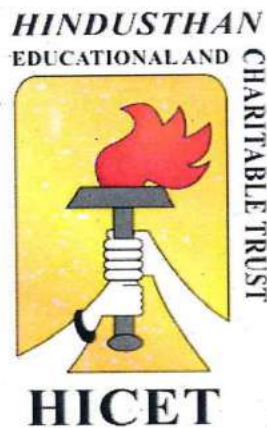


# ***HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY***

(An Autonomous Institution, Affiliated to Anna University, Chennai  
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)  
Coimbatore – 641 032

## **B.E. COMPUTER SCIENCE AND ENGINEERING**



### **Curriculum & Syllabus**

**2020-2021**

**CHOICE BASED CREDIT SYSTEM**

## VISION AND MISSION OF THE INSTITUTION

### VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

### MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

  
**Chairman - BoS  
CSE - HiCET**

  
**Dean (Academics)  
HiCET**



## VISION AND MISSION OF THE DEPARTMENT

### VISION

To provide an excellence for individuals to develop technologically superior, socially conscious and nationally responsible citizens.

### MISSION

DM1: To develop competent Computer Science and Engineering professionals with knowledge in current technology.

DM2: To mould them to attain excellent leadership qualities there by making them excel in their careers.

DM3: To inspire and nurture students to come out with innovation and creativity solutions meeting the societal needs.

  
**Chairman - BoS  
CSE - HiCET**

  
**Dean (Academics)  
HiCET**



## PROGRAM OUTCOMES (POs)

**Engineering Graduates will be able to:**

	<b>Graduate attributes</b>	<b>Descriptions</b>
<b>PO1</b>	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO2</b>	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO3</b>	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.
<b>PO4</b>	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.
<b>PO5</b>	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.
<b>PO6</b>	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
<b>PO7</b>	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.
<b>PO8</b>	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

*J. S. H.*  
**Chairman - BoS  
CSE - HICET**



*[Signature]*  
**Dean (Academics)  
HICET**

<b>PO9</b>	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO10</b>	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.
<b>PO11</b>	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
<b>PO12</b>	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### PROGRAM SPECIFIC OUTCOMES (PSOs)

<b>PSO1</b>	An ability to apply, design and develop principles of software engineering, networking and database concepts for computer-based systems in solving engineering problems.
<b>PSO2</b>	An ability to understand, design and code engineering problems using programming skills.

### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

**PEO1:** To acquire knowledge in the latest technologies and innovations and an ability to identify, analyze and solve problems in computer engineering.

**PEO2:** To be capable of modeling, designing, implementing and verifying a computing system to meet specified requirements for the benefit of society.

**PEO3:** To possess critical thinking, communication skills, teamwork, leadership skills and ethical behavior necessary to function productively and professionally.

  
**Chairman - BoS**  
**CSE - HiCET**



  
**Dean (Academics)**  
**HiCET**

# **CURRICULUM**



# Hindusthan College of Engineering and Technology

(An Autonomous Institution, Affiliated to Anna University, Chennai  
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade),  
Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.



## DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

### CBCS PATTERN

### UNDERGRADUATE PROGRAMMES

### B.E. COMPUTER SCIENCE AND ENGINEERING (UG)

### REGULATION 2016 & 2019

### REGULATION-2019

For the students admitted during the academic year 2020-2021 and onwards

### SEMESTER – I

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1101	Calculus	BS	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices/ICC1	ES	2	0	2	3	50	50	100
6	19EC1154	Basics of Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
<b>PRACTICAL</b>										
7	19HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
8	19HE1072	Career Guidance Level-I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
9	19HE1073	Entrepreneurship and Innovation	EEC	1	0	0	0	100	0	100
<b>MANDATORY</b>										
10	19MC1191	Induction Program	MC	0	0	0	0	0	0	0
<b>Total Credits</b>				<b>16</b>	<b>2</b>	<b>10</b>	<b>20</b>	<b>550</b>	<b>350</b>	<b>900</b>

**SEMESTER II**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2104	Differential Equations and Linear Algebra	BS	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
3	19PH2151	Material Science	BS	2	0	2	3	50	50	100
4	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	19CS2152	Essentials of C and C++ Programming / ICC2	ES	2	0	2	3	50	50	100
6	19ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
<b>PRACTICAL</b>										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
9	19HE2072	Career Guidance Level-II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
<b>Total Credits</b>				<b>14</b>	<b>2</b>	<b>16</b>	<b>22</b>	<b>500</b>	<b>400</b>	<b>900</b>

**Following is the Industry Core Courses (ICC) which will be offered as Choice Based Course in the following semesters**

ICC. No.	Sem. No	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	19CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	19CS2153	Java Fundamentals	2	0	2	3	50	50	100
ICC3	III	19CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	19CS4204	Data Visualization	3	0	0	3	25	75	100
ICC5	IV	19CS4003	Data Visualization Laboratory	0	0	3	1.5	50	50	100
ICC6	V	19CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	19CS6253	Predictive Modeling	3	0	2	4	50	50	100
ICC8	VI	19CS6306	Development of Machine Learning Models	3	0	0	3	25	75	100
ICC9	VII	19CS7306	AI Analyst	3	0	0	3	25	75	100



For the students admitted during the academic year 2019-2020 and onwards

**SEMESTER III**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19MA3104	Discrete Mathematics and Graph Theory	BS	3	1	0	4	25	75	100
2	19CS3201	Data Structures	PC	3	0	0	3	25	75	100
3	19CS3202	Database Management Systems	PC	3	0	0	3	25	75	100
4	19CS3203	Computer Architecture	PC	3	0	0	3	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
5	19CS3251	Digital Principles and System Design	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
6	19CS3001	Data Structures Laboratory	PC	0	0	3	1.5	50	50	100
7	19CS3002	Database Management Systems Laboratory	PC	0	0	3	1.5	50	50	100
<b>MANDATORY</b>										
8	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
<b>Total Credits</b>				<b>17</b>	<b>1</b>	<b>8</b>	<b>20</b>	<b>350</b>	<b>450</b>	<b>800</b>

