilities of IoT, Security Requirements, Threat Analysis, IoT Security Tomography and Layered Attacker

## TEXT BOOKS

[1] Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, 1st Edition, University Press Private Limited, 2017

[2] Raj Kamal, “Internet of Things, Architecture and Design Principles” 1st Edition, McGraw Hill Education Private Limited, 2017.

## REFERENCE BOOKS

[1] Matt Richardson & Shawn Wallace, “Getting Started with Raspberry Pi”, O'Reilly (SPD), 2014

[2] David Hanes, “IOT FUNDAMENTALS” 1<sup>ST</sup> Edition, CISCO PRESS, 2018

## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Prof. Sudip Misra, IIT Kharagpur “Introduction to Internet of things”

Available: <https://nptel.ac.in/courses/106/105/106105166/>

[2] Prof. T V Prabhakar, IISc Bangalore “Design for Internet of things” [Web Content]. Available:

<https://nptel.ac.in/courses/108/108/108108098/>

**20CS6404D**  
**SOFTWARE DEFINED NETWORKS**

<b>Course Category:</b>	Programme Elective II	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	Computer Networks: 20CS4304	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the evolution of Software Defined Networks	K2	1.7.1, 2.7.2, 3.6.1
<b>CO2</b>	Apply various components of SDN architecture and make use of it	K3	1.6.1, 2.7.1, 5.5.1
<b>CO3</b>	Apply SDN in the current networking scenario	K3	1.2.2, 4.5.1, 5.4.1
<b>CO4</b>	Apply SDN and NFV applications in various use cases	K3	1.2.2, 3.8.1, 5.6.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	3	2											
<b>CO2</b>	1	2			3								1	1
<b>CO3</b>	1			3	2								2	
<b>CO4</b>	1		2		3								1	3

**COURSE CONTENT**

## UNIT I: INTRODUCTION

**Introduction:** Historical Background, The Modern Data Center, Traditional Switch Architecture.

**Why SDN:** Evolution of Switches and Control Planes, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs.

**How SDN Works:** Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Methods.

## UNIT II: OPEN FLOW & SDN CONTROLLERS

**Open Flow Specification:** OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow Additions (1.1, 1.2, 1.3), OpenFlow Limitations.

**Alternative Definition of SDN:** Potential Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization.

**SDN Controllers:** General Concepts, VMware, Nicira, VMware/Nicira, OpenFlow-Related, Mininet, NOX/POX, Trema, Ryu, Big Switch Networks/Floodlight.

## UNIT III: SDN IN DATA CENTER AND OTHER ENVIRONMENTS

**Data Center Concepts and Constructs:** Introduction, Multitenant Data Center, Virtualized Multitenant Data Center, SDN Solutions for the Data Center Network.

**SDN in Data Center:** Data Center Definition, Data Center Demands, Tunneling Technologies, Path Technologies, Ethernet Fabrics, SDN Use Cases, Open SDN versus Overlays, Real-World Data Center Implementations.

**SDN in Other Environments:** Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, In-Line Network Functions, Optical Networks, SDN vs. P2P/Overlay Networks.

## UNIT IV: SDN APPLICATIONS AND NETWORK FUNCTION VIRTUALIZATION

**SDN Applications:** Reactive versus Proactive Applications, Analyzing Simple SDN Applications, A Simple Reactive Java Application, Background on Controllers, Using Floodlight Controller - OpenDaylight Controller - Cisco XNC Controller - Hewlett-Packard Controller, Switch Considerations, Creating Network Virtualization Tunnels, Offloading Flows in the Data Center, Access Control for the Campus, Traffic Engineering for Service Providers.

**Network Function Virtualization:** Virtualization and Data Plane I/O, Services Engineered Path, Service Locations and Chaining, NFV at ETSI, Non-ETSI NFV Work.

### TEXT BOOKS

- [1] Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
- [2] Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013.

### REFERENCE BOOKS

- [1] Siamak Azodolmolky, Software Defined Networking with Open Flow, Packet Publishing, 2013.
- [2] Vivek Tiwari, SDN and Open Flow for Beginners, Amazon Digital Services, Inc., 2013.
- [3] Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

### E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] Dr. Nick Feamster Software Defined Networking, last accessed on 10-02-2022, <https://www.coursera.org/learn/sdn>
- [2] Software Defined Networking, <https://www.coursera.org/learn/sdn>

**20CS6404E**  
**ADVANCED PROGRAMMING FOR GAMES**

<b>Course Category:</b>	Programme Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	20ES3102 Java Programming	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand advanced concepts in game design and development.	<b>K2</b>	1.6.1,3.5.6,5.4.1
<b>CO2</b>	Understand the architecture of Game Programming	<b>K2</b>	1.7.1,3.8.3,5.4.2
<b>CO3</b>	Apply scripting on game using Lua programming.	<b>K3</b>	3.8.2,5.5.2
<b>CO4</b>	Apply 3D Game graphics, sound and AI on Gamming	<b>K3</b>	1.7.1,5.5.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3		2		2									
<b>CO2</b>	1		2		3									3
<b>CO3</b>			2		3								2	3
<b>CO4</b>	2				3									3

**COURSE CONTENT**

**UNIT 1**

**Game Architecture** - Applying the Game Architecture, Application Layer, Game Logic, Game view for human player, Networked Game Architecture

**Coding** – General coding styles, smart code design practices, smart pointers and naked pointers, Using memory correctly

**Building Your Game** – Creating a Project, Source Code Repositories and Version Control, Building the Game, Creating Build Scripts

## UNIT 2

**Game Actors and Component Architecture** - Component Architecture, Creating Actors and Components, Defining Actors and Components, Storing and Accessing Actors, Data Sharing

**Controlling the Main Loop** - Organizing the Main Loop Hard – Coded Updates Multithreaded Main Loops

A Hybrid Technique, A Simple Cooperative Multitasker, Using the DirectX 11 Framework

**Loading and Caching Game Data** - Game Resources: Formats and Storage Requirements, Resource Files, The Resource Cache

## UNIT 3

**Programming Input Devices** - Getting the Device State, Using Xinput or DirectInput, Working with Two-Axis Controls, Working with a Game Controller, Working with the Keyboard

**Game Event Management** - Game Events, Importance of Game Events, Distinguishing Events from Processes

**Scripting with Lua** - Brief History of Game Programming Languages, Using a Scripting Language, Scripting Language Integration Strategies, A crash course in Lua, Object Oriented Programming in Lua, Memory Management, Binding Lua to C++, LuaPlus

## UNIT 4

**Game Audio** - How Sound Works, Game Sound System Architecture, Technical Hurdles

**3D Graphics Basics** - 3D Graphics Pipeline, 3D Math 101, C++ Math Classes

**An Introduction to Game AI** - AI Techniques, Finite – State Machines, Decision Trees, Fuzzy Logic, Utility Theory, Goal –Oriented Action Planning, Path Finding

## TEXT BOOKS

[1] Mike McShaffry and David Graham, Game Coding Complete, Course Technology PTR, 4th Edition

## REFERENCE BOOKS

- [1] Goldstone, Will. Unity game development essentials. Packt Publishing Ltd, 2009.
- [2] Zapušek, Matej, and Jože Rugelj. "Learning programming with serious games." EAI Endorsed Transactions on Serious Games 1.1 (2013).

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Game Development – Advanced Programming,  
<https://academics.sheridancollege.ca/programs/game-development-advanced-programming>



**20CS6404F**  
**NATURAL LANGUAGE PROCESSING**

<b>Course Category:</b>	Programme Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3 - 0 - 0
<b>Prerequisites:</b>	20CS3305 Data Structures	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the basics of Natural language processing concepts	K2	1.6.1, 1.7.1
<b>CO2</b>	Understand linear text classification and nonlinear text classification techniques	K2	1.6.1, 1.7.1, 2.7.1, 3.8.3
<b>CO3</b>	Apply speech recognition techniques in NLP	K3	1.6.1, 1.7.1, 2.7.1, 2.6.4, 2.8.3, 2.8.4
<b>CO4</b>	Understand the knowledge on various syntax and semantics techniques involved in NLP	K2	1.6.1, 1.7.1, 2.7.1, 3.8.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1												1	2
<b>CO2</b>	2	2											1	2
<b>CO3</b>	2	2	2										1	2
<b>CO4</b>	2	1											1	2

**COURSE CONTENT**

**UNIT I**

**Introduction to NLP:** Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms, Language, Thought, and Understanding, The State of the Art, Some Brief History

**UNIT II**

**Linear Text Classification:** Naïve Bayes: Types and tokens, prediction, estimation and smoothing, Discriminative learning: Perceptron, Average perceptron, Loss function, Logistic regression: Regularizations and gradients and optimization: Batch optimization and Online optimization

Non Linear classification: Feed forward neural networks, Designing neural networks, Learning neural networks and convolution neural networks

**UNIT III**

**Sequence Labeling:** Viterbi Algorithm, Hidden Markov Model, Discriminative Sequence labeling with features, Neural sequence labeling, Application of sequence labeling, POS tagging, Morpho syntactic Attribute, Named Entity Recognition, Tokenization

**UNIT IV**

**Logical semantics:** Logical representation of meaning, Semantic parsing and the lambda calculus, Learning semantic parsers, predicate argument semantics: Semantic roles, Semantic role labeling, AMR parsing, Design decision for word representation.

**TEXT BOOKS**

- [1] Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 3rd Edition, 2021.( UNIT-1)
- [2] Jacob Eisenstein, Introduction to Natural Language Processing, MIT press (2018) [UNIT 2,3,4]

**REFERENCE BOOKS**

- [1] James Allen, Benjamin/cummings, "Natural Language Understanding", 2nd edition, 1995.
- [2] C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA., 1999

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Massachusetts Institute of Technology Open Course Lecture Notes on Advance Natural Language Technology.

<https://ocw.mit.edu/courses/6-864-advanced-natural-language-processing-fall-2005/pages/lecture-notes/> Accessed on 24 December 2022

[2] Dan Jurafsky and James H. Martin

<https://web.stanford.edu/~jurafsky/slp3/> Accessed on 24 December 2022

[3] By Prof. Pawan Goyal, IIT Kharagpur

[https://onlinecourses.nptel.ac.in/noc22\\_cs98/preview](https://onlinecourses.nptel.ac.in/noc22_cs98/preview) Accessed on 24 December 2022

**20CS6205A**  
**MOBILE APPLICATION DEVELOPMENT**

<b>Course Category:</b>	Open Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 -2
<b>Prerequisites:</b>	20ES3102 Java Programming	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the fundamentals of Android Operating System.	K2	1.7.1,2.5.1, 2.5.2,2.7.1
<b>CO2</b>	Apply UI principles to develop interfaces for Android platform.	K3	1.7.1,2.5.1,2.5.2, 2.6.3, 2.7.1,3.5.1
<b>CO3</b>	Apply mobile application concepts to deploy and publish a given app into android device.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,3.8.2
<b>CO4</b>	Apply principles to develop a database connection for a given mobile application.	K3	2.5.1,2.5.2,2.6.3,2.6.4, 3.5.1,3.6.2,3.8.2, 4.6.2,5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	3										2	2
<b>CO4</b>		2	3	2	2								2	2

## COURSE CONTENT

### UNIT I

**Introduction to Android:** An open platform for mobile development, Native android applications, Android SDK Features, Introducing the Development Framework, Downloading and Installing the Android SDK, Creating your First Android Application, Types of Android Applications, Developing for Mobile and Embedded devices, Android Development Tools.

**Creating Applications and Activities:** Introducing the Application Manifest File, Externalizing Resources, The Android Application Lifecycle, A Closer look at Android Activities.

### UNIT II

**Building User Interfaces:** Fundamental Android UI Design, Android User Interface fundamentals, Introducing Layouts.

**User Interface (UI) Components:** Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

**Event Handling:** Handling clicks or changes of various UI components.

### UNIT III

**Introducing Fragments:** Creating New Fragments, The Fragment Lifecycle, Introducing the Fragment Manager, Adding Fragments to Activities, Interfacing Between Fragments and Activities, Fragments Without User Interfaces.

**Introducing Adapters:** Introducing Some Native Adapters, Customizing the Array Adapter, Using Adapters to Bind Data to a View

**Introducing Intents:** Using intents to launch activities, Introducing Linkify, Using Intents to broadcast Events, Notifications – Creating and Displaying notifications, Displaying Toasts

### UNIT IV

**Creataing Intent Filters and Broadcast Receivers:** Using Intent Filters to Service Implicit Intents, Using Intent Filters for Plug-Ins and Extensibility, Listening for Native

**Working with SQLite Databases:** Introducing the SQLiteOpenHelper, Opening and Creating Databases without SQLite Open Helper, Android Database design considerations, Quering a Database, Extracting values from a cursor, Adding,

Updating and Removing Rows.

### **TEXT BOOKS**

[1] Reto Meier , “Professional Android 4 Application Development”, Wiley India, (Wrox),2012

### **REFERENCE BOOKS**

[1] David Griffiths and Dawn Griffiths, Head First Android Development: A Brain-Friendly Guide, O'Reilly Media, Inc.

[2] James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning.

[3] Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox)

[4] Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, “Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC”, 3rd Edition.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Oak Academy, Mehmet Ongel, Build Real Android Apps: Android 11 App Development:

Java,<https://www.udemy.com/course/build-real-android-apps-android-app-development-with-java/>

[2] Courseera : Dr. Jerry Roth, Android App Development Specialization, Department of Computer Science and Electrical Engineering, Vanderbilt University

<https://www.coursera.org/specializations/android-app-development>

## 20CS6205B NO SQL DATABASES

<b>Course Category:</b>	Open Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 -2
<b>Prerequisites:</b>	20CS5301: Database Management Systems	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

COURSE OUTCOMES		BTL	POI
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand different types of NoSQL Databases	K2	1.7.1,2.5.1, 2.5.2,2.7.1
<b>CO2</b>	Analyze the detailed architecture and performance tune of Document-oriented NoSQL databases.	K4	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1 3.5.1, 3.6.1, 3.7.1
<b>CO3</b>	Analyze the performance tune of Key-Value Pair NoSQL databases.	K4	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1 3.5.1, 3.6.1, 3.7.1
<b>CO4</b>	Apply NoSQL development tools on different types of NoSQL Databases	K3	1.7.1,2.5.1, 2.5.2,2.6.3, 2.7.1,3.5.1

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	1											1	1
<b>CO2</b>	1	2	2										1	1
<b>CO3</b>	1	2	2										1	1
<b>CO4</b>	1	3	3										1	1

## **COURSE CONTENT**

### **UNIT I**

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.