**SEMESTER IV**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19CS4201	Java Programming	PC	3	0	0	3	25	75	100
2	19CS4202	Software Engineering	PC	3	1	0	4	25	75	100
3	19CS4203	Operating Systems	PC	3	0	0	3	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
4	19MA4151	Probability, Statistics and Queuing Theory	BS	3	0	2	4	50	50	100
5	19CS4251	Design and Analysis of Algorithms	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
6	19CS4001	Java Programming Laboratory	PC	0	0	3	1.5	50	50	100
7	19CS4002	Operating System Laboratory	PC	0	0	3	1.5	50	50	100
<b>MANDATORY</b>										
8	19MC4191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	100	0	100
<b>Total Credits</b>				<b>17</b>	<b>1</b>	<b>10</b>	<b>21</b>	<b>375</b>	<b>425</b>	<b>800</b>

### SEMESTER V

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19CS5201	Theory of Computing	PC	3	1	0	4	25	75	100
2	19CS5202	Computer Networks	PC	3	0	0	3	25	75	100
3	19CS5203	Data mining	PC	3	0	0	3	25	75	100
4	19EC5231	Principles of Microprocessors and Micro Controllers	PC	3	0	0	3	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
5	19CS5252	Object Oriented Analysis and Design	PC	2	0	2	3	50	50	100
6	19CS53**	Professional Elective I	PE	2	0	2	3	50	50	100
<b>PRACTICAL</b>										
7	19CS5001	Engineering Clinic	PC	0	0	3	1.5	50	50	100
8	19EC5031	Principles of Microprocessors and Micro Controllers Laboratory	PC	0	0	3	1.5	50	50	100
<b>MANDATORY COURSES</b>										
9	19HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
<b>Total Credits</b>				<b>18</b>	<b>1</b>	<b>10</b>	<b>24</b>	<b>500</b>	<b>500</b>	<b>1000</b>

### SEMESTER VI

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19CS6181	Principles of Management	HS	3	0	0	3	25	75	100
2	19CS6201	Artificial Intelligence	PC	3	1	0	4	25	75	100
3	19CS6202	Mobile Computing	PC	3	0	0	3	25	75	100
4	19**6401	Open Elective I	OE	3	0	0	3	25	75	100
5	19CS63**	Professional Elective II	PE	3	0	0	3	25	75	100

**THEORY & LAB COMPONENT**

6	19CS6251	Compiler Design	PC	2	0	3	3.5	50	50	100
<b>PRACTICAL</b>										
7	19CS6001	Mobile Application Development Laboratory	PC	0	0	3	1.5	50	50	100
<b>MANDATORY COURSES</b>										
8	19CS6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
9	19HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
10	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
<b>Total Credits</b>				<b>19</b>	<b>1</b>	<b>6</b>	<b>24</b>	<b>425</b>	<b>575</b>	<b>1000</b>

**LIST OF PROFESSIONAL ELECTIVES**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>PROFESSIONAL ELECTIVE I</b>										
1	19CS5351	Internet and Web Technology	PE	2	0	2	3	50	50	100
2	19CS5352	Advanced Java Programming	PE	2	0	2	3	50	50	100
3	19CS5353	Fundamentals of Open Source Software	PE	2	0	2	3	50	50	100
4	19CS5354	R Programming	PE	2	0	2	3	50	50	100
5	19CS5355	Computer Graphics and Multimedia	PE	2	0	2	3	50	50	100

**PROFESSIONAL ELECTIVE II**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19CS6301	Business Intelligence – Data Warehousing and Analytics	PE	3	0	0	3	25	75	100
2	19CS6302	Embedded Systems	PE	3	0	0	3	25	75	100
3	19CS6303	Internet of Things	PE	3	0	0	3	25	75	100
4	19CS6304	Big Data Analytics and Tools	PE	3	0	0	3	25	75	100
5	19CS6305	Soft Computing	PE	3	0	0	3	25	75	100

**OPEN ELECTIVE**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
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**OPEN ELECTIVE - I**

1	19CS6401	Introduction to Java Programming	OE	3	0	0	3	25	75	100
2	19CS6402	Green Computing	OE	3	0	0	3	25	75	100

**REGULATION-2016**

For the students admitted during the academic year 2018-2019 and onwards

**SEMESTER V**

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CS5201	Computer Networks	3	0	0	3	25	75	100
2	16CS5202	Free Open Source Software I	3	0	0	3	25	75	100
3	16CS5203	Computer Architecture	3	0	0	3	25	75	100
4	16CS5204	Theory of Computation	3	0	0	3	25	75	100
5	16CS53XX	<b>Professional Elective – I</b>	3	0	0	3	25	75	100
6	16CS5001	Networks Laboratory	0	0	4	2	50	50	100
7	16CS5002	Open Source Programming Laboratory	0	0	4	2	50	50	100
8	16CS5701	Technical Presentation	0	0	4	2	0	100	100
		<b>TOTAL CREDITS</b>	<b>15</b>	<b>0</b>	<b>12</b>	<b>21</b>	<b>225</b>	<b>575</b>	<b>800</b>

**SEMESTER VI**

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CS6201	Free Open Source Software II	3	0	0	3	25	75	100
2	16CS6202	Compiler Design	3	0	0	3	25	75	100
3	16CS6203	Internet of Things	3	0	0	3	25	75	100
4	16CS6204	Software Quality Assurance	3	0	0	3	25	75	100
5	16CS63XX	<b>Professional Elective – II</b>	3	0	0	3	25	75	100
6	16XX64XX	<b>Open Elective – I</b>	3	0	0	3	25	75	100
7	16CS6001	Open Source Programming Laboratory - II	0	0	4	2	50	50	100
8	16CS6002	Compiler Design Laboratory	0	0	4	2	50	50	100
9	16CS6801	Mini Project	0	0	6	3	50	50	100
		<b>TOTAL CREDITS</b>	<b>18</b>	<b>0</b>	<b>14</b>	<b>25</b>	<b>300</b>	<b>600</b>	<b>900</b>

### LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
<b>ELECTIVE I</b>									
1	16CS5301	Advanced Java Programming	3	0	0	3	25	75	100
2	16CS5302	Visualization Techniques	3	0	0	3	25	75	100
3	16CS5303	Service Oriented Architecture	3	0	0	3	25	75	100
4	16CS5304	Information Storage Management	3	0	0	3	25	75	100
5	16CS5305	TCP/IP Principles and Architecture	3	0	0	3	25	75	100
6	16CS5306	System Software	3	0	0	3	25	75	100
<b>ELECTIVE II</b>									
1	16CS6301	Enterprise Computing	3	0	0	3	25	75	100
2	16CS6302	Social Network Analysis	3	0	0	3	25	75	100
3	16CS6303	Embedded Systems	3	0	0	3	25	75	100
4	16CS6304	Total Quality Management	3	0	0	3	25	75	100
5	16CS6305	Network and Routing Protocols	3	0	0	3	25	75	100
6	16CS6306	Signals and Systems	3	0	0	3	25	75	100

<b>OPEN ELECTIVE</b>									
S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CS6402	Introduction to Java Programming	3	0	0	3	25	75	100

**For the students admitted during the academic year 2017-2018 and onwards  
SEMESTER VII**

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CS7201	Cryptography and Network Security	3	0	0	3	25	75	100
2	16CS7202	Cloud Computing	3	0	0	3	25	75	100
3	16CS7203	Mobile Computing	3	0	0	3	25	75	100
4	16CS73XX	Professional Elective – III	3	0	0	3	25	75	100
5	16CS73XX	Professional Elective – IV	3	0	0	3	25	75	100
6	16XX74XX	Open Elective – II	3	0	0	3	25	75	100

7	16CS7001	Cryptography and Network Security Laboratory	0	0	4	2	50	50	100
8	16CS7002	Cloud Computing Laboratory	0	0	4	2	50	50	100
		<b>TOTAL CREDITS</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>	<b>250</b>	<b>550</b>	<b>800</b>

### SEMESTER VIII

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CS83XX	Professional Elective – V	3	0	0	3	25	75	100
2	16CS83XX	Professional Elective – VI	3	0	0	3	25	75	100
3	16CS8901	Project Work	0	0	24	12	100	100	200
<b>Total Credits:</b>			<b>6</b>	<b>0</b>	<b>24</b>	<b>18</b>	<b>150</b>	<b>250</b>	<b>400</b>

### LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
<b>ELECTIVE III</b>									
1	16CS7301	C# and .NET Programming	3	0	0	3	25	75	100
2	16CS7302	Biometrics	3	0	0	3	25	75	100
3	16CS7303	E-Commerce	3	0	0	3	25	75	100
4	16CS7304	Wireless Sensor Networks	3	0	0	3	25	75	100
5	16CS7305	Data Mining and Warehousing	3	0	0	3	25	75	100
6	16CS7306	Digital Signal Processing	3	0	0	3	25	75	100
<b>ELECTIVE IV</b>									
1	16CS7307	Text Mining	3	0	0	3	25	75	100
2	16CS7308	Soft Computing	3	0	0	3	25	75	100
3	16CS7309	Human Interface System Design	3	0	0	3	25	75	100
4	16CS7310	Artificial Intelligence	3	0	0	3	25	75	100
5	16CS7311	High speed Networks	3	0	0	3	25	75	100
6	16CS7312	Semantic Web	3	0	0	3	25	75	100
<b>ELECTIVE V</b>									
1	16CS8301	Software Project Management	3	0	0	3	25	75	100
2	16CS8302	Web Technology	3	0	0	3	25	75	100

3	16CS8303	Pervasive Computing	3	0	0	3	25	75	100
4	16CS8304	Database Security and Privacy	3	0	0	3	25	75	100
5	16CS8305	R Programming	3	0	0	3	25	75	100
6	16CS8306	Database Tuning	3	0	0	3	25	75	100
<b>ELECTIVE VI</b>									
1	16CS8307	Visual Programming	3	0	0	3	25	75	100
2	16CS8308	Software Testing	3	0	0	3	25	75	100
3	16CS8309	High Performance Computing	3	0	0	3	25	75	100
4	16CS8310	Management Information System	3	0	0	3	25	75	100
5	16CS8311	Engineering Economics	3	0	0	3	25	75	100
6	16CS8312	Big data Analytics	3	0	0	3	25	75	100

<b>OPEN ELECTIVE</b>									
S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CS7403	Foundation Skills in Information Technology	3	0	0	3	25	75	100

(L – Lecture, T –Tutorial, P – Practical, C – Credit, CIA – Continuous Internal Assessments, ESE – End Semester Examinations)

# Continuous Internal Assessment (CIA) only.

\*\*NCM (Non-Credit Mandatory Course)

\$ Audit Course

### CREDIT DISTRIBUTION

#### R2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	24	25	21	25	22	18	187

#### R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

Chairman, Board of Studies

Dean – Academics

Principal

Chairman - BoS  
CSE - HiCET



Dean (Academics)  
HiCET

PRINCIPAL  
Hindusthan College of Engineering & Technology  
COIMBATORE - 641 032

# **SYLLABUS**



PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19HE1101	TECHNICAL ENGLISH	2	1	0	3

Course Objective	Description
	1. To facilitate students to communicate effectively with coherence. 2. To train the learners in descriptive communication. 3. To introduce professional communication. 4. To enhance knowledge and to provide the information on corporate environment. 5. To equip the trainers with the necessary skills on critical thinking.

Unit	Description	Instructional Hours
I	<b>Listening and Speaking</b> – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) <b>Reading</b> –Reading articles from newspaper, Reading comprehension <b>Writing</b> Chart analysis, process description, Writing instructions <b>Grammar and Vocabulary</b> - Tenses, Regular and irregular verb, technical vocabulary.	9
II	<b>Listening and Speaking</b> - listening to product description, equipment & work place (purpose, appearance, function) <b>Reading</b> - Reading technical articles <b>Writing</b> - Letter phrases, writing personal letters, <b>Grammar and Vocabulary</b> -articles, Cause & effect, Prepositions.	9
III	<b>Listening and Speaking</b> - listening to announcements <b>Reading</b> - Reading about technical inventions, research and development <b>Writing</b> - Letter inviting a candidate for interview, Job application and resume preparation <b>Grammar and Vocabulary</b> - Homophones and Homonyms.	9
IV	<b>Listening and Speaking</b> - Practice telephone skills and telephone etiquette (listening and responding, asking questions). <b>Reading</b> - Reading short texts and memos <b>Writing</b> - invitation letters, accepting an invitation and declining an invitation <b>Grammar and Vocabulary</b> - Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.	9
V	<b>Listening and Speaking</b> - listening to technical group discussions and participating in GDs <b>Reading</b> - reading biographical writing - <b>Writing</b> - Proposal writing, Writing definitions, <b>Grammar and Vocabulary</b> - Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9
<b>Total Instructional Hours</b>		<b>45</b>

Course Outcome	Description
	CO1- Trained to maintain coherence and communicate effectively. CO2- Practiced to create and interpret descriptive communication. CO3- Introduced to gain information of the professional world. CO4- acquired various types of communication and etiquette. CO5- Taught to improve interpersonal and intrapersonal skills.

**TEXT BOOKS:**

- T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.  
 T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

**REFERENCE BOOKS :**

- R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.  
 R2- Raymond Murphy, "English Grammar in Use"- 4<sup>th</sup> edition Cambridge University Press, 2004.  
 R3- Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

  
**Chairman - BoS**  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19MA1101	CALCULUS	3	1	0	4

- Course Objective**
1. Understand the concept of differentiation
  2. Interpret in the area of infinite series and their convergence.
  3. Evaluate the functions of several variables which are needed in many branches of engineering.
  4. Understand the concept of double integrals.
  5. Understand the concept of triple integrals.

Unit	Description	Instructional Hours
I	<b>DIFFERENTIAL CALCULUS</b> Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12
II	<b>SEQUENCE AND SERIES</b> Definition and examples – Series – Test for Convergence – Comparison Test – D'Alembert's Ratio Test – Alternative Series – Alembert's Leibnitz test.	12
III	<b>MULTIVARIATE CALCULUS (DIFFERENTIATION)</b> Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
IV	<b>DOUBLE INTEGRATION</b> Double integrals in Cartesian coordinates – Area enclosed by the plane curves (excluding surface area) – Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parelloiped.	12
V	<b>TRIPLE INTEGRATION</b> Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parelloiped.	12
<b>Total Instructional Hours</b>		<b>60</b>

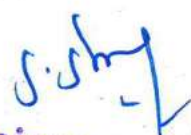
- Course Outcome**
- CO1: Apply the concept of differentiation in any curve.  
CO2: Evaluation of infinite series approximations for problems arising in mathematical modeling.  
CO3: Identify the maximum and minimum values of surfaces.  
CO4: Apply double integrals to compute area of plane curves.  
CO5: Evaluation of triple integrals to compute volume of solids.

**TEXT BOOKS:**

- T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, Wiley India Private Ltd., New Delhi, 2018.  
T2 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

**REFERENCE BOOKS :**

- R1- Thomas & Finney " Calculus and Analytic Geometry" , Sixth Edition,,Narosa Publishing House, New Delhi.  
R2 - Weir,M.D and Joel Hass, ' Thomas Calculus" 12<sup>th</sup> Edition,Pearson India 2016..  
R3 - Grewal B.S, "Higher Engineering Mathematics", 42<sup>nd</sup> Edition, Khanna Publications, Delhi, 2012.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19PH1151	APPLIED PHYSICS	2	0	2	3

The student should B.E. able to

- Course Objective**
1. Enhance the fundamental knowledge in properties of matter
  2. Analysis the oscillatory motions of particles
  3. Extend the knowledge about wave optics
  4. Gain knowledge about laser and their applications
  5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	<b>PROPERTIES OF MATTER</b> Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment. <b>Determination of Young's modulus by uniform B.E.nding method.</b>	6+3=9
II	<b>OSCILLATIONS</b> Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment. <b>Determination of Rigidity modulus – Torsion pendulum.</b>	6+3=9
III	<b>WAVE OPTICS</b> Conditions for sustained Interference – air wedge and it's applications - Diffraction of light – Fresnel and Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. <b>Determination of wavelength of mercury spectrum – spectrometer grating. Determination of thickness of a thin wire – Air wedge method.</b>	6+6=12
IV	<b>LASER AND APPLICATIONS</b> Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO <sub>2</sub> laser- Laser Applications – Holography – Construction and reconstruction of images. <b>Determination of Wavelength and particle size using Laser.</b>	6+3=9
V	<b>FIBER OPTICS AND APPLICATIONS</b> Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- After completion of the course the learner will B.E. able to**
- CO1: Illustrate the fundamental properties of matter
  - CO2: Discuss the Oscillatory motions of particles
  - CO3: Analyze the wavelength of different colors
  - CO4: Understand the advanced technology of LASER in the field of Engineering
  - CO5: Develop the technology of fiber optical communication in engineering field

**TEXT BOOKS:**

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8<sup>th</sup> edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.


**REFERENCE BOOKS:**

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016



  
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Programme BE/B.Tech	Course Code 19CY1151	Name of the Course <b>CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)</b>	L 2	T 0	P 2	C 3
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### Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques.
2. The principles of polymer chemistry and engineering applications of polymers and composites.
3. The principles of electrochemistry and with the mechanism of corrosion and its control.
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
5. The important concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	<b>WATER TECHNOLOGY</b> Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. <b>Estimation of total, permanent and temporary hardness of water by EDTA.</b>	6+3=9
II	<b>POLYMER &amp; COMPOSITES</b> Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
III	<b>ELECTROCHEMISTRY AND CORROSION</b> Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. <b>Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using BaCl<sub>2</sub> and Na<sub>2</sub>SO<sub>4</sub>. Estimation of Ferrous iron by Potentiometry.</b>	6+9 =15
IV	<b>ENERGY SOURCES AND STORAGE DEVICES</b> Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H <sub>2</sub> -O <sub>2</sub> fuel cell applications.	6
V	<b>ANALYTICAL TECHNIQUES</b> Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principle – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. <b>Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).</b>	6+3
<b>Total Instructional Hours</b>		<b>45</b>

### Course Outcome

- CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life
- CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.
- CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design.
- CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities.
- CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

### TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

### REFERENCE BOOKS

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).