### **UNIT II**

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations.

### **UNIT III**

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability.

### **UNIT IV**

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Storing Session Information, 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.

## **TEXT BOOKS**

[1] Fowler, M., Sadalage, P. J. (2013). NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. United Kingdom: Addison-Wesley.

## **REFERENCE BOOKS**

[1] Christopher, D. M., Prabhakar, R., & Hinrich, S. (2008). Introduction to information retrieval.

[2] Harizopoulos, S., Idreos, S., Madden, S., Boncz, P., Abadi, D. (2013). The Design and Implementation of Modern Column-oriented Database Systems. Netherlands

[3] Harrison, G. (2015). Next Generation Databases: NoSQL and Big Data. United States: Apress.

## **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] <https://www.ibm.com/cloud/learn/nosql-databases>



(Last Accessed: 15-12-2022).

[2] María del Pilar Ángeles NoSQL systems Coursera

<https://www.coursera.org/learn/nosql-databases>

(Last Accessed: 15-12-2022).

[3] <https://www.geeksforgeeks.org/introduction-to-nosql/>

(Last Accessed: 15-12-2022)

[4] <https://www.javatpoint.com/nosql-databa>

(Last Accessed: 15-12-2022)

**20CS6205C**  
**FUNDAMENTALS OF JAVA PROGRAMMING**

<b>Course Category:</b>	Open Elective-II	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture - Tutorial - Practice:</b>	2-0-2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester End Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the basic concepts of object oriented programming.	K2	1.7.1,2.5.1,2.5.2,2.7.1
<b>CO2</b>	Apply multiple inheritance through interfaces.	K3	2.5.1,2.5.2, 2.6.3,2.7.1,3.5.1,3.8.2
<b>CO3</b>	Apply exceptions, thread capabilities on a given application.	K3	2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,3.8.2
<b>CO4</b>	Apply Collections framework for a given application.	K3	2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,3.6.2,3.8.2, 4.6.2,5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes(1 – Low 2 - Medium 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3												
CO2		2	3										2	2
CO3		2	3										2	2
CO4		2	3	2	2								2	2

## UNIT I

The History and Evolution of Java: Java's Magic: Byte Code, Java Buzzwords.

An Overview of Java: Object Oriented Programming, Two paradigms, Abstraction, The Three OOP Principles , A First simple Program.

Data Types, Variables and Arrays: Java keywords, Primitive types, Integers, Floating-Point Types, Characters, Booleans, Variables, Operators, Type Conversion and Casting, Arrays.

Introducing Classes and Objects: Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, Garbage collection, overloading methods, using objects as parameters, returning objects, understanding static, Introducing final keywords, Introducing nested and inner classes.

## UNIT II:

String Handling: The String Class, String Buffer Class, String Tokenizer class.

Inheritance: Inheritance basics, using super, multilevel hierarchy, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance.

Packages & Interfaces: Defining a package, packages and member Access, importing packages, Defining an interface, implementing interfaces, nested interfaces, applying interfaces, variables in interfaces.

## UNIT III:

Exception handling: Exception handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, throw, throws, finally, creating your own exception subclasses.

I/O streams: Byte Streams- InputStream, OutputStream, FileInputStream, FileOutputStream, Character Streams- Reader, Writer, FileReader, FileWriter.

## UNIT – IV

Multithread Programming: The Java Thread Model, Creating a thread: Implementing Runnable, Extending Thread, creating multiple threads, Thread Priorities, Synchronization: Using Synchronized methods, The synchronized

**Statement.**

Collections Framework: Collections overview, Collection interfaces: Collection, List, and Set. Collection Classes: ArrayList, LinkedList, HashSet. MapClasses:HashMap.

**Text Books:**

[1] Herbert Schildt, “Java The Complete Reference”, Eleventh Edition, Oracle Press, 2019.

**Reference Books:**

[1] Herbert Schildt, Dale Skrien, “Java Fundamentals A Comprehension Introduction”, Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2017.

[2] E Balaguruswamy, "Programming with Java", 4th Edition, Mc GrawHill , 2020.

[3] Paul J. Dietel and Dr.Harvey M. Deitel, “Java How to Program”, Eleventh Edition, Deitel& Associates, Inc.l, 2018.

**E-resources and other digital material:**

[1] Prof.DebasisSamanta. (14th,September, 2022), Department of Computer Science & Engineering, I.I.T.,Kharagpur, Swayam, NPTEL.

[https://onlinecourses.nptel.ac.in/noc21\\_cs03/preview](https://onlinecourses.nptel.ac.in/noc21_cs03/preview).

[2] Evan Jones, Adam Marcus,Eugene Wu "Introduction to Programming in Java", MIT OpenCourseWare, Massachusetts Institute of Technology, October 28, 2022. <https://ocw.mit.edu/courses>

[3] Prof. Owen Astrachan, "Object Oriented Programming in Java", Duke University, 21st September 2022. [coursera.org](https://www.coursera.org)

<https://www.coursera.org/specializations/object-oriented-programming>

**20CS6205D**  
**INTRODUCTION TO**  
**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

<b>Course Category:</b>	Open Elective 2	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2 - 0 -2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

COURSE OUTCOMES											BTL	POI			
Upon successful completion of the course, the student will be able to:															
CO1	Understand the basic principles and applications of Artificial Intelligence.										K2	1.2.1, 1.6.1, 2.6.2, 2.6.4,2.7.1			
CO2	Apply predicate logic to represent knowledge of real world problems										K3	1.6.1,2.5.1,2.7.1 3.5.1			
CO3	Understand the concepts of machine learning and Regression										K2	1.2.1,1.7.1,2.5.3			
CO4	Apply supervised learning and un supervised learning algorithms to real world problems.										K3	1.2.1,1.7.1,2.5.3, 2.6.3			
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	1	2											1	1	
CO2	1	2	3										1	2	
CO3	1	1											1	1	
CO4	2	2		2									1	2	

**COURSE CONTENT**

**UNIT I**

Problems, Problem Spaces And Search: Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search

**UNIT II**

Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Facts in logic, Representing Instance and Is a Relationships, Resolution

**UNIT III**

Introduction to Machine Learning: Introduction. Different types of learning, Examples of Machine Learning Applications, Learning a Class from Examples, Probably Approximately Correct Learning

Regression: Linear regression, Multiple Linear regression, Logistic Regression

**UNIT IV**

Supervised Learning: Introduction, Classification, Decision Trees

Unsupervised Learning: Introduction, Types of clustering Techniques, K-means Clustering.

**TEXT BOOKS**

[1] Elaine Rich, Kevin Knight, Shivashankar B Nair, “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill Edition, 2008(UNITs I & II)

[2] Ethem Alpaydın, “Introduction to Machine Learning”, Second edition, The MIT Press Cambridge. (UNITs III& IV)

**REFERENCE BOOKS**

[1] Patrick Henry Winston ‘Artificial Intelligence’, 3rd Edition, Prentice Hall, 1992.

[2] Stuart Russell and Peter Norvig, ‘Artificial Intelligence’, 3rd Edition, Prentice Hall of India, 2009

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Prof. Anupam Basu, Prof. S. Sarkar, “Artificial Intelligence, IIT Kharagpur

<https://nptel.ac.in/courses/106105077/> last accessed on 10-01-2023

[2] <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6->

034-artificial-intelligence-fall-2010/lecture-videos/ last accessed on 10-01-2023

[3] <https://www.cmpe.boun.edu.tr/~ethem/i2ml3e/> last accessed on 10-01-2023

## 20CS6351 MACHINE LEARNING LABORATORY

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0- 0-3
<b>Prerequisites:</b>	20CS4351 Advanced Data Structures and Algorithms Laboratory	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

COURSE OUTCOMES		BTL	POI
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Demonstrate the concepts of computational intelligence in machine learning	K3	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3 ,3.5.1,3.6.2,5.4.2
<b>CO2</b>	Choose the dimensionality reduction techniques for feature selection	K5	1.2.1, 2.6.2, 2.6.4,2.7.2,4.6.4,5.4.2
<b>CO3</b>	Choose the machine learning techniques to solve real time problems	K5	1.6.1, 2.5.2, 2.6.3, 2.6.4, 2.7.2,3.6.1, 3.6.2 ,4.4.2, 4,6,1, 5.4.2
<b>CO4</b>	Build ensemble models to solve classification problems	K6	1.6.1, 2.5.2, 2.6.3, 2.6.4, 2.7.2,3.6.1, 3.6.2 ,4.4.2, 4,6,1, 5.4.2

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	1			2								1	1
<b>CO2</b>	2	2	2	2	2								1	2
<b>CO3</b>	2	2		2	2								1	1
<b>CO4</b>	1	2	2	2	2								1	2

### TASKS

Task 1: Implement Linear Regression and logistic regression and calculate sum of residual error



Task 2: Program to implement Principle Component Analysis

Task 3: Program to implement decision tree learning and evaluate the algorithm

Task 4. Program to implement perceptron for different learning task and evaluate the algorithm

Task 5: Programs on Covariance, Correlation, Covariance Matrix and Correlation Matrix

Task 6: Program to construct Bayesian Network on a sample dataset and evaluate the algorithm

Task 7. Program to implement K nearest neighbour classifier and evaluate the algorithm

Task 8 Program to implement classification task using Support Vector machine and evaluate the algorithm

Task 9. Program to implement Random Forest and evaluate the algorithm

Task 10. Program to implement Expectation maximization

### **TEXT BOOKS**

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

### **REFERENCE BOOKS**

1. Jason Brownlee, Machine Learning Mastery With Python, Understand Your Data, Create Accurate Models and Work Projects, 2021
2. Stephen Marsland, “Machine learning An algorithmic Perspective”, Second Edition, CRC Press, 2015
3. Jiawei Han, Jian Pei, Hanghang Tong, Data Mining Concepts and Techniques, fourth edition, Elsevier Science, 2022
4. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

1. Prof. Balaraman Ravindran | IIT Madras Introduction to Machine Learning [https://onlinecourses.nptel.ac.in/noc22\\_cs29/preview](https://onlinecourses.nptel.ac.in/noc22_cs29/preview) last accessed on 16-12-2022
2. Andrew Ng, Machine Learning Specialization <https://www.coursera.org/specializations/machine-learning-introduction> last accessed on 16-12-2022

**20CS6352****CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY**

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0- 0-3
<b>Prerequisites:</b>	20CS4304	<b>Continuous Evaluation:</b>	30
	Computer Networks	<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand various security issues related to cryptography and Network Security.	K2	1.7.1,5.6.1
<b>CO2</b>	Analyze the process of cryptographic ciphers.	K3	1.7.1, 2.5.2,2.6.2,7.1.1
<b>CO3</b>	Summarizes the Network Security Scenarios.	K3	1.7.1
<b>CO4</b>	Inspect the protection methods against Network security threats.	K3	2.6.3 ,5.6.1,7.1.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3				2									
<b>CO2</b>	2	3					2							2
<b>CO3</b>	2													
<b>CO4</b>		2			3		2							2

**TASKS****Software Requirements:**

- Virtual Box.
- Ubuntu Desktop OS.
- Burpsuite, John The Ripper, macchanger, Wireshark, Nmap, tcpdump

**Task 1: Prepare a write-up and familiarize with the following concepts**

a. Security basics (Authentication, Authorization, Data

Confidentiality, Non- repudiation, Data Integrity)

- b. Network security (ACL, Firewall, IDS, IPS, Vulnerability Assessment, CVEs, Penetration testing and its phases, NAT, Honeypots, WLAN Encryption – WEP, WPA, WPA2, WPA3, Malware)
- c. Physical Security (Mantrap, CCTV, Cable protection in Data centers, Lock Pickers, in- person security for data centers, Defense-in-depth)
- d. Cloud Security (Identity and Access Management -Azure, AWS, GCP, Microsoft Defender for cloud, AWS Security Hub, Single sign-on)
- e. System Security (buffer overflow, secure code analysis, port security, host security)

Application Security – OWASP Top 10 2021.

**Task 2:** Deploy an Open-source Linux Distribution (Ubuntu) in a Virtual Box and configure virtual networking to it. Also, install common tools like – Nmap, Wireshark, tcpdump, macchanger, Burpsuite, JohnTheRipper.

**Task 3:** Understand the usage of nmap and perform a ping sweep in your LAN with nmap and output verbosely to normal, XML formats. – Disable port scan.

**Task 4:** Perform a port scan (SYN, CONNECT, ACK, NULL, FIN, XMAS) on scanme.nmap.org domain and identify what ports and services including OS detection and output to normal and XML formats.

**Task 5:** Demonstrate TCP three-way handshake with Wireshark

**Task 6:** Sniff traffic with Wireshark and apply some filters based on IP address and protocols

**Task 7:** Know the usage of tcpdump and use it show the ICMP live traffic.

**Task 8:** Create a new Linux user and Perform a Password less authentication for newly created user and know how SSH works.

**Task 9:** Crack common password Hashes with John The Ripper with RockYou wordlist.

**Task 10:** Create a Linux Bash Script to get a hash signature (MD5, SHA1, SHA256, SHA512) for any given file for maintaining Integrity.

**Task 11:** Know about NIC and MAC Address. Change the MAC Address of

your NIC to some random, custom, and vendor specific.

**Task 12:** Develop a small PHP webapp (no database required) and intercept the webapp traffic with Burp Suite. Webapp Requirement:

- A HTML File having login form.
- A PHP File handling authentication of HTML login form.
- Dummy Username and Password can be used.

### **Supplementary Coding Tasks**

Using any programming language of your choice, implement the following:

- Classic Encryption Techniques such as Caesar cipher, Playfair cipher, Hill cipher and other techniques
- Encryption algorithms - DES, AES, RSA, ECC
- Hashing algorithms - MD5, SHA-1
- Digital Signature standard

### **TEXT BOOKS**

- [1] William Stalligs, Cryptography and Network Security: Principles and Practice. 5th & 7th ed, Pearson Education, 2017.
- [2] J. Katz and Y. Lindell, “Introduction to Modern Cryptography”, CRC Press, 2008

### **REFERENCE BOOKS**

- [1] Cryptography and Network Security: ForouzanMukhopadhyay, McGraw Hill, 2<sup>nd</sup> Edition
- [2] Network Security and Cryptography, Bernard Menezes, CENGAGE Learning
- [3] Cryptography & Network Security, AtulKahate, McGraw Hill

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] nptelonlinecourse.com,”Cryptography and network Security”, 2021. [Online]. Available: <https://nptel.ac.in/courses/106/105/106105162/> Accessed on 02/12/2021.
- [2]cybrary.com, “Cryptography”, 2021, [Online]. Available: <https://www.cybrary.it/course/fundamental-cryptography-data-protection/>. Accessed on 02/12/2021

## 20CS6353

### SOFTWARE ENGINEERING LABORATORY

<b>Course Category:</b>	Programme Core	<b>Credits:</b>	1.5
<b>Course Type:</b>	Laboratory	<b>Lecture -Tutorial-Practice:</b>	0- 0-3
<b>Prerequisites:</b>	20CS3303	<b>Continuous Evaluation:</b>	30
	Operating Systems	<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Compare different software engineering process models.	K4	1.7.1,2.5.1, 2.5.2, 2.6.4,2.7.1
<b>CO2</b>	Analyse the principles of requirement engineering.	K3	1.7.1,2.5.1,2.7.1, 3.5.1,3.5.2,3.5.6
<b>CO3</b>	Create architectural design for a given project.	K6	1.7.1,2.5.1,2.6.4 3.5.1,3.8.1
<b>CO4</b>	Apply different testing techniques	K3	1.7.1,2.5.1,2.6.4, 3.5.1,3.6.2,3.8.2, 4.4.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	3												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	3										2	2
<b>CO4</b>		2	3	2	2								2	2

### TASKS

Task 1: Overview of SDLC: A Study

Task 2: Studying various phases of waterfall model.

Task 3: Estimation of Project Metrics using COCOMO model

Task 4: Identifying the Software Requirement from problem statements

Task 5: Project Planning.

Task 6: Capturing use case and modelling use case diagram for the given problem

Task 7: System modelling.

Task 8: OOA: Identifying Domain Classes from the problem statement and State Transition Diagram.

Task 9: Interaction diagrams: Sequence and collaboration diagrams and Flow of events and activity diagram.

Task 10: Software Design: software architecture and object oriented design.

Task 11: Component and Deployment diagrams.

Task 12: Estimation of test coverage metrics and Structural Complexity.

Task 13: Software Testing.

Task 14: Design Test Suits.

### **TEXT BOOKS**

[1] Roger S. Pressman, Bruce R. Maxim, "Software Engineering a practitioners approach" 8th edition, McGraw-Hill Publication 2019

### **REFERENCE BOOKS**

[1] Ian Somerville, "Software Engineering". 9th ed, Pearson Education. 2011.

[2] Carlo Ghezzi, Mehdi Jazayeri and Dino Mandrioli, "Fundamentals of Software Engineering". 2 ed, PHI. 2009

[3] Rajib Mall, Fundamentals of Software Engineering. 3 ed, PHI. 2009.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Lecture Series on Software Engineering by Prof.N.L. Sarda, Prof. Umesh Bellur, Prof.R.K.Joshi and Prof.Shashi Kelkar, Department of Computer Science & Engineering ,IIT Bombay <https://nptel.ac.in/courses/106101061/2>

[2] Software Engineering By Dr. B. LAVANYA, Assistant Professor| University of Madras  
[https://onlinecourses.swayam2.ac.in/cec20\\_cs07/preview](https://onlinecourses.swayam2.ac.in/cec20_cs07/preview).

### [3] Software Engineering Basics

<https://www.youtube.com/watch?v=sB2iQSvrcG0>

## 20TP6106 QUANTITATIVE APTITUDE

<b>Course Category:</b>	Soft Skills - 4	<b>Credits:</b>	1
<b>Course Type:</b>	Learning by doing	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

### COURSE OUTCOMES

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

<b>CO1</b>	Effectively organize, summarize and present information in quantitative forms including tables,
<b>CO2</b>	Use mathematical based reasoning and to evaluate alternatives and make decisions
<b>CO3</b>	Think and reason logically and critically in any given situation.
<b>CO4</b>	Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams

### Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>										3	3			
<b>CO2</b>									3	3	3			
<b>CO3</b>										3	3			
<b>CO4</b>								2		3	3			

### COURSE CONTENT

#### UNIT I

- Number system
- HCF & LCM,
- Average,



- Percentages,
- Profit & Loss

## UNIT II

- Ratio & Proportion,
- Partnership,
- Chain Rule,
- Time & Distance,
- Time & Work

## UNIT III

- Pipes & Cistern,
- Problems on Trains,
- Problems on boats & Steams,
- Allegation,
- Simple interest and compound interest.

## UNIT IV

- Area, Volume and Surface areas,
- Races & Games of skills,
- Calendar & Clock,
- Stocks & Shares,
- Permutations & Combination, Probability.

## METHODOLOGY

Learning Resources: Quantitative Aptitude by R.S..Aggarwal

## 20CS6554 MINI PROJECT - I

<b>Course Category:</b>	Project	<b>Credits:</b>	1
<b>Course Type:</b>	Project	<b>Lecture -Tutorial-Practice:</b>	0 - 0 - 2
<b>Prerequisites:</b>	20CS5354 EPICS	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

1. Formulate Domain Analysis, Elaboration through Modeling and Implementation through state of the art technology available.
2. Develop generic and modular programs that includes Handling exceptional cases in providing reliable solutions
3. Testing and verification of programs for different scenarios
4. Conclude findings through oral presentations
5. Prepare proper documentation consisting of Software Requirements Specification (SRS), Modeling Techniques, Development Strategies, Implementation and Testing Strategies. Student may use any Design Methodologies such as SSAD, OOAD and UML
6. Builds the spirit of team work in design process.
7. Become proficient in the programming languages

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	2	2				1					3	2	2
<b>CO2</b>	1	2	2		1		1					3	2	2
<b>CO3</b>				2									2	2
<b>CO4</b>						1			2	2		3	2	2
<b>CO5</b>								2					2	2
<b>CO6</b>								2	2	2	2		2	2

**Mini Project I could be done by a group of students; involves working under a faculty member and carry out detailed feasibility study, literature survey and prepare a detailed project report during VI semesters.**

**20MC6107B****INNOVATION, IPR & ENTREPRENEURSHIP**

<b>Course Category:</b>	Mandatory Course	<b>Credits:</b>	-
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	2-0-0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	100
		<b>Semester end Evaluation:</b>	0
		<b>Total Marks:</b>	100

**COURSE OUTCOMES****BTL****POI**

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

<b>CO1</b>	Learn the innovation concepts related to business organizations.	K2	2.5.1,2.6.2,2.6.3,2.6.4,8.3.1,8.4.2,9.4.2,9.5.1,11.6.1,11.6.2
<b>CO2</b>	Understand the importance of innovation in new start-ups.	K2	2.5.1,2.6.2,2.6.3,2.6.4,8.3.1,8.4.2,9.4.2,9.5.1,11.6.1,11.6.2
<b>CO3</b>	Know fundamental aspects of Intellectual property Rights.	K2	2.5.1,2.6.2,2.6.3,2.6.4,8.3.1,8.4.2,9.4.2,9.5.1,11.6.1,11.6.2
<b>CO4</b>	Learn the basic concepts of entrepreneurship and its benefits.	K2	2.5.1,2.6.2,2.6.3,2.6.4,8.3.1,8.4.2,9.4.2,9.5.1,11.6.1,11.6.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	-	1	-	-	-	-	-	2	2	-	2	-	1	-
<b>CO2</b>	-	2	-	-	-	-	-	1	2	-	2	-	1	-
<b>CO3</b>	-	2	-	-	-	-	-	2	3	-	3	-	1	-
<b>CO4</b>	-	1	-	-	-	-	-	3	2	-	2	-	1	-

**COURSE CONTENT**

**UNIT – I****Innovation Management: Introduction Innovation:**

Definition, Importance – The need to view innovation in an organizational context – Different types of innovation - Innovation and Invention – Popular views of innovation – Innovation as a management process.

**UNIT II****Innovation: New Product Development (NPD)**

Innovation Management and New Product Development – Considerations when developing as NPD strategy - NPD as a strategy for growth – What is new product? – Classification of new products – NPD as an industry innovation cycle.

**UNIT III****Intellectual Property Rights (IPR)**

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development..

**UNIT IV****Entrepreneurship Concept and need of entrepreneurship**

Characteristics and Types of Entrepreneurship - Entrepreneurship as a career - Entrepreneurship as a style of Management - The changing role of the entrepreneur - Entrepreneurial traits, factors affecting entrepreneurs.

**TEXT BOOKS**

[1] Paul Trott, Innovation Management and New Product Development, Pearson Education Limited, UK, 2017.

[2] Nithyananda, K V., Intellectual Property Rights: Protection and Management, Cengage Learning India Private Limited, 2019.

[3] Dr.S S Khanka, Entrepreneurial Development, S Chand, New Delhi, 2020

**REFERENCE BOOKS**

[1] Managing innovation: Integrating Technological, Market and Organizational

Change, Joe Tidd, John Besant, 2018.

[2] Neeraj, P., & Khusdeep, D, Intellectual Property Rights. PHI learning Private Limited, India, 2019.

[3] Vasant Desai, The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, India, 2022.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

<https://edisciplinas.usp.br/acessar/>

## **SEMESTER VII**

**20CS7301****AUTOMATA & COMPILER DESIGN**

<b>Course Category:</b>	<b>Programme Core</b>	<b>Credits:</b>	<b>3</b>
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	<b>3-0-0</b>
<b>Prerequisites:</b>	Programming for Problem Solving Theory of Computation	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	<b>30</b> <b>70</b> <b>100</b>

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the basic concepts of formal languages and finite automata techniques	2	1.1.1, 1.3.1, 2.1.1, 2.1.3, 2.2.4
<b>CO2</b>	Apply the parsing techniques for the given programming construct described in Context Free Grammar.	3	1.1.1, 1.3.1, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 3.2.1, 3.3.1
<b>CO3</b>	Identify the suitable intermediate representation based on the storage administration	3	1.1.1, 1.3.1, 2.2.3, 2.2.4, 3.1.1, 3.3.1,
<b>CO4</b>	Generate the machine code by considering all the functionalities involved in different phases of the compilation process	3	2.2.3, 2.2.4, 2.4.3, 3.2.1, 3.3.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	2											1	
<b>CO2</b>	2	2	3										2	
<b>CO3</b>	2	3	3										2	
<b>CO4</b>	1	2	3										3	

**COURSE CONTENT****UNIT-I**

**Structure of Compiler:** Lexical Analysis, Syntax analysis, Intermediate Code generation, Code Optimization, Code generation, Bookkeeping, Error handling,



**Formal Language and Regular Expressions:** Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools. **Implementation of Lexical Analyzer (LTC)**

## UNIT-II

**Context Free grammars and parsing:** Context free grammars, derivations, parse trees, ambiguity, simplification of CFG, Normal Forms: CNF and GNF.

**Top Down and Bottom up Parsing:** LL(K) grammars and LL(1) parsing, Bottom up parsing, handle pruning, LR Parsing, parsing using ambiguous grammars. **Computing FIRST and FOLLOW terms (LTC)**

## UNIT-III

**Syntax Directed Translation:** S-attributed and L-attributed grammars, abstract syntax trees, **Intermediate Code:** types of intermediate code, Translation of simple assignment statements and control flow statements. Type checking, type conversions.

**Symbol Table:** The contents of a symbol table, Data structures for symbol tables, Representing scope information. **Generating Three address code (LTC)**

## UNIT-IV

**Storage organization:** Storage allocation strategies, scope access to non local names, language facilities for dynamics storage allocation.

**Code optimization:** Principal sources of optimization, optimization of basic blocks, flow graphs, peephole optimization.

**Code Generation:** Issues in the design of a Code generator, The Target language, A simple code generator, Code generation from DAG's.

## TEXT BOOKS

- [1] John E. Hopcroft, Rajeev M & J D Ullman: "Introduction to Automata Theory Languages & Computation", 3rd Edition, Pearson Education, 2007.
- [2] Alfred V. Aho, Jeffrey D. Ullman, 'Principles of Compiler Design', Narosa Publishing, 2002
- [3] Alfred V. Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, 'Compilers Principles, Techniques and Tools', Second Edition, Pearson Education

India , 2014.

**REFERENCE BOOKS**

- [1] Tremblay J P, Sorenson G P: “The Theory & Practice of Compiler writing”, 1st Edition, BSP publication, 2010.
- [2] Louden, ‘Compiler Construction : Principle and Practice ‘Cengage Publications, 1997.
- [2] Jean-Paul Trembly, Paul G. Sorenson, ‘ The Theory and Practical of Compiler Writing’, BS Publications, 2009

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Compiler Design by Prof.Y.N.Srikant, Department of Computer Science and Automation, IISC Bangalore. <http://nptel.iitm.ac.in/courses/106108052> Last access date: 09.06.2022
- [2] NPTEL lectures by Professor Sanjeev K Agarwal, Dept. of CSE IIT Kanpur <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/compiler-desing/ui/TOC.htm> Last access date:

**20CS7402A****BUSINESS INTELLIGENCE AND DATA VISUALIZATION**

<b>Course Category:</b>	<b>Program Elective III</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS5301 Database Management Systems	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the need and value of business intelligence	K2	1.6.1,1.7.1
<b>CO2</b>	Understand business intelligence environment and models	K2	1.6.1, 1.7.1
<b>CO3</b>	Apply data visualization anatomy for data representation and presentation	K3	1.6.1,1.7.1, 2.7.1
<b>CO4</b>	Analyse the data visualization methods.	K4	1.6.1,1.7.1,2.7.1, 2.6.4,2.6.5

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1												1	1
<b>CO2</b>	2												2	2
<b>CO3</b>	2	2											2	2
<b>CO4</b>	2	2											2	2

**COURSE CONTENT****UNIT I**

**Business Intelligence and Information Exploitation:** Introduction to Business Intelligence ,The Information Asset ,Exploiting Information ,Business Intelligence and Program Success , Actionable Knowledge.