R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).

  
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PROGRAMME B.E.	COURSE CODE 19CS1151	NAME OF THE COURSE PYTHON PROGRAMMING AND PRACTICES	L 2	T 0	P 2	C 3
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- Course Objective**
- To know the basics of algorithmic problem solving
  - To read and write simple Python programs
  - To develop Python programs with conditionals and loops and to define Python functions and call them
  - To use Python data structures — lists, tuples, dictionaries
  - To do input/output with files in Python

Unit	Description	Instructional Hours
I	<b>ALGORITHMIC PROBLEM SOLVING</b> Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	9
II	<b>DATA, EXPRESSIONS, STATEMENTS</b> Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments. <i>Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.</i>	7+2(P)
III	<b>CONTROL FLOW, FUNCTIONS</b> Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. <i>Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.</i>	5+4(P)
IV	<b>LISTS, TUPLES, DICTIONARIES</b> Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; <i>Illustrative programs: selection sort, insertion sort, merge sort, histogram.</i>	3+6(P)
V	<b>FILES, MODULES, PACKAGES</b> Files and exception: text files, reading and writing files, format operator; command line arguments, errors, handling exceptions, modules, packages. <i>Illustrative programs: word count, copying file contents.</i>	5+4(P)
<b>Total Instructional Hours</b>		<b>(29 + 16) 45</b>

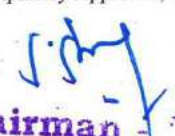
Course Outcome	Description
CO1:	Develop algorithmic solutions to simple computational problems
CO2:	Read, write, execute by hand simple Python programs
CO3:	Structure simple Python programs for solving problems and Decompose a Python program into functions
CO4:	Represent compound data using Python lists, tuples, dictionaries
CO5:	Read and write data from/to files in Python Programs.

#### TEXT BOOKS:

- T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.6.2, Shroff Publishers, First edition (2017).
- T2: S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019

#### REFERENCE BOOKS:

- R1: Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
- R2: Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015
- R3: Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19EC1154	BASICS OF ELECTRON DEVICES AND ELECTRIC CIRCUITS	2	0	2	3

- Course Objective**
- To introduce the fundamental concepts of electrical circuits and theorems.
  - To introduce the concept of circuit transients and resonance.
  - To understand the basics theory, operational characteristics of diodes and transistors.
  - To study the operating principles of special semiconductor devices..
  - To create awareness on the methods for electrical safety and protection.

Unit	Description	Instructional Hours
I	<b>UNIT I : ELECTRICAL CIRCUITS AND ANALYSIS</b> Ohm's law, DC and AC circuits fundamentals, Kirchhoff's laws, Mesh and Nodal analysis- Theorems and simple problems: Superposition, Maximum power transfer theorem - <b>Experimental study -Verification of superposition theorem.</b>	6+3
II	<b>UNIT II : CIRCUIT TRANSIENTS AND RESONANCES</b> Basic RL, RC and RLC circuits and their responses to DC and sinusoidal inputs –frequency response – Parallel and series resonances – Q factor. Experimental verification of series resonance. <b>Experimental study-Determination of Resonance Frequency of Series RLC Circuits</b>	6+3
III	<b>UNIT III : DIODE AND TRANSISTOR</b> Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect– Zener Voltage Regulator. Bipolar Junction Transistor (BJT) Construction – CB, CE, CC Configurations and Characteristics- <b>Experimental study-PN Junction Diode Characteristics,Zener Diode Characteristics</b>	6+3
IV	<b>UNIT IV : SPECIAL SEMICONDUCTOR DEVICES</b> Construction, Characteristics and Applications of FET - UJT – SCR, Photo diode, Photo Transistor -LED and LCD- Implementation of Photo diode application. <b>Experimental study-FET Characteristics</b>	6+3
V	<b>UNIT V : BASICS OF POWER SUPPLY AND ELECTRICAL WIRING</b> Introduction to Power supply circuits: Half wave, Full wave Rectifier –SMPS - UPS (online & offline).Cable and wire types and applications – Two way and three way control- <b>Experimental study- Implementation of simple wiring circuit for a Computer network.</b>	6+3
<b>Total Instructional Hours</b>		<b>45</b>

Course Outcome	CO1:	CO2:	CO3:	CO4:	CO5:
	Apply network theorems for AC and DC Circuits.	Understand the concept of transient response of circuits.	Ability to explain the theory, construction, and operation of diodes and BJT.	Ability to explain the theory, construction, and operation of FET and special semiconductor diodes.	Ability to apply the methods to ensure electrical safety.

**TEXT BOOKS:**

- T1 - W David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5Th Edition,(2008).  
T2 - Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

**REFERENCES BOOKS:**

- R1- M.Robert T. Paynter, "Introducing Electronics Devices and Circuits", PearsonEducation, 7thEducation, (2006).  
R2- J. Millman&Halkins, SatyabrantaJit, "Electronic Devices &Circuits",Tata McGraw Hill, 2<sup>nd</sup> Edition, 2008  
R3 -William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6<sup>th</sup> Edition, 2002.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- I (COMMON TO ALL BRANCHES)	0	0	2	1


Course Objective	
	✓ To enhance student language competency
	✓ To identify individual students level of communication skills
	✓ To develop English Vocabulary and spoken communication skills.
	✓ To revive the fundamentals of English Grammar.

Unit	Description	Instructional Hours
I	<b>Listening</b> Language of Communication- English listening- Hearing Vs Listening- Verbal and Non-verbal communication – Listening strategies-Sounds of English.	3
III	<b>Reading</b> English Language Enhancement – Indianism in English – Role of Reading in effective communication – Techniques for good reading (skimming and scanning) Reading articles from newspaper, magazine. Reading and interpreting a passage.	3
III	<b>Speaking</b> Common errors in Pronunciation – Signposts in English (Role play) – Public Speaking skills – Social Phobia – Eliminating fear – Common etiquette of speaking - Debate and Discuss.	3
IV	<b>Writing</b> Writing genre – Enhancement of basic English Vocabulary; Parts of Speech, Noun, Verbs, and Tenses – combining sentences, sentence formation and completion.	3
V	<b>Art of Communication</b> Communication process – Word building and roleplay – Exercise on English Language for various situations through online and offline activities.	3
<b>Total Instructional Hours</b>		<b>15</b>

Course Outcome	
	CO1- Trained to maintain coherence and communicate effectively.
	CO2- Practiced to create and interpret descriptive communication.
	CO3- Introduced to gain information of the professional world.
	CO4- acquired various types of communication and etiquette.
	CO5- Taught to improve interpersonal and intrapersonal skills.

#### REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma, 9<sup>th</sup> edition, Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis, – Print, 1 June 2011.
3. High School English Grammar by Wren and Martin, S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19HE1072	CAREER GUIDANCE LEVEL I Personality, Aptitude and Career Development None	2	0	0	0

**Course Objectives:**

- Introduce students to building blocks of Logical reasoning and Quantitative Aptitude [SLO 1]
- Train students on essential grammar for placements [SLO 2]
- Introduce students on scientific techniques to pick up skills [SLO 3]
- Provide an orientation for recruiter expectation in terms of non-verbal skills, and for how to build one's career with placements in mind [SLO 4]

**Expected Course Outcome:**

Enable students to approach learning Aptitude with ease, and understand recruiter expectation.

**Student Learning Outcomes (SLO):** 1, 2, 3 and 4

**Module:1 Lessons on excellence** **1 hour** **SLO: 3**  
Skill introspection, Skill acquisition, consistent practice

**Module:2 Logical Reasoning** **7 hours** **SLO: 1**  
**Thinking Skill**

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

**Coding & decoding, Series, Analogy, Odd man out and Visual reasoning**

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

**Sudoku puzzles**

Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

**Attention to detail**

Picture and word driven Qs to develop attention to detail as a skill

**Module:3 Quantitative Aptitude** **8 hours** **SLO: 1**  
**Speed Maths**

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques
- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

**Algebra and functions**

**Module:4 Recruitment Essentials 1 hour SLO: 4**

**Looking at an engineering career through the prism of an effective resume**

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?

**Impression Management**

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behaviour

**Module:5 Verbal Ability 3 hours SLO: 2**

**Essential grammar for placements:**

- Nouns and Pronouns
- Verbs
- Subject-Verb Agreement
- Pronoun-Antecedent Agreement
- Punctuations

**Verbal Reasoning**


**Total Lecture hours: 20 hours**

**Mode of Evaluation:** Assignments, 3 Assessments with End Semester (Computer Based Test)

Recommended by Board of Studies

Approved by Academic Council

Date

  
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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19HE1073	<b>NAME OF THE COURSE</b> ENTREPRENEURSHIP & INNOVATION	<b>L</b> 1	<b>T</b> 0	<b>P</b> 0	<b>C</b> 0
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Course Objective

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
5. To make students understand organizational performance and its importance.

Module	Description	Instructional Hours
--------	-------------	---------------------

- |     |   |  |
|-----|---|--|
| 1.  | Entrepreneurial Thinking                      |  |
| 2.  | Innovation Management                         |  |
| 3.  | Design Thinking                               |  |
| 4.  | Opportunity Spotting / Opportunity Evaluation |  |
| 5.  | Industry and Market Research                  |  |
| 6.  | Innovation Strategy and Business Models       |  |
| 7.  | Financial Forecasting                         |  |
| 8.  | Business Plans/ Business Model Canvas         |  |
| 9.  | Entrepreneurial Finance                       |  |
| 10. | Pitching to Resources Providers / Pitch Deck  |  |
| 11. | Negotiating Deals                             |  |
| 12. | New Venture Creation                          |  |
| 13. | Lean Start-ups                                |  |
| 14. | Entrepreneurial Ecosystem                     |  |
| 15. | Velocity Venture                              |  |

**Total Instructional Hours 15**

Course Outcome

CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.  
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.  
CO3: Remember effectively and efficiently the potential of new business opportunities.  
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..  
CO5: Develop a business model for a new venture, including revenue. Margins, operations, working capital, and investment.

#### TEXT BOOKS

- T1: Arya Kumar "Entrepreneurship – Creating and leading an Entrepreneurial Organization", Pearson, Second Edition (2012).  
T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition(2016).

#### REFERENCE BOOKS

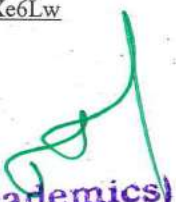
- R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).  
R2: Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017).  
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).

#### WEB RESOURCES

- W1: <https://blof.forgeforward.in/tagged/startup-lessons>  
W2: <https://blof.forgeforward.in/tagged/entrepreneurship>  
W3: <https://blof.forgeforward.in/tagged/minimum-viable-product>  
W4: <https://blof.forgeforward.in/tagged/minimum-viable-product>  
W5: <https://blof.forgeforward.in/tagged/innovation>  
W6: <https://www.youtube.com/watch?v=8vEyL7uKXs&list=PLmP9QrmTNPqBEvKbMSXvwIwn7fdnXe6Lw>

  
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Programme B.E.	Course Code 19CS1152	Name of the Course <b>OBJECT ORIENTED PROGRAMMING USING PYTHON</b> (Common to CSE, IT, ECE and AI&ML)	L 2	T 0	P 2	C 3
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- Course Objective**
1. To read and write simple Python programs.
  2. To develop Python programs with conditionals and loops.
  3. To define Python functions and call them.
  4. To understand OOP concepts and write programs using classes and objects.
  5. To do input/output with files in Python.