**The Value of Business Intelligence:** The Information Asset and Data Valuation, Actionable Knowledge-Return on Investment, Business Intelligence Applications, The Intelligence Dashboard Business Intelligence Adds Value .

## UNIT II

**The Business Intelligence Environment:** The Business Case, The Business Intelligence Process, System Infrastructure, Information Access, Delivery, and Analysis, Services.

**Business Models and Information Flow:** Information Processing and Information Flow, The Information Flow Model, Usage in Practice ,Modeling Frameworks .

## UNIT III

**The Context of Data Visualization :** Visualization as a discovery tool, The bedrock of visualization knowledge, Defining data visualization, Visualization skills for the masses, The data visualization methodology.

**Conceiving and Reasoning Visualization Design Options:** Data visualization design is all about choices, The visualization anatomy – data representation, The visualization anatomy – data presentation

## UNIT IV

**Taxonomy of Data Visualization Methods:** Data visualization methods, Choosing the appropriate chart type, Comparing categories, Dot plot ,Bar chart, Floating bar,Pixelated bar chart,Histogram, SlopeGraph, Radial chart,Glyph chart,Assessing hierarchies and part-to-whole relationships,Pie chart,Stacked bar chart,Square pie,Tree map,Circle packing diagram,Bubble hierarchy,Tree hierarchy,Showing changes over time,Line chart,Sparklines,Area chart,Plotting Connections and Relationships,Scatterplot,Bubble plot,Heat map,Case studies-coca-cola: shaping the essence of analytics, linkedin: empowering of the sales team.

## TEXT BOOKS

- [1] Loshin, David. Business intelligence: the savvy manager's guide,Newnes, 2012. [UNIT-I,II]
- [2] Kirk, Andy. Data Visualization: a successful design process,Packt publishing LTD, 2012. [UNIT-III, IV]

**REFERENCE BOOKS**

- [1] Kemper, Hans-Georg, Walid Mehanna, and Carsten Unger “Business Intelligence-Grundlagen und praktische Anwendungen” Wiesbaden: Vieweg+ Teubner, Third Edition 2010.
- [2] Moss, Larissa T., and Shaku Atre. “ Business intelligence roadmap: the complete project lifecycle for decision-support applications”. Addison-Wesley Professional, 2003.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Business Intelligence Concepts, Tools, and Applications by Jahangir Karimi, University of Colorado.  
<https://www.coursera.org/learn/business-intelligence-tools>  
(Last Accessed on 15-10-2022)
- [2].Introduction to learning analytics by Ramkumar Rajendran, IIT Bombay  
<https://freevidelectures.com/course/4041/nptel-introduction-to-learning-analytics/11> (Last accessed on 15-10-2022)
- [3].<https://datarootlabs.com/blog/complex-data-visualization-with-tableau-use-cases> (Last accessed on 15-10-2022)

## 20CS7402B

### CLOUD ARCHITECTURE

<b>Course Category:</b>	<b>Program Elective III</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS4304 Computer Networks	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the concepts, characteristics, delivery models and benefits of cloud computing.	K2	1.6.1, 2.5.2, 2.6.4, 2.8.4
<b>CO2</b>	Analyze Cloud Infrastructure and Management Mechanisms	K4	2.6.3, 2.6.4, 2.8.3, 2.8.4, 3.7.1
<b>CO3</b>	Understand fundamental and advanced Cloud architectures	K2	2.5.2, 2.6.3, 2.6.4, 2.8.4
<b>CO4</b>	Understand specialized cloud architectures and impact of SLA's	K2	2.5.2, 2.6.3, 2.6.4, 2.8.4

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1	3												1
<b>CO2</b>		2	3											1
<b>CO3</b>		2												1
<b>CO4</b>		2												1

### COURSE CONTENT

#### UNIT I

**Fundamental Concepts and Models:** Roles and Boundaries, Cloud Provider, Cloud Consumer, Cloud Service Owner, Cloud Resource Administrator, Additional Roles, Organizational Boundary, trust Boundary, Cloud

**Characteristics:** On-Demand Usage Ubiquitous Access, Multitenancy (and Resource Pooling), Elasticity, Measured Usage, Resiliency, Cloud Delivery Models: Comparing Cloud Delivery Models, Combining Cloud Delivery Models, IaaS + PaaS, IaaS + PaaS + SaaS

**Cloud-Enabling Technology:** Broadband Networks and Internet Architecture, Internet Service Providers (ISPs), Connectionless Packet Switching (Datagram Networks), Router-Based Interconnectivity, Physical Network, Transport Layer Protocol, Application Layer Protocol, Technical and Business Considerations, Connectivity Issues, Network Bandwidth and Latency Issues, Cloud Carrier and Cloud Provider Selection

**Data Center Technology:** Virtualization, Standardization and Modularity, Automation, Remote Operation and Management, High Availability, Security-Aware Design, Operation, and Management, Facilities, Computing Hardware, Storage Hardware, Network Hardware, Carrier and External Networks Interconnection, Web-Tier Load Balancing and Acceleration, LAN Fabric, SAN Fabric, NAS Gateways

## UNIT II

**Cloud Infrastructure Mechanisms:** Logical Network Perimeter, Virtual Server, Cloud Storage Device - Cloud Storage Levels, Network Storage Interfaces, Object Storage Interfaces, Database Storage Interfaces, Relational Data Storage, Non-Relational Data Storage, Cloud Usage Monitor - Monitoring Agent, Resource Agent, Polling Agent, Resource Replication, Ready-Made Environment

**Cloud Management Mechanisms -** Remote Administration System, Resource Management System, SLA Management System, Billing Management System

## UNIT III

**Fundamental Cloud Architectures:** Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture

**Advanced Cloud Architectures:** Hypervisor Clustering Architecture, Load Balanced Virtual Server Instances Architecture, Non-Disruptive Service Relocation Architecture, Zero Downtime Architecture, Cloud Balancing Architecture, Resource Reservation Architecture, Dynamic Failure Detection



and Recovery Architecture, Bare-Metal Provisioning Architecture, Rapid Provisioning Architecture, Storage Workload Management Architecture

#### **UNIT IV**

**Specialized Cloud Architectures:** Direct I/O Access Architecture, Direct LUN Access Architecture, Dynamic Data Normalization Architecture, Elastic Network Capacity Architecture, Cross-Storage Device Vertical Tiering Architecture, Intra-Storage Device Vertical Data Tiering Architecture, Load Balanced Virtual Switches Architecture, Multipath Resource Access Architecture, Persistent Virtual Network Configuration Architecture, Redundant Physical Connection for Virtual Servers Architecture, Storage Maintenance Window Architecture

**Service Quality Metrics and SLAs:** Service Quality Metrics, Service Availability Metrics, Service Reliability Metrics, Service Performance Metrics, Service Scalability Metrics, Service Resiliency Metrics, SLA Guidelines

#### **TEXT BOOKS**

- [1] Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", 1st Ed, Pearson, 2014
- [2] RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", McGraw Hill, 2013

#### **REFERENCE BOOKS**

- [1] RajkumarBuyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2013
- [2] Kai Hwang, Geoffrey C Fox, Jack J Dongarra, "Distributed and Cloud Computing - From Parallel Processing to the Internet of Things", Morgan Kaufman Publishing, 2012

#### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] [https://cs.uwaterloo.ca/~a78khan/courses-offered/cs446/2010\\_05/lecture-slides/16\\_CloudComputing.pdf](https://cs.uwaterloo.ca/~a78khan/courses-offered/cs446/2010_05/lecture-slides/16_CloudComputing.pdf)
- [2] <http://www.cs.iit.edu/~iraicu/teaching/CS553-S12/index.html>
- [3] <https://www.youtube.com/user/arch4cloud/playlists>



## 20CS7402C

### CYBER SECURITY

<b>Course Category:</b>	<b>Program Elective III</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS6302 - Cryptography & Network Security	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand classification of cyber crimes.	K2	1.7.1, 2.6.4
<b>CO2</b>	Understand the impact of cyber attacks	K2	1.7.1, 8.3.1
<b>CO3</b>	Apply tools and methods used in cyber crime	K3	1.7.1, 5.4.1, 5.5.1
<b>CO4</b>	Understand organizational implications of cyber security	K2	3.6.2, 8.3.1

#### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3													1
<b>CO2</b>	2							2						2
<b>CO3</b>	2				3									1
<b>CO4</b>			2					2						2

### COURSE CONTENT

#### UNIT I: INTRODUCTION

Introduction of Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web Jacking, Newgroup Spam, Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-Mail bombing, computer network intrusions, password sniffing, credit card frauds, identity theft.

**UNIT II:**

**Cyber offenses:** Criminals Plan: Categories of Cybercrime Cyber Attacks: Reconnaissance, Passive Attack, Active Attacks, Scanning/Scrutinizing gathered Information, Attack, Social Engineering: Classification of Social Engineering. **Cyberstalking:** Types of Stalkers, Working of Stalking, Real-Life Incident of Cyber stalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Botnet, Attack Vector, Attacks on mobile/cell phones – Theft, viruses, mishing, vishing, smishing, hacking Bluetooth.

**UNIT III:**

**Tools and Methods:** Introduction, Proxy Servers and Anonymizers, how phishing works, password cracking, keyloggers and spywares, types of viruses, steganography, DoS and DDoS attacks – classification, types, tools used for launch, DDoS attacks, protection, SQL injection – steps and prevention, Buffer Overflow – types and minimizing attack, Attacks on Wireless Networks.

**UNIT IV:**

**Organizational Implications** –Introduction –Insider threats, Privacy, Key challenges to organizations, Cost of Cybercrimes and IPR issues

**Incident Handling:** Definitions, Organizations need Incident Response systems, Examples of incidents, what organizations can do to protect, best practices for organizations.

**TEXT BOOKS**

[1] Nina Godbole, Sunit Belapur, “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, 2nd edition, Wiley India Publications, April, 2015

**REFERENCE BOOKS**

- [1] James Graham, R Howard, R Olson, "Cyber Security Essentials" CRC Press, 2018
- [2] Michael E Whitman, Herbert J Mattord, "Principles of Information Security", 4th Edition, Cengage Learning, 2012
- [3] William Stallings, “Cryptography and Network Security- Principles and Practice”, 7<sup>th</sup> Edition, Pearson Education, 2017

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] MITOPENCOURSEWARE Computer Systems Security  
[https://ocw.mit.edu/courses/6-858-computer-systems-security-fall-2014/video\\_galleries/video-lectures/](https://ocw.mit.edu/courses/6-858-computer-systems-security-fall-2014/video_galleries/video-lectures/) accessed on 9th Jan 2023
- [2]Oxford Home Study Center, Cyber Security short course available @  
<https://www.oxfordhomestudy.com/courses/cyber-security-courses/free-cyber-security-online> accessed on 9th Jan 2023

**20CS7402D**  
**UI&UX Design**

<b>Course Category:</b>	<b>Program Elective III</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>		<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand Human factors and Psychology in design process of Interactive systems.	K2	1.6.1, 1.7.1, 2.5.2, 2.6.1, 2.6.2
<b>CO2</b>	Understand interaction and experience design in the different contexts.	K2	2.5.1, 2.5.2, 2.6.1, 2.6.2, 2.7.1
<b>CO3</b>	Apply techniques to design interactive systems and prototypes.	K3	2.7.1, 2.7.2, 3.6.1, 3.7.1
<b>CO4</b>	Apply the user experience from websites, mobile and smart devices to design interactive systems.	K3	2.6.1, 2.7.2, 3.6.2, 3.7.1, 3.8.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	2												
<b>CO2</b>		3											2	
<b>CO3</b>		3	3										2	
<b>CO4</b>		3	3										2	

**COURSE CONTENT**

**UNIT I:**

**The Importance of the User Interface :** Defining the User Interface, The Importance of Good Design, A Brief History of the Human-Computer Interface, Introduction of the Graphical User Interface,

**Characteristics of Graphical and Web User Interfaces:** Interaction Styles, Command Line, Menu Selection, Form Fill-in, Direct Manipulation,

Anthropomorphic; The Graphical User Interface, The Web User Interface, The Merging of Graphical Business Systems and the Web, Principles of User Interface Design.

## UNIT II:

**The User Interface Design Process:** Obstacles and Pitfalls in the Development Path, Usability, Important Human Characteristics in Design, Human Considerations in the Design of Business Systems.

**Understand the Business Function:** Determining Basic Business Functions, Design Standards or Style Guides.

**Understand the Principles of Good Interface and Screen Design:** Human Considerations in Interface and Screen Design.

## UNIT III:

**Techniques for designing interactive systems:** Understanding requirements, Participative design, Interviews, Questionnaires, Probes, Card sorting techniques, Working with groups, Onsite working.

**Envisionment:** Basic techniques, Prototypes, Envisionment in practice.

**Design:** Introduction, Conceptual design, Metaphors in design, Physical design.

## UNIT IV:

**Agents and Avatars:** Agents, Adaptive systems, An architecture for agents, Applications of agent-based interaction, Avatars and conversational agents

**Mobile and Wearable devices:** Understanding in mobile computing, Designing for mobiles, Evaluation for mobile computing, Smart materials, Material design.

### TEXT BOOKS

- [1] Wilbert O Galitz, The Essential Guide to User Interface Design, 2 ed, Wiley Dreamatech [UNIT I,II]
- [2] David Benyon “Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction Design” 3rd ed. Addison Wesley, 2013, [UNIT III, IV]

### REFERENCE BOOKS

- [1] Alan Dix, Janet Finckay, Gregor, Abowd and Russell Beaulieu, Human

Computer interaction. Pearson Education.

[2]Prece, Rogers, Sharps Interaction Design. Wiley Dreamatech Soren Lauesen, User Interface Design. Pearson Education.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Dr.Samit Bhattacharya, CSEm IIT Guwahati, “Human Computer Iteration”  
NPTEL videos

<http://nptel.ac.in/syllabus/106103115/>

[2] Pradeep P Yammivayar , CSE, IIT Guwahati, NPTEL Videos

<http://www.nptelvideos.com/video.php?id=1461&c=15>

## 20CS7402E

### HIGH SPEED NETWORKS

<b>Course Category:</b>	<b>Program Elective III</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS4304 Computer Networks	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the concepts of High speed networks.	K2	1.7.1, 2.6.4
<b>CO2</b>	Apply different traffic management approaches	K3	1.7.1, 2.5.2, 2.6.2
<b>CO3</b>	Analyze congestion control mechanisms	K4	1.7.1, 2.5.2, 2.6.4
<b>CO4</b>	Understand the different concepts of Integrated services.	K2	1.7.1, 2.6.3

#### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	2											2	
<b>CO2</b>	3	2											2	
<b>CO3</b>	3	2											2	
<b>CO4</b>	3	2											2	

### COURSE CONTENT

#### Unit I

#### High Speed Networks

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL.

**High Speed LAN's:** Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless

LAN's: applications, requirements – Architecture of 802.11.

## **Unit II**

### **Congestion and Traffic Management**

Queuing Analysis – queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

## **Unit III**

### **TCP and ATM Congestion Control**

**TCP Flow Control** – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO back off – KARN's Algorithm – Window Management – Performance of TCP over ATM

**Traffic and Congestion control in ATM** – Requirements – Attributes – Traffic Management Frame work, Traffic control – ABR traffic Management - ABR rate control, RM cell formats ABR Capacity allocations – GFR traffic management.

## **Unit IV**

### **Integrated and Differentiated Services**

**Integrated Services Architecture** – Approach, Components, Services – Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services. Protocols for QOS Support: RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label.

**Switching** – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

### **TEXT BOOKS**

[1] William Stallings, “High Speed Networks and Internets”, Pearson Education India, 2nd edition, 2002

### **REFERENCE BOOKS**

[1] IrvanPepelnjk, Jim Guichard and Jeff Apcar, “MPLS and VPN architecture”, Cisco Press, Volume 1 and 2, 2003.

[2] Tom Sheldon, “Encyclopedia of Networking and telecommunications” TMH, 2001



**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Prof. A. Pal, Department of Computer Science Engineering, IIT Kharagpur

<https://www.youtube.com/watch?v=oSQrL4x-YiM>

[2] Prof. Sujoy Ghosh Computer Networks, IIT Kharagpur

<https://nptel.ac.in/courses/106105081>

**20CS7402F**  
**PATTERN RECOGNITION**

<b>Course Category:</b>	<b>Program Elective III</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20BS4101-Probability and Statistics	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the basic concepts and importance of pattern recognition.	K2	1.2.1,1.6.1
<b>CO2</b>	Analyse the supervised, unsupervised and semi-supervised learning	K4	1.2.1,1.6.1
<b>CO3</b>	Apply the Bayesian decision theory for continuous and discrete features	K3	1.2.1,1.6.1, 2.5.3,2.6.2
<b>CO4</b>	Understand the Maximum likelihood and Bayesian parameter estimation	K2	1.2.1,1.6.1, 2.5.3,2.6.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1												1	
<b>CO2</b>	1												1	
<b>CO3</b>	2	2											1	
<b>CO4</b>	3	2											1	

**COURSE CONTENT**

**UNIT I**

**Introduction:** Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation,

**Bayesian Decision Theory:** Introduction, continuous features –two categories classifications, minimum error-rate classification-zero-one loss function, classifiers, discriminant functions, and decision surfaces.

## Unit II

**Normal density:** Univariate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory –discrete features, compound Bayesian decision theory and context.

## Unit III

**Maximum likelihood and Bayesian parameter estimation:** Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case, Component analysis and Discriminants: Principal Component Analysis, Fisher Linear Discriminant, Multiple Discriminant Analysis

## Unit IV

**Un-supervised learning and clustering:** Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Data description and clustering –similarity measures, criteria function for clustering.

### TEXT BOOKS

[1]Richard O. Duda, Peter E. Hart and David G. Stroke, “Pattern Classifications”, 2nd Edition, Wiley Student Edition,2011.

### REFERENCE BOOKS

[1] EarlGose, Richard John Baugh and Steve Jost, “Pattern Recognition and Image Analysis”, PHI, 2004.

### E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Prof. P.K. Biswas. (June 2014). Pattern Recognition and Applications [NPTEL,Video lecture]. Available: <http://www.nptel.ac.in/courses/117105101/>

**20CS7402G****HIGH PERFORMANCE COMPUTING**

<b>Course Category:</b>	<b>Program Elective III</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS3305 Data Structures, 20CS3304 Digital logic and Computer Design 20CS4303 Computer Organization and Microprocessor	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand parallel programming platforms and parallel algorithms on parallel computer systems.	K2	1.2.1, 1.7.1, 2.5.3
<b>CO2</b>	Analyze the performance of a parallel program to outfit a particular platform.	K4	1.6.1, 2.5.2, 2.6.3, 2.6.4, 2.7.2, 3.6.1, 3.6.2, 4.4.2, 4.6.1, 5.4.2
<b>CO3</b>	Understand the accelerated technologies of Multicore processor systems using MPI, Open MP and threading techniques.	K2	1.2.1, 2.6.2, 2.6.4, 2.7.2, 4.6.4
<b>CO4</b>	Apply the concepts of dense matrix, sorting and graphs.	K3	1.6.1, 2.5.2, 2.6.3, 2.6.4, 2.7.2, 3.6.1, 3.6.2, 4.4.2, 4.6.1, 5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1	1											1	1
<b>CO2</b>	2	2	2	2	2								1	2
<b>CO3</b>	2	2		2									1	1
<b>CO4</b>	1	2	2	2	2								1	2

**COURSE CONTENT**

## UNIT I

**Parallel Programming Platforms: Implicit parallelism:** Trends in Microprocessor Architectures, Limitations of memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, Routing mechanisms for interconnection networks.

**Principles of Parallel Algorithm Design:** Preliminaries, decomposition Techniques, Characteristics of tasks and interactions, mapping techniques for load balancing, parallel algorithm models.

## UNIT II

**Basic communication operations:** One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather.

**Analytical modelling of parallel programs:** sources of overhead in parallel programs, performance metrics for parallel systems, The Effect of granularity on performance, scalability of parallel systems.

## UNIT III

**Programming using the message passing paradigm:** Principles of Message passing programming, the building blocks: Send and Receive Operations, MPI: the message passing interface, Overlapping communication with computation, collective communication and computation Operations.

**Programming shared address space platforms:** Thread Basics, why Threads, Thread Basics: Creation and Termination, Synchronization primitives in Pthreads, OpenMP: a standard for Directive based Parallel Programming.

## UNIT IV

**Dense Matrix Algorithms:** Matrix-Vector Multiplication, Matrix – Matrix Multiplication, Quick sort.

**Sorting:** Issues in Sorting on Parallel Computers, Sorting Networks, Bubble sort and its variants.

**Graph Algorithms: Minimum Spanning Tree:** Prim's Algorithm, Single-Source shortest paths: Dijkstra's Algorithm, all-pairs shortest paths, Transitive closure, connected components.

## TEXT BOOKS

[1] AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar: Introduction to Parallel Computing, Second Edition Pearson Education, 2016.

**REFERENCE BOOKS**

- [1] Michael J. Quinn, Parallel Programming in C with MPI and OpenMP McGraw-Hill International Editions, Computer Science Series, 2004.
- [2] David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
- [3] Joseph Jaja, "An Introduction to Parallel Algorithms", Addison-wesley, 1992.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] High Performance Computing, IISc Bangalore, Prof. Mathew Jacob, accessed 03 May 2023, <http://nptel.ac.in/courses/106108055>
- [2] NVIDIA Accelerated Computing - Training, accessed 03 May 2023, <https://developer.nvidia.com/accelerated-computing-training>
- [3] Google Cloud's HPC solutions, accessed 03 May 2023, <https://cloud.google.com/solutions/hpc>
- [4] OpenCL Developer Manual, accessed 03 May 2023, <https://opencl.org/projects/developer-manual>

**20CS7403A****PREDICTIVE MODELLING AND ANALYTICS**

<b>Course Category:</b>	<b>Program Elective IV</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS6301 Machine Learning	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the fundamentals and functionalities of Data Mining	K2	1.2.1, 1.7.1
<b>CO2</b>	Apply the preprocessing techniques to prepare the datasets.	K3	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1
<b>CO3</b>	Analyze appropriate predictive modeling approaches to identify cases to progress with.	K4	1.2.1, 1.7.1 2.5.2, 2.6.4, 2.8.1 3.6.1
<b>CO4</b>	Apply predictive modeling approaches using a suitable package such as SPSS Modeler	K3	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1 3.5.1, 3.6.1, 3.7.1

**Contribution of Course Outcomes towards achievement of Program****Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1												1	2
<b>CO2</b>	2	2											1	2
<b>CO3</b>	3	2	2										1	2
<b>CO4</b>	3	2	2										1	2

**COURSE CONTENT****UNIT I**

**Introduction to Data Mining:** Data Mining, Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.

**UNIT II**

**Data Understanding and Preparation** Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.

### UNIT III

**Model development & techniques** Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rule, Tree Pruning Techniques.

### UNIT IV

**Model Evaluation and Deployment** Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, MetaLevel Modeling, Deploying Model, Assessing Model Performance, Updating a Model.

### TEXT BOOKS

- [1] Predictive & Advanced Analytics (IBM ICE Publication)
- [2] Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd ed.

### REFERENCE BOOKS

- [1] Eric Siegal, “Predictive Analytics”, Wiley Publications, 2016
- [2] Edward W. Frees, Glenn Meyers, Richard A. Derrig, “Predictive Modeling Applications in Actuarial Science: Volume 2, Case Studies in Insurance (International Series on Actuarial Science)”, Cambridge press, 2016.

### E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] Dan Zhang, Introduction to Predictive Modeling, Last accessed on 05-03-2023  
<https://www.coursera.org/lecture/predictive-modeling-analytics/0-introduction-to-predictive-modeling-uvobZ>



**20CS7403B**  
**BIG DATA ANALYTICS**

<b>Course Category:</b>	<b>Program Elective IV</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS5301 Database Management Systems	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the concepts of Big Data Analytics and hadoop	K2	2.5.1, 2.5.2,2.6.3,2.6.4
<b>CO2</b>	Analyze large dataset with Hadoop Distributed File System and MapReduce techniques to optimize storage space.	K4	2.5.1,2.5.2,2.6.3, 2.7.1,3.5.1,3.8.2
<b>CO3</b>	Apply MapReduce, Pig, and Hive tools for data analytics.	K3	2.5.1, 2.5.2,2.6.4 3.5.1,3.8.2
<b>CO4</b>	Apply Sqoop, and Zookeeper tools for solving the Data Analysis problems.	K3	2.5.1, 2.5.2,2.6.3, 3.5.1,3.6.2,3.8.2

**Contribution of Course Outcomes towards achievement of Program Outcomes**  
(1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>		2											2	2
<b>CO2</b>		2	3										2	2
<b>CO3</b>		2	3										2	2
<b>CO4</b>		2	3										2	2

**COURSE CONTENT**

**UNIT I**

**Introduction to Big Data Analytics:** Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics.

**Data Analytics Lifecycle:** Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize.

**Introduction to Hadoop:** Data storage and analysis, Comparison with other systems, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem.

## UNIT II

**Hadoop Distributed File system:** The Design of HDFS, HDFS concepts, Command-Line Interface, Hadoop file systems, The Java Interface, Data Flow, Hadoop Archives.

**Hadoop I/O:** Data Integrity in HDFS, LocalFileSystem, ChecksumFileSystem, Compression, Serialization, File-Based Data Structures, SequentialFile, Map File.

## UNIT III

**MapReduce:** Analyzing the data with Hadoop, Map and Reduce, Java Map and Reduce, Scaling Out, Hadoop Streaming, Hadoop Pipes.

**MapReduce Types and Formats:** MapReduce Types, Input Formats, Output Formats.

**MapReduce Features:** Counters, Sorting, Joins, Side Data Distribution and MapReduce Library Classes.

## UNIT IV

**Pig:** Pig-Installation and Running of Pig, Execution Types, Running Pig Programs, Pig Latin Editors, Comparison with databases, Pig Latin, Functions, Data Processing Operators.

**Hive:** Installing Hive, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data, Spark Architecture

## TEXT BOOKS

- [1] “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services, John Wiley & Sons, Inc., 2015.
- [2] Tom White, “Hadoop, The Definitive Guide”, 3rd Edition, O’Reilly Publications, 2012.

## REFERENCE BOOKS

- [1] Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publications, 2014.
- [2] Anil Maheswari, “Data Analytics”, Tata McGraw Hill, 1st Edition, 2017.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Frank Kane, Sundog Education Team, “Big Data Analytics”,Udemy.  
<https://www.udemy.com/topic/big-data/> Available: Last accessed on November 2022.
- [2] Prof. Rajiv Misra. “ Big Data Computing”,  
[https://onlinecourses.nptel.ac.in/noc20\\_cs92/preview](https://onlinecourses.nptel.ac.in/noc20_cs92/preview), NPTEL videos.  
Available: Last accessed on November 2022.