Unit	Description	Instructional Hours												
	<b>INTRODUCTION TO PYTHON</b> What is Python - Advantages and Disadvantages, Benefits and Limitation-Downloading and Python-installation-Python Versions-Running Python Scripts, Executing scripts with python launcher-Using interpreter interactively- Using variables-String types: normal, raw and Unicode-String operations and functions- Math operator and functions. <i>Illustrative program: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.</i>	7+2(P)												
I														
	<b>DATA TYPES, STATEMENTS, CONTROL FLOW</b> Data Types(List, Tuple, string, dictionary, set)-Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass. <i>Illustrative programs: Find the square root of a number, To find the given number is Prime or not, Write a Python program which accepts a sequence of comma-separated numbers from user, generate a list and find the sum and average of the numbers.</i>	5+4(P)												
II														
	<b>PYTHON FUNCTIONS</b> Introduction to functions-Global and local variable in python-Decorators in python-Python lamda functions-Exception handling in python. <i>Illustrative programs: Square root, GCD, exponentiation, linear search, binary search, Write a menu driven program to perform the following task: a) A function Sum_DigN() to find the sum of the digits of a given number, b) A recursive function Sum_DigR() to find the same.</i>	5+4(P)												
III														
	<b>PYTHON OOPS</b> Introduction to oops concept-Python class and objects-Constructor in python-Inheritance-Types of inheritance-Encapsulation in python-Polymorphism in python. <i>Illustrative programs: Write a Python program using class for the calculation of telephone bill. The charges for the calls are fixed as follows:</i>	5+4(P)												
IV	<table border="1"> <tr> <td>Unit Call</td> <td>Cost/unit</td> </tr> <tr> <td>Below 100 calls</td> <td>No Charge, only rental amount Rs. 250</td> </tr> <tr> <td>100-150 calls</td> <td>Rs. 1.00</td> </tr> <tr> <td>151-300 calls</td> <td>Rs. 2.50</td> </tr> <tr> <td>301-600 calls</td> <td>Rs. 4.50</td> </tr> <tr> <td>Above 600</td> <td>Rs. 6.00</td> </tr> </table>	Unit Call	Cost/unit	Below 100 calls	No Charge, only rental amount Rs. 250	100-150 calls	Rs. 1.00	151-300 calls	Rs. 2.50	301-600 calls	Rs. 4.50	Above 600	Rs. 6.00	
Unit Call	Cost/unit													
Below 100 calls	No Charge, only rental amount Rs. 250													
100-150 calls	Rs. 1.00													
151-300 calls	Rs. 2.50													
301-600 calls	Rs. 4.50													
Above 600	Rs. 6.00													
	<b>FILES, PACKAGES</b> File handling in python-Open a file in python-How to read from a file in python-writing to file in python-Python numpy-Python pandas. <i>Illustrative programs: How to display the contents of text file in reverse order? Write the code for the same, not exceeding 10 lines of code, Creating Modules and Packages for arithmetic Operations.</i>	5+4(P)												
V														

**Total Instructional Hours**      **45**

<b>Course Outcome</b>	CO1: Understanding the basic concepts to read, write and execute simple python programs.
	CO2: Apply the conditional and looping concepts for solving problems.
	CO3: Apply functions to decompose larger complex programs.
	CO4: Understanding the OOPS concepts and writing programs using classes and objects.
	CO5: Understand to read and write data from/to files in Python Programs.

**TEXT BOOKS:**

T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

**REFERENCE BOOKS:**

- R1: Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
- R2: Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015
- R3: Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19HE2101	BUSINESS ENGLISH FOR ENGINEERS	2	1	0	3

- Course Objective**
1. To introduce to business communication.
  2. To train the students to react to different professional situations.
  3. To make the learner familiar with the managerial skills
  4. To empower the trainee in business writing skills.
  5. To learn to interpret and expertise different content.

Unit	Description	Instructional Hours
I	<b>Listening and Speaking</b> – listening and discussing about programme and conference arrangement <b>Reading</b> –reading auto biographies of successful personalities <b>Writing</b> Formal & informal email writing, Recommendations <b>Grammar and Vocabulary</b> - Business vocabulary, Adjectives & adverbs.	9
II	<b>Listening and Speaking</b> - listening to TED talks <b>Reading</b> - Making and interpretation of posters <b>Writing</b> - Business letters; letters giving good and bad news, Thank you letter, Congratulating someone on a success” <b>Grammar and Vocabulary</b> - Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	9
III	<b>Listening and Speaking</b> -travel arrangements and experience <b>Reading</b> - travel reviews <b>Writing</b> - Business letters (Placing an order, making clarification & complaint letters). <b>Grammar and Vocabulary</b> - Direct and Indirect speech.	9
IV	<b>Listening and Speaking</b> - Role play - <b>Reading</b> - Sequencing of sentence <b>Writing</b> - Business report writing (marketing, investigating) <b>Grammar and Vocabulary</b> - Connectors, Gerund & infinitive.	9
V	<b>Listening and Speaking</b> - Listen to Interviews & mock interview <b>Reading</b> - Reading short stories, reading profile of a company - <b>Writing</b> - Descriptive writing (describing one’s own experience) <b>Grammar and Vocabulary</b> - Editing a passage(punctuation, spelling & number rules).	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1- Introduced to different modes and types of business communication.
  - CO2- Practiced to face and react to various professional situations efficiently.
  - CO3- learnt to practice managerial skills.
  - CO4- Familiarized with proper guidance to business writing.
  - CO5- Trained to analyze and respond to different types of communication.

**TEXT BOOKS:**

- T1 - Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”, Cambridge University Press, 2016.
- T2- Ian Wood and Anne Willams. “Pass Cambridge BEC Preliminary”, Cengage Learning press 2015.

**REFERENCE BOOKS :**

- R1 - Michael Mc Carthy, “Grammar for Business”, Cambridge University Press, 2009.
- R2- Bill Mascull, “Business Vocabulary in use: Advanced 2<sup>nd</sup> Edition”, Cambridge University Press, 2009.
- R3- Frederick T. Wood, “Remedial English Grammar For Foreign Students”, Macmillan publishers, 2001.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19MA2104	DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	3	1	0	4

- Course Objective**
1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications
  2. Extend the knowledge of vector spaces
  3. Describe some methods to solve different types of first order differential equations.
  4. Solve ordinary differential equations of certain types using Wronskian technique.
  5. Use the effective mathematical tools for the solutions of partial differential equation