## 20CS7403C

### BIG DATA ON CLOUD

<b>Course Category:</b>	<b>Program Elective IV</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS5301: Database Management Systems	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

COURSE OUTCOMES		BTL	POI
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the concepts and technologies of big data analytics.	K2	1.7.1,2.5.1,2.5.2
<b>CO2</b>	Apply the techniques in handling and analysis of big data.	K3	1.7.1,2.5.1,2.5.2, 2.6.3,2.7.1,3.5.1, 5.1.2
<b>CO3</b>	Apply cloud frameworks and technologies on real world applications.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,5.1.2
<b>CO4</b>	Understand fine data intensive computing.	K2	2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1, 5.1.2

#### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2												1
<b>CO2</b>	2	2	3		1									2
<b>CO3</b>	2	2	3		1									2
<b>CO4</b>	2	2	3											2

### COURSE CONTENT

#### UNIT I

**Introduction To Big Data:** Classification of digital data, Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Other Characteristics of Data, Information, Traditional Business Intelligence

(BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment, Changing in the Realms of Big Data

**Big Data Analytics:** Big Data Analytics, Classification of Analytics, Top Challenges Facing Big Data, Big Data Analytics Importance, Data Science, Few Top Analytics Tools.

## UNIT II

### **Bigdata Technology Landscape**

**NoSQL (Not Only SQL):** Introduction, Types of NoSQL databases, Advantages, Uses of NoSQL, NewSQL, comparison of SQL, NoSQL and NewSQL.

**MongoDB:** Introduction, using JSON, Terms used in RDBMS and MongoDB, Datatypes, MongoDB Query Language,

**Introduction to Cassandra:** Apache Cassandra, features of Cassandra, CQL datatypes, CRUD operations, collections, alter commands, Import and Export

## UNIT III

**Cloud Computing Terminology:** Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies,

**Cloud Computing Architecture:** Introduction, Cloud Reference Model, Architecture, Types of Clouds, Economics of the Cloud, Open Challenges, Aneka: Cloud Application Platform: Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Programming and Management.

## UNIT IV

### **Industrial platforms and new developments:**

**Amazon web services:** Compute Services, Storage Services, Communication services, Additional Services.

**Google AppEngine:** Architecture and core concepts, Application life cycle, cost model, observations.

**Microsoft Azure:** Azure core concepts, SQL Azure, Windows Azure platform appliance, observations.

## TEXT BOOKS

[1] Big Data and Analytics – Seema Acharya, SubhashiniChellappan Willey India ISBN 13 9788126554782

- [2] Mastering Cloud Computing – RajkumarBuyya, Christian Vecchiola, and ThamaraiSelvi McGraw Hill Education

**REFERENCE BOOKS**

- [1] Big Data Analytics with R and Hadoop – VigneshPrajapati, 2013 Packt Publishing.
- [2] Cloud Computing Bible – Barrie Sosinsky, Wiley-India, 2010.
- [3] Cloud Computing: A Practical Approach – Toby Velte, Anthony Velte, Robert Elsenpeter, McGraw Hill Professional Publications, 2009.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Coursera: Fundamentals of Big data by Eric Herman, Offered by LearnQuest fundamentals-of-big-data-course-courl3640, Last accessed on 05-05-2023

**20CS7403D**  
**CYBER FORENSICS**

<b>Course Category:</b>	<b>Program Elective IV</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS6302 Cryptography & Network Security	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the concepts of cyber forensics related Issues.	K2	1.7.1
<b>CO2</b>	Analyse the process of various forensic systems.	K4	1.7.1, 3.6.2
<b>CO3</b>	Analyze Evidence capture mechanism and Recovery steps	K4	1.7.1, 3.6.2, 5.1.2
<b>CO4</b>	Apply principles of electronic communications and report evidences.	K3	5.1.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3													1
<b>CO2</b>	2		2											2
<b>CO3</b>	2		2		1									1
<b>CO4</b>		2			1									2

**COURSE CONTENT**

**UNIT I**

**Forensic Terminology and Investigations:** Introduction, Traditional problems in investigation, Forensic science and disk structure. Forensic Laboratory: Developing computer Forensic Science capabilities, Minimum Housing requirements, Hardware and Software requirements, Popular Software.

**UNIT II**

**Search and Seize Computer Related Evidence:** Identifying Digital Evidence, Collecting the Evidence in Private-Sector Incident Scenes, Processing law Enforcement Crime Scenes, Preparing for a Search, Securing a Computer Incident or Crime Scene, Sizing Digital evidence at the Scene, Storing Digital evidence, obtaining a Digital Hash.

**UNIT III**

**Computer Forensics Analysis and Validation:** Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing Remote Acquisition, Current Forensic Tool: Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software

**UNIT IV**

**E-mail Investigations & Report Writing:** Exploring the Role of E-mail in Investigations, Exploring the Role of Client and Server in E-mail, Investigating E-mail Crimes and Violations, Using Specialized E-mail Forensics Tools, Report Writing

**TEXT BOOKS**

- [1] John R. Vacca, Firewall Media, “Computer Forensics: Computer Crime Investigation”, Charles River Media, 2015.
- [2] Nelson, Phillips Enfinger, Stuart, “Computer Forensics and Investigations”, CENGAGE, 2005.

**REFERENCE BOOKS**

- [1] Keith J. Jones, Richard Bejtlich, Curtis W. Rose, Addison, Real Digital Forensics, Wesley Pearson Education, 2006
- [2] Tony Sammes and Brain Jenkinson, “Forensic Compiling”, Springer, 2007
- [3] Christopher L.T. Brown, “Computer Evidence Collection & Preservation”, Firewall Media, 2005.
- [4] Chuck Eastom, “Certified Cyber Forensics Professional Certification: McGraw Hill, July 2017

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Neeraj Kheria, [https://www.youtube.com/watch?v=\\_X1\\_LF\\_8gSA](https://www.youtube.com/watch?v=_X1_LF_8gSA), Edurekha, accessed on 24-04-2023
- [2] Santosh Khadsare, <https://www.youtube.com/watch?v=ZyJdXp3aWKY>, c3ihub-iit-kanpur, access on 24-04-2023



**20CS7403E****CROSS PLATFORM GAME DEVELOPMENT**

<b>Course Category:</b>	<b>Program Elective IV</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20ES3102 Java Programming	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand 2D graphics and Linear Algebra concept in game design and development.	K2	1.6.1,3.5.6,5.4.1
<b>CO2</b>	Understand 3D graphics and tools of Game Development	K2	1.7.1,3.8.3,5.4.2
<b>CO3</b>	Apply Artificial Intelligence and UI design concept in game programming.	K3	3.8.2,5.5.2
<b>CO4</b>	Apply Scripting and Networking Gaming	K3	1.7.1,5.5.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3		2		2									2
<b>CO2</b>	1		2		3									3
<b>CO3</b>			2		3									3
<b>CO4</b>	2				3									3

**COURSE CONTENT****Unit I**

**Game Programming Overview:** Evolution of Video Game Programming, The Game Loop, Time and Games, Game Objects.

**2D Graphics:** 2D Rendering Foundations, Sprites, Scrolling, Tile Maps

Linear Algebra for Games: Vectors, Matrices

**Unit II**

**3D Graphics:** Basics, Coordinate Spaces, Lighting and Shading, Visibility, World Transform

**Input :** Input Devices, Event-Based Input Systems, Mobile Input

**Sound:** Basic Sound, 3D Sound Digital Signal Processing, Other Sound Topics

**Physics:** Planes, Rays, and Line Segments, Collision Geometry, Collision , Physics-Based Movement, Physics Middleware

**Unit III**

**Cameras:** Types of Cameras, Perspective Projections, Camera Implementations, Camera Support Algorithms

**Artificial Intelligence:** “Real” AI versus Game AI, Path finding, State-Based Behaviors, Strategy and Planning.

**User Interfaces:** Menu Systems, HUD Element, Other UI Considerations

**Unit IV**

**Scripting Languages and Data Formats:** Scripting Languages, Implementing a Scripting Language, Data Formats

**Case Study:** UI Mods in World of Warcraft.

Networked Games: Protocols, Network Topology, Cheating.

Sample Game: Side-Scroller for iOS, Overview, Code Analysis

Sample Game: Tower Defense for PC/Mac, Overview, Code Analysis.

**TEXT BOOKS**

- [1] Sanjay Madhav, Game Programming Algorithms and Techniques. Addison Wesley, 2013

**REFERENCE BOOKS**

- [1] Jeremy Gibson, Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#. 3rd ed, Addison Wesley, 2020
- [2] Steven Goodwin, Cross-Platform Game Programming, Charles River Media, 2005

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Game Design and Development with Unity 2020 Specialization, Coursera, <https://in.coursera.org/specializations/game-design-and-development>, Last accessed on November,2022

**20CS7403F**  
**WIRELESS COMMUNICATION NETWORKS**

<b>Course Category:</b>	<b>Program Elective IV</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS4304 Computer Networks	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand Wireless Network and its Topologies	K2	1.2.2, 2.7.1, 3.7.1
<b>CO2</b>	Understand Wireless LAN standards and Bluetooth	K2	1.2.2, 2.8.1, 3.8.3
<b>CO3</b>	Apply Wireless Routing Protocols	K3	1.2.2, 2.5.3, 4.4.2
<b>CO4</b>	Apply Satellite Communication Technologies	K3	1.2.1, 2.8.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	1	2											1
<b>CO2</b>	3	2	1											1
<b>CO3</b>	2	3	1										1	1
<b>CO4</b>	1	3	2										1	1

## **COURSE CONTENT**

### **UNIT I:**

**Introduction:** Introduction to Wireless Networks, Wireless Network Topologies, Characteristics of the Wireless Medium, GSM Cellular Network concept, Cellular transmission principles Typical cell layout, Signals Transmission interference, Cell splitting, TDMA technology, Spread spectrum and CDMA technology, GPRS, 3G, 4G and long-term evolution, 5G.

**UNIT II:**

**Wireless LAN Standards:** Evolution of IEEE 802.1, Introduction to IEEE 802.11, General Description, Medium Access Control (MAC) for the IEEE 802.11, WLANs Physical Layer for IEEE 802.11, WLANs; Radio systems, IR Systems Applications.

**Bluetooth:** Bluetooth and IEEE 802.15, Bluetooth Specifications, Bluetooth Architectures, Bluetooth Protocols, Bluetooth Service Discovery, Bluetooth MAC, Bluetooth Packet Structure, Bluetooth Audio, Bluetooth Addressing, Bluetooth Limitations, Zigbee.

**UNIT III:**

**WAP:** The WAP Forum, WAP Service Model, WAP Protocol Architecture, WAP Programming Model, Mobile applications, and Mobile IP, Mobile adhoc networks (MANET) Wireless Routing Protocol, Cluster Switch Gateway Routing (CSGR), Ad Hoc On-Demand Distance Vector Routing (AODV).

**UNIT IV:**

**Satellite Communication:** Overview of Satellite Systems, Orbits and Launching Methods, Geostationary Orbit, Radio Wave propagation, Interference, Satellite Access, Satellites in Networks, Direct Broadcast Satellite (DBS) Television, Satellite Services, INSAT, VSAT

**TEXT BOOKS**

- [1] Cory Beard, William Stallings, Wireless Communication Networks and Systems, Pearson Education, 2015. (Unit I, II)
- [2] William Stallings, Wireless communications and Networks, 2nd Edition, Pearson Education Asia, 2005. (Unit III, IV)

**REFERENCE BOOKS**

- [1] Jochen Schiller, Mobile Communications, 2nd Edition, Addison-Wesley, 2000.
- [2] Chai-KeongToh, Adhoc Mobile Wireless Networks: Protocols and Systems, Addition Wesley, 2002.
- [3] Dennis Roddy, Satellite Communications, Fourth Edition, McGraw hill 2008.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Introduction to Wireless and Cellular Communications,  
[https://onlinecourses.nptel.ac.in/noc21\\_ee66/preview](https://onlinecourses.nptel.ac.in/noc21_ee66/preview)

**20CS7403G****SOFTWARE TESTING METHODOLOGIES**

<b>Course Category:</b>	<b>Program Elective IV</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS6303 Software Engineering	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the basic concepts of testing and defects.	K2	1.2.1,1.7.1,2.5.1, 4.6.3
<b>CO2</b>	Apply path testing, data flow and transaction flow testing.	K3	1.2.1,2.5.1, 2.5.3
<b>CO3</b>	Apply path testing, data flow and transaction flow testing.	K3	1.2.1,2.5.1, 2.5.3
<b>CO4</b>	Apply domain testing, reduction procedure algorithm.	K3	1.2.1,2.8.1, 4.4.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3	1		3									1	
<b>CO2</b>	3	1											1	
<b>CO3</b>	3	1											1	
<b>CO4</b>	1	2		1									1	

**COURSE CONTENT****UNIT I**

**Introduction to Testing as an Engineering Activity:** Role of Process in Software Quality, Testing as a Process, Basic Definitions, Software Testing Principles, The Tester's Role in a software development Organization, Origins of Defects, Defect Classes, The Defect Repository and Test Design, Defect

Examples, Developer/Tester Support for Developing a Defect Repository, Test case design strategies, Test planning.

**Flow graphs and Path testing:** Basics concepts of path testing, predicates, path predicates and Achievable paths, path sensitizing, path instrumentation, application of path testing.

## UNIT II

**Dataflow testing:** Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

**Transaction flow testing:** Transaction flows, Transaction Flow Testing Techniques, Implementation.

## UNIT III

**Domain Testing:** Domains and paths, Nice domains and ugly domains, Domain testing, Domain and Interface testing, Domains and testability.

**Paths, Path products and Regular expressions:** path products and path expression, reduction procedure, applications, regular expressions and flow anomaly detection,

## UNIT IV

**Logic Based Testing:** overview, decision tables, path expressions, KV charts, specifications,

**State, State Graphs and Transition testing:** state graphs, good and bad state graphs, state testing, Transition testing.

## TEXT BOOKS

[1] Ilene Burnstein, “practical software testing”, First Indian Reprint, Springer-Verlag, 2004 [UNIT 1]

[2] Boris Beizer, Software Testing Techniques, 2 ed, Dreamtech  
[UNIT II,III,IV]

## REFERENCE BOOKS

[1] Naresh Chauhan, Software testing: principles and practices, Oxford University Press, 2010.

[2] Perry, Effective Methods of Software Testing, John Wiley

[3] Edward Kit, Software Testing in the Real World. Pearson

## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Software testing Tutorial for Beginners

<https://freevidelectures.com/course/3655/softwaretesting>

[2] Software testing technology

<https://www.techtarrget.com/whatis/definition/software-testing>

## 20CS7404A DEEP LEARNING

<b>Course Category:</b>	<b>Program Elective V</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS6301 Machine Learning	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the fundamentals of Applied Math for deep learning	K2	1.2.1, 1.7.1, 2.8.1
<b>CO2</b>	Apply various Neural Networks in TensorFlow	K3	1.2.1, 1.7.1, 2.8.1, 3.6.2, 4.6.1, 5.4.1
<b>CO3</b>	Understand various Architectures of Deep Networks	K2	1.2.1, 1.7.1, 2.5.2, 5.5.2
<b>CO4</b>	Understand various Tuning techniques for deep networks	K2	1.2.1, 1.7.1, 2.5.2, 5.5.2

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	1											1	1
<b>CO2</b>	1	2	3	2	2								2	2
<b>CO3</b>	1	2			2								1	1
<b>CO4</b>	1	2			2								1	1

## COURSE CONTENT

### UNIT I: INTRODUCTION

**The Math Behind Machine Learning:** Linear Algebra: Scalars, Vectors, Matrices, Tensors, Hyperplanes, Mathematical Operations

**The Math Behind Machine Learning:** Statistics : Probabilities, Distributions,



## Resampling methods

**Implementing Neural Networks in TensorFlow:** TensorFlow, TensorFlow Alternatives, Installing TensorFlow, Creating and Manipulating TensorFlow Variables, TensorFlow Operations, Placeholder Tensors, Sessions in TensorFlow, Navigating Variable Scopes and Sharing Variables, Managing Models over the CPU and GPU, Specifying the Logistic Regression Model in TensorFlow, Logging and Training the Logistic Regression Model Overview of machine learning, linear classifiers

## UNIT II

**Foundations of Neural Networks and Deep Learning:** Neural Networks The Biological Neuron The Perceptron Multilayer Feed-Forward Networks Training Neural Networks Backpropagation Learning

Activation Functions: Sigmoid, Softmax, Rectified Linear Unit

**Loss Functions:** Loss Function Notation, Loss Functions for Regression, Loss Functions for Classification, Loss Functions for Reconstruction

Hyperparameters: Learning Rate, Regularization, Momentum, Sparsity

## UNIT III

### Fundamentals of Deep Networks

Define Deep learning, Deep networks, Common Architectural Principles of Deep Networks, Building Blocks of Deep Networks

**Major Architectures of Deep Networks:** Convolutional Neural Networks (CNNs): CNN Architecture Overview, Layers and Applications of CNNs

**Recurrent Neural Networks:** General Recurrent Neural Network Architecture, LSTM Networks, Applications

## UNIT IV

**Unsupervised Pretrained Networks:** Deep Belief Networks (DBNs) Generative Adversarial Networks (GANs)

**Deep Learning applications:** Image segmentation, Self-Driving Cars, News Aggregation and Fraud News Detection Natural Language Processing, Virtual Assistants, Entertainment, Visual Recognition Fraud Detection, Healthcare.

## TEXT BOOKS

- [1] Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly, 2017.[Unit I,II,III,IV]
- [2] Buduma, Nikhil, and Nicholas Locascio. Fundamentals of deep learning: Designing next generation machine intelligence algorithms. " O'Reilly Media, Inc.", 2017 [Unit I]

**REFERENCE BOOKS**

- [1] Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2017
- [2] Charu C. Aggarwal, “Neural Networks and Deep Learning”, Springer, 2018.
- [3] Gulli, Antonio, and Sujit Pal. Deep learning with Keras. Packt Publishing Ltd, 2017.
- [4] Buduma, Nikhil, and Nicholas Locascio. Fundamentals of deep learning: Designing

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] <https://nptel.ac.in/courses/106/106/106106184/>
- [2] Ian GoodFellow, Introduction to Deep Learning

**20CS7404B**  
**CYBER PHYSICAL SYSTEMS**

<b>Course Category:</b>	<b>Program Elective V</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS4304-Computer Networks	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply Embedded system concepts to solve real word problems.	K3	2.5.2, 2.6.3, 2.6.4, 2.8.4
<b>CO2</b>	Understand solution to automated systems.	K2	2.6.3, 2.6.4, 2.8.3, 2.8.4
<b>CO3</b>	Apply concepts of embedded systems and microcontroller to enhance existing systems.	K3	2.5.2, 2.6.3, 2.6.4, 2.8.4
<b>CO4</b>	Apply concepts and logic to solve unknown problem in research and industry.	K3	2.5.2, 2.6.3, 2.6.4, 2.8.4

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>		3												1
<b>CO2</b>		2												1
<b>CO3</b>		2												1
<b>CO4</b>		2												1

**COURSE CONTENT**

**UNIT I:**

**Introduction:** Cyber-Physical System, Key Features of CPS, Application Domains of CPS, Basic principles of design and validation of CPS, Challenges in CPS.

**UNIT II:**

**CPS Platform components:** CPS HW platforms, Processors, Sensors and Actuators, CPS Network - Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model

**UNIT III:**

**Synchronous and Asynchronous Model:** Reactive Components, Components Properties, Components Composing, Synchronous Designs and Circuits, Asynchronous Processes and operations, Design Primitives in Asynchronous Process, Coordination Protocols in Asynchronous Process, Leader Election, Reliable Transmission.

**UNIT IV:**

**Security of Cyber-Physical Systems:** Introduction to CPS Securities, Basic Techniques in CPS Securities, Cyber Security Requirements, Attack Model and Countermeasures, Advanced Techniques in CPS Securities.

**CPS Application:** Health care and Medical Cyber-Physical Systems, Smart grid and Energy Cyber-Physical Systems, WSN based Cyber-Physical Systems, Smart Cities.

**TEXT BOOKS**

- [1] E. A. Lee and S. A. Seshia, "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", 2011.
- [2]. R. Alur, "Principles of Cyber-Physical Systems," MIT Press, 2015.

**REFERENCE BOOKS**

- [1] Raj Rajkumar, Dionisio de Niz and Mark Klein, "Cyber-Physical Systems", Addison-Wesley, 2017

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] André Platzer, "Lecture Notes on Foundations of Cyber-Physical Systems", Carnegie Mellon University, available @ <https://www.cs.cmu.edu/~aplatzer/course/fcps14/fcps14.pdf>, accessed on 2nd May 2023.
- [2] Dr. Sayan Mitra, "Modeling and verification of Cyber-Physical Systems", IIT GUwahati, available @ <https://www.iitg.ac.in/pbhaduri/GIAN-CPS/>, accessed on 2nd May 2023.

**20CS7404C**  
**BLOCKCHAIN TECHNOLOGY**

<b>Course Category:</b>	<b>Program Elective V</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS6302 Cryptography & Network Security	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the basics of blockchain, Mining, Consensus.	K2	1.7.1
<b>CO2</b>	Analyze the architecture of blockchain and Consensus agreement methods.	K4	1.7.1
<b>CO3</b>	Understand blockchain components with the development tools.	K2	1.7.1, 5.4.1
<b>CO4</b>	Apply various technologies to Integrate Blockchain.	K3	1.7.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3													
<b>CO2</b>	3													
<b>CO3</b>	2				2									
<b>CO4</b>	2													2

**COURSE CONTENT**

**UNIT I**

**Basics of Blockchain:** Introduction, History, Definition of Blockchain, Fundamentals of Blockchain, Characteristics, Public, Private, and Hybrid Blockchains, Distributed Ledger Technologies, Architecture of Blockchain.

**UNIT II**

**Consensus:** Introduction, Consensus Approach, Consensus Algorithms, Byzantine Agreement Methods, Consensus in Trust-Building Exercise.

Mining: Introduction, Mining Nodes, Mining the block, Validating a New Block, Blockchain Forks, Mining Hardware and Software

**UNIT III**

**Blockchain Components:** Introduction, Ethereum, History, Ethereum Virtual Machine, Working of Ethereum, Ethereum Clients, Key Pairs, Addresses, Wallets, Transactions, Development Tools.

**UNIT IV**

**Blockchain Applications:** Smart Contracts, Supply Chain Management, Finance

**Blockchain Allied Technologies:** Cloud Computing, Artificial Intelligence, IoT, Machine Learning, Robotic Process Automation

**TEXT BOOKS**

- [1] A. Sourabh, A. Sexena, "Blockchain Technology: Concepts and Applications", Wiley, 2019.
- [2] Melanie Swan, "Blockchain", O'Reilly, 2nd Ed, 2018

**REFERENCE BOOKS**

- [1] Andreas M. Antonopoulos, "Mastering Bitcoin", O'Reilly, 2nd Ed, 2017.
- [2] Manav Gupta, "Blockchain for Dummies", John Wiley & Sons, 2nd Ed, 2018

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Prof. Sandeep Sukla, IIT Kanpur,  
<https://www.digimat.in/nptel/courses/video/106104220/L01.html> - Accessed on 24-04-2023
- [2] Prof. Sandeep Chakraborty, IIT Kharagpur  
<https://archive.nptel.ac.in/courses/106/105/106105184/>  
 Last Accessed on 17-11-2022

**20CS7404D****VIRTUAL REALITY TECHNOLOGIES AND AR DEVELOPMENT**

<b>Course Category:</b>	<b>Program Elective V</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20ES3102 Java Programming	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the concepts of virtual reality and Communication Media	K2	1.2.1,1.6.1,2.6.1, 2.7.1
<b>CO2</b>	Understand about the human perceptual system.	K2	1.2.1,1.6.1,2.6.1, 2.7.1
<b>CO3</b>	Understand about various input and output devices used in the virtual reality	K2	1.2.1,1.6.1,2.6.1, 2.7.1
<b>CO4</b>	Apply the concepts of Representation and Rendering of the Virtual World.	K3	1.2.1,1.6.1,2.6.1, 2.7.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1	2											1	
<b>CO2</b>	1	2											1	
<b>CO3</b>	1	2											1	
<b>CO4</b>	1	2											1	

**COURSE CONTENT**

**UNIT I**

**INTRODUCTION TO VIRTUAL REALITY (VR):** Defining Virtual Reality, Five key elements of the virtual reality experience, Virtual Reality, Telepresence, Augmented Reality and Cyberspace, History of Virtual Reality.

**VR-THE MEDIUM:** Communicating through a Medium, Communication: Conveyance of Ideas, Common Issues of Human Communication Media.

**UNIT II**

**THE HUMAN IN THE LOOP:** The Human Perceptual System: Sensation-The Physiological Side of Perception, Visual Perception, Aural Perception, Haptic Perception, Vestibular Perception, Olfactory Perception, Gustation Perception, Cross-Sensory Effects and Virtual Reality.

**PRESENCE AND EMBODIMENT:** The Concept of Presence, The Determinants and Responses of Presence, Measuring Presence, Embodiment.

**UNIT III**

**Interfacing the Participant(s) with the Virtual World (INPUT):** Input Technologies-Input Classifications, Position-Tracking Technologies, Using Inputs within a Virtual Reality System-Position Tracking the Body, Physical Input Devices, Body Posture and Gesture Recognition, Speech Recognition (Audio Input).

**INTERFACING THE VIRTUAL WORLD WITH THE PARTICIPANT(S)(OUTPUT):** Visual

Displays-Nonocclusive Head-Based Displays, Smartphone-Virtual Reality Head-Based Displays, Handheld Virtual Reality, Summary of Visual Display Paradigms; Aural Displays-Properties of Aural Displays, Aural Display Paradigms; Haptic Displays-Properties of Haptic Displays, Haptic Display Paradigms, Tactile Haptic Displays, End-Effector Displays.

**UNIT IV**

**PRESENTING THE VIRTUAL WORLD:** Representation of the Virtual World- Verisimilitude, Human Perception, choosing a Mapping, Quantitative and Qualitative Representations; Visual Representation in VR, Aural Representation in VR, Haptic Representation in VR; Rendering Systems-Visual Rendering Systems, Sonic Rendering Systems, Haptic Rendering



Systems.

**THE VIRTUAL REALITY EXPERIENCE:** Immersion, providing the Context, Physical/Sensory Immersion, Mental Immersion, the virtual World: Substance of the Virtual World, Object Modelling and World Layout.

### TEXT BOOKS

[1] William R. Sherman and Alan B. Craig, *Understanding Virtual Reality Interface, Application, and Design*, 2<sup>nd</sup> Edition, Morgan Kaufmann Publishers, Elsevier, 2019.