Unit	Description	Instructional Hours
<b>MATRICES</b>		
I	Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) Cayley - Hamilton Theorem (excluding proof) - Orthogonal matrices – Definition – Reduction of a quadratic form to canonical form by orthogonal transformation.	12
<b>VECTOR SPACES</b>		
II	Complex matrices – Conjugate of the matrix – Hermitian and Skew Hermitian matrices – Properties (without proof) – Unitary matrix – Properties (without proof) - Inner product spaces – Gram – Schmidt orthogonalization.	12
<b>FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS</b>		
III	Equations of the first order and of the first degree – Homogeneous equations – Exact differential equations – Linear equations – Equations reducible to the linear form – Benoulli's equation.	12
<b>ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER</b>		
IV	Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of paramers.	12
<b>PARTIAL DIFFERENTIAL EQUATIONS</b>		
V	Formation of partial differential equations by the elemination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form $f(p,q)=0$ , Clairaut's type : $z = px+qy +f(p,q)$ – Lagrange's linear equation.	12
<b>Total Instructional Hours</b>		<b>60</b>

<b>Course Outcome</b>	CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies
	CO2: Infer the knowledge of vector spaces
	CO3: Apply few methods to solve different types of first order differential equations.
	CO4: Develop sound knowledge of techniques in solving ordinary differential equations.
	CO5: Solve Partial Differential Equations using various methods.

**TEXT BOOKS:**

- T1- Grewal B.S, "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna Publications, Delhi, 2018.  
T2- Howard Anton, Chris Torres, Elements of Linear Algebra with Applications, Wiley, New Delhi, 2<sup>nd</sup> Edition, 2015.

**REFERENCE BOOKS :**

- R1-E. A. Coddington, An Introduction to ordinary Differential Equations, Prentice Hall India, 1995.  
R2 - G.F.Simmons and S. G. Krantz, Differential Equations, Tata McGraw Hill, 2007.  
R3 - Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19PH2151	MATERIAL SCIENCE	2	0	2	3

- Course Objective**
1. Acquire fundamental knowledge of semiconducting materials which is related to the engineering program
  2. Extend the knowledge about the magnetic materials
  3. Explore the behavior of super conducting materials
  4. Gain knowledge about Crystal systems
  5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
I	<b>SEMICONDUCTING MATERIALS</b> Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative). <b>Determination of band gap of a semiconductor. Determination of acceptance angle and numerical aperture in an optical fib.E.r</b>	6+(6)
II	<b>MAGNETIC MATERIALS</b> Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. <b>B – H curve by Magnetic hysteresis experiment.</b>	6+(3)
III	<b>SUPERCONDUCTING MATERIALS</b> Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
IV	<b>CRYSTAL PHYSICS</b> Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
V	<b>ULTRASONICS</b> Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system. <b>Determination of velocity of sound and compressibility of liquid – Ultrasonic wave. Determination of Coefficient of viscosity of a liquid –Poiseuille’s method.</b>	6+(6)
<b>Total Instructional Hours</b>		<b>45</b>

**Course Outcome**

**After completion of the course the learner will B.E. able to**

CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor  
CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday  
CO3: Discuss the behavior of super conducting materials  
CO4: Illustrate the types and importance of crystal systems  
CO5: Evaluate the production of ultrasonics and its applications in NDT

**TEXT BOOKS:**

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.  
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8<sup>th</sup> edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

**REFERENCE BOOKS:**

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015  
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd.,

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CY2151	ENVIRONMENTAL STUDIES	2	0	2	3

**The student should B.E. conversant with**

- Course Objective**
1. The natural resources, exploitation and its conservation
  2. The importance of environmental education, ecosystem and biodiversity.
  3. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
  4. Scientific, technological, economic and political solutions to environmental problems.
  5. An awareness of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	<b>NATURAL RESOURCES</b> Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	6
II	<b>ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY</b> Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem - energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	6
III	<b>ENVIRONMENTAL POLLUTION</b> Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution. <b>Determination of Dissolved Oxygen in sewage water by Winkler’s method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.</b>	6+9=15
IV	<b>SOCIAL ISSUES AND THE ENVIRONMENT</b> From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. <b>Determination of pH in B.E.verages.</b>	6+3=9
V	<b>HUMAN POPULATION AND THE ENVIRONMENT</b> Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. <b>Estimation of heavy metal ion (copper) in effluents by EDTA.</b>	6+3=9
<b>Total Instructional Hours</b>		<b>45</b>

**After the completion of the course, the learner will B.E. able to**

- Course Outcome**
- CO1: Develop an understanding of different natural resources including renewable resources.  
 CO2: Realise the importance of ecosystem and biodiversity for maintaining ecological balance.  
 CO3: Understand the causes of environmental pollution and hazards due to manmade activities.  
 CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.  
 CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment.

**TEXT BOOKS:**

T1- Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

T2 – S.Annadurai and P.N. Magudeswaran, “Environmental studies”, Cengage Learning India Pvt.Ltd, Delhi, 2018

**REFERENCES:**

R1 – Erach Bharucha, “Textbook of environmental studies” University Press (I) Pvt.ltd, Hyderabad, 2015

R2 - G.Tyler Miller, Jr and Scott E. Spoolman“Environmental Science” Thirteenth Edition, Cengage Learning, 2010.

R3 - Gilbert M. Masters and Wendell P. Ela “Introduction to Environmental Engineering and Science”, 3rd edition, Pearson Education, 2013.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS2152	ESSENTIALS OF C AND C++ PROGRAMMING	2	0	2	3

- Course Objective**
1. To Learn and develop basics of C programming
  2. To understand Object Oriented Programming concepts and basic characteristics of C++.
  3. Be familiar with the constructors and operator overloading.
  4. To understand the concepts of inheritance, polymorphism and virtual function
  5. To learn and define concept of templates and exception handling.

Unit	Description	Instructional Hours
I	<p><b>BASICS OF 'C' PROGRAMMING</b>  Fundamentals of 'C' programming – Structure of a 'C' program – Constants - Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations-Branching and Looping - Arrays – One dimensional and Two dimensional arrays.  <i>Programs: 1. Write a C program to calculate sum of individual digits of a given number. 2. Write a C program to count no. of positive numbers, negative numbers and zeros in the array. 3. Write a C program to find sum of two numbers using functions with arguments and without return type.</i></p>	3+6(P)
II	<p><b>BASICS OF 'C++' PROGRAMMING</b>  Introduction to C++ – structures and unions- Object oriented