### REFERENCE BOOKS

- [1] Rajesh K. Maurya, *Computer Graphics with Virtual Reality System*, 3rd Edition, Wiley Publication, 2018.
- [2]. Grigore C. Burdea, Philippe Coiffet, *Virtual Reality Technology*, 2nd Edition, Wiley, 2017.
- [3]. K.S. Hale and K. M. Stanney, *Handbook on Virtual Environments*, 2nd Edition, CRC Press, 2015

### E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1]. Virtual Reality, IIT Madras Prof Steven LaValle <https://nptel.ac.in/courses/106106138> - Accessed on 17-11-2022
- [2]. Dr M. Manivannan, Professor, Department of Applied Mechanics, IIT Madras. <https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/> - Accessed on 17-11-2022

**20CS7404E****ADHOC AND SENSOR NETWORKS**

<b>Course Category:</b>	<b>Program Elective V</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS4304 Computer Networks	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand the concepts, network architectures and applications of ad hoc and wireless sensor networks	K2	1.7.1, 2.6.4
<b>CO2</b>	Analyze the applications and issues related to Wireless ad hoc networks	K4	1.7.1, 2.5.2, 2.6.2
<b>CO3</b>	Understand the working of MAC and Routing Protocols for ad hoc and sensor networks	K2	1.7.1, 2.5.2, 2.6.4
<b>CO4</b>	Analyze the issues related to sensor network implementation	K4	1.7.1, 2.6.3

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	3													1
<b>CO2</b>	2	3												2
<b>CO3</b>	2													1
<b>CO4</b>		2												2

**COURSE CONTENT****UNIT I:**

Fundamentals Of Wireless Communication Technology, The Electromagnetic Spectrum, Radio Propagation Mechanisms, Characteristics of The Wireless Channel

**AD HOC WIRELESS NETWORKS:** Cellular And Ad Hoc Wireless Networks, Applications Of Ad Hoc Wireless Networks, Issues In Ad Hoc Wireless Networks, Ad Hoc Wireless Internet

## **UNIT II:**

**MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS:** Issues In Designing A Mac Protocol For Ad Hoc Wireless Networks, Design Goals Of A Mac Protocol For Ad Hoc Wireless Networks, Classifications Of Mac Protocols

**CONTENTION-BASED PROTOCOLS - MACAW:** A Media Access Protocol for Wireless LANs, Floor Acquisition Multiple Access Protocols, **CONTENTION-BASED PROTOCOLS WITH RESERVATION MECHANISMS** - Distributed Packet Reservation Multiple Access Protocol, Collision Avoidance Time Allocation Protocol, Five-Phase Reservation Protocol

## **UNIT III:**

**ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS:** Issues In Designing A Routing Protocol For Ad Hoc Wireless Networks, Classifications Of Routing Protocols, Table-Driven Routing Protocols - Destination Sequenced Distance-Vector Routing Protocol, Wireless Routing Protocol, On-Demand Routing Protocols - Dynamic Source Routing Protocol, Ad Hoc On-Demand Distance-Vector Routing Protocol, Temporally Ordered Routing Algorithm

## **UNIT IV:**

**WIRELESS SENSOR NETWORKS:** Applications Of Sensor Networks, Comparison With Ad Hoc Wireless Networks, Issues And Challenges In Designing A Sensor Network, Sensor Network Architecture - Layered Architecture, Clustered Architecture, Data Dissemination - Flooding, Gossiping, Rumor Routing, Sequential Assignment Routing, Sensor Protocols For Information Via Negotiation, Data Gathering - Direct Transmission, Power-Efficient Gathering For Sensor Information Systems, Binary Scheme, Mac Protocols For Sensor Networks, Location Discovery

## **TEXT BOOKS**

- [1] C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall Professional Technical Reference, 2008.
- [2] Dargie, Waltenegus, and Christian Poellabauer. Fundamentals of wireless sensor networks: theory and practice. John Wiley & Sons, 2010.

### **REFERENCE BOOKS**

- [1] Carlos De MoraesCordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
- [2] Feng Zhao and LeonidesGuibas, “Wireless Sensor Networks”, Elsevier Publication – 2002.
- [3] Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005
- [4]KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor NetworksTechnology, Protocols, and Applications”, John Wiley, 2007.
- [5] Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Wireless Adhoc and Sensor Netwroks by Prof. Sudip Mishra, IIT KGP  
<https://archive.nptel.ac.in/courses/106/105/106105160/>,  
Last accessed on 03-02-2023

**20CS7404F**  
**M COMMERCE**

<b>Course Category:</b>	<b>Program Elective V</b>	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-0-0
<b>Prerequisites:</b>	20CS3303 Operating Systems	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		<b>BTL</b>	<b>POI</b>
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	Understand about the infrastructure required for building an M-commerce application	K2	5.2.1,5.3.1, 6.1.1, 7.2.1
<b>CO2</b>	Analyze the M-Commerce Technologies.	K4	5.2.1,5.3.1, 6.1.1, 7.2.1
<b>CO3</b>	Understand the secure Electronic transactions	K2	5.2.1,5.3.1, 6.1.1, 8.1.1
<b>CO4</b>	Analyze the Challenges in implementing M Commerce applications	K4	5.2.1,5.3.1, 6.1.1, 7.2.1,8.1.1, 10.3.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>					2	1	1							
<b>CO2</b>					2	1	1							
<b>CO3</b>					1	2		2						1
<b>CO4</b>					1	2	2	2		2				2

**COURSE CONTENT**

**UNIT I**

**ELECTRONIC COMMERCE**

**Traditional commerce and E-commerce** – The Dimensions of E-Commerce – E-Commerce Business Models – E-Commerce information System Function Model

**MOBILE COMMERCE Introduction** – Infrastructure of M- Commerce –

Types Of Mobile Commerce Services – Technologies Of Wireless Business – Benefits And Limitations, Support, Mobile Marketing & Advertisement, Non-Internet Applications In M-Commerce – Wireless/Wired Commerce Comparisons.

## **UNIT II**

### **M COMMERCE: TECHNOLOGY**

**Mobile Clients:** Types –Device limitations – Device location technology

**Mobile Client Software:** Mobile Device Operating System – Micro Browsers – Mobile Device Communication protocols: WAP, Client Side – Server side – WAP, i-Mode – Page Description languages – application Software

**WIRELESS COMMUNICATION TECHNOLOGY:** Wireless wide area network Technology: Cellular Systems – 2G(CDMA, TDMA, GSM) – 2.5G(GPRS, EDGE) – 3G(UMTS, CDMA-2000) – 4G – Wireless LAN (Wi-fi) – WMAN (wi-max) – WPAN(Bluetooth).

## **UNIT III**

**APPROACHES TO SAFE ELECTRONIC COMMERCE:** Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET)

**ELECTRONIC CASH AND ELECTRONIC PAYMENT SCHEMES:** Introduction, Internet Monetary Payment & Security Requirements. Payment and Purchase Order Process, On-line Electronic cash.

**MASTER CARD/VISA SECURE ELECTRONIC TRANSACTION:** Introduction, Business Requirements, Concepts, payment Processing.

## **UNIT IV**

**ADVERTISING ON INTERNET:** Issues and Technologies. Introduction, advertising on the Web, Marketing, Electronic Publishing Issues, Approaches and Technologies: EP and web based EP

### **M-COMMERCE ISSUES**

Technology Issues – Mobile Client Issues – Communication infrastructure Issues – other technology Issues – Application issues – Global m-Commerce issues

### **TEXT BOOKS**

- [1] Norman Sadeh, “ M-Commerce Technologies, Services and Business Models” Wiley publications, 2002.

**REFERENCE BOOKS**

- [1] Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, “E-Commerce fundamentals and applications”, John Wiley.
- [2] Paul May, “Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business” Cambridge University Press March 2001.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] PROF. MAMATA JENAMAN E-Business  
<https://nptel.ac.in/courses/110105083> last accessed on 28-03-2022.
- [2] Lecture Series on Internet Technologies by Prof.I.Sengupta, Department of Computer Science & Engineering, IITKharagpur  
<https://www.youtube.com/watch?v=xKJjyn8DaAw> Last accessed on 28-03-2022.

**20CS7205A****PROGRAMMING IN C++: A HANDS-ON INTRODUCTION  
SPECIALIZATION (OFFERED BY CODIO)**

<b>Course Category:</b>	Open Elective 3	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	0-0 -0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>			
<b>CO2</b>			
<b>CO3</b>			
<b>CO4</b>			

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>														
<b>CO2</b>														
<b>CO3</b>														
<b>CO4</b>														

**COURSE CONTENT**



**TEXT BOOKS****REFERENCE BOOKS****E-RESOURCES AND OTHER DIGITAL MATERIAL**

Note: Open Elective Courses 3 and 4 are self-learning. Students may opt from any MOOCs platform. They have to submit the certificate before the last instruction day of VII semester. Course selection for MOOCs is subject to approval by the Head of the Department.

**20CS7205B****SOCIAL NETWORKS(OFFERED BY NPTEL)**

<b>Course Category:</b>	Open Elective 3	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	0-0 -0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
------------------------	------------	------------

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

<b>CO1</b>			
<b>CO2</b>			
<b>CO3</b>			
<b>CO4</b>			

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>														
<b>CO2</b>														
<b>CO3</b>														
<b>CO4</b>														

**COURSE CONTENT****TEXT BOOKS**

**REFERENCE BOOKS****E-RESOURCES AND OTHER DIGITAL MATERIAL**

**20CS7206A**  
**MASTERING SOFTWARE DEVELOPMENT IN R**  
**SPECIALIZATION(OFFERED BY JOHNS**  
**HOPKINS UNIVERSITY)**

<b>Course Category:</b>	Open Elective 4	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	0-0 -0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
------------------------	------------	------------

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

<b>CO1</b>			
<b>CO2</b>			
<b>CO3</b>			
<b>CO4</b>			

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>														
<b>CO2</b>														
<b>CO3</b>														
<b>CO4</b>														

**COURSE CONTENT**

**TEXT BOOKS****REFERENCE BOOKS****E-RESOURCES AND OTHER DIGITAL MATERIAL**

**20CS7206B****FOUNDATIONS OF R SOFTWARE(OFFERED BY NPTEL)**

<b>Course Category:</b>	Open Elective 4	<b>Credits:</b>	3
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	0-0 -0
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
------------------------	------------	------------

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

<b>CO1</b>			
<b>CO2</b>			
<b>CO3</b>			
<b>CO4</b>			

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>														
<b>CO2</b>														
<b>CO3</b>														
<b>CO4</b>														

**COURSE CONTENT****TEXT BOOKS**

**REFERENCE BOOKS****E-RESOURCES AND OTHER DIGITAL MATERIAL**

**20CS7607****CORPORATE READINESS SKILLS**

<b>Course Category:</b>	Advanced Skill Course	<b>Credits:</b>	2
<b>Course Type:</b>	Lab	<b>Lecture -Tutorial-Practice:</b>	1-0-2
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>			
<b>CO2</b>			
<b>CO3</b>			
<b>CO4</b>			

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>														
<b>CO2</b>														
<b>CO3</b>														
<b>CO4</b>														

**COURSE CONTENT**



**TEXT BOOKS****REFERENCE BOOKS****E-RESOURCES AND OTHER DIGITAL MATERIAL**

## 20CS7551

### MINI PROJECT - II

<b>Course Category:</b>	Project	<b>Credits:</b>	1.5
<b>Course Type:</b>	Lab	<b>Lecture -Tutorial-Practice:</b>	0-0 -3
<b>Prerequisites:</b>	20CS6554 Mini Project – I	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

1. Formulate Domain Analysis, Elaboration through Modeling and Implementation through state of the art technology available.
2. Develop generic and modular programs that includes Handling exceptional cases in providing reliable solutions
3. Testing and verification of programs for different scenarios
4. Conclude findings through oral presentations
5. Prepare proper documentation consisting of Software Requirements Specification (SRS), Modeling Techniques, Development Strategies, Implementation and Testing Strategies. Student may use any Design Methodologies such as SSAD, OOAD and UML
6. Builds the spirit of team work in design process.
7. Become proficient in the programming languages

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	2	2				1					3	2	2
<b>CO2</b>	1	2	2		1		1					3	2	2
<b>CO3</b>				2									2	2
<b>CO4</b>						1			2	2		3	2	2
<b>CO5</b>								2					2	2
<b>CO6</b>								2	2	2	2		2	2

**20CS7552****INDUSTRIAL / RESEARCH INTERNSHIP**

<b>Course Category:</b>	Internship	<b>Credits:</b>	1.5
<b>Course Type:</b>	Lab	<b>Lecture -Tutorial-Practice:</b>	0-0 -3
<b>Prerequisites:</b>	-	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

1. Formulate Domain Analysis, Elaboration through Modeling and Implementation through state of the art technology available.
2. Develop generic and modular programs that includes Handling exceptional cases in providing reliable solutions
3. Testing and verification of programs for different scenarios
4. Conclude findings through oral presentations
5. Prepare proper documentation consisting of Software Requirements Specification (SRS), Modeling Techniques, Development Strategies, Implementation and Testing Strategies. Student may use any Design Methodologies such as SSAD, OOAD and UML
6. Builds the spirit of team work in design process.
7. Become proficient in the programming languages

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	2	2				1					3	2	2
<b>CO2</b>	1	2	2		1		1					3	2	2
<b>CO3</b>				2									2	2
<b>CO4</b>						1			2	2		3	2	2
<b>CO5</b>								2					2	2
<b>CO6</b>								2	2	2	2		2	2

**Note: Industrial/Research Internship six weeks (Mandatory) during summer vacation. The student should undergo internship and parallelly he/she should work on a project with well-defined objectives. A student shall also be permitted to submit project report on the work carried out during the internship. At the end of the VII semester the candidate shall submit an internship completion certificate and a project report.**

## **SEMESTER VIII**

## 20CS8551 MAJOR PROJECT

<b>Course Category:</b>	Project	<b>Credits:</b>	12
<b>Course Type:</b>	Lab	<b>Lecture -Tutorial-Practice:</b>	0-0 -24
<b>Prerequisites:</b>	20CS7551 MINI PROJECT - II	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

1. Formulate a real world problem and develop its requirements
2. Develop and design solution for a set of requirements
3. Test and validate the conformance of the developed prototype against the original requirements of the problem
4. Work as a responsible member and possibly a leader of a team in developing software solutions
5. Express technical and behavioral ideas and thought in oral settings
6. Participate in and possibly moderate, discussions that lead to making decisions
7. Express technical ideas, strategies and methodologies in written form
8. Prepare and conduct oral presentations
9. Self learn new tools, algorithms, and/or techniques that contribute to the software solution of the project
10. Generate alternative solutions, compare them and select the optimum one

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	2	2				1						2	2
<b>CO2</b>	1	2	2		1	2	1	2	2				2	2
<b>CO3</b>	1	2	2		1	2	1	2	2				2	2
<b>CO4</b>						1			3	2	2	2	2	2
<b>CO5</b>								2	3		2		2	2

<b>CO6</b>								<b>2</b>	<b>3</b>		<b>2</b>		<b>2</b>	<b>2</b>
<b>CO7</b>								<b>2</b>	<b>3</b>		<b>2</b>		<b>2</b>	<b>2</b>
<b>CO8</b>								<b>2</b>	<b>3</b>		<b>2</b>		<b>2</b>	<b>2</b>
<b>CO9</b>					<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>		<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO10</b>				<b>2</b>	<b>2</b>							<b>2</b>	<b>2</b>	<b>2</b>

**Note: The student should undergo internship and simultaneously he/she should work on a project with well-defined objectives. At the end of the semester the student should submit an internship completion certificate and a project report.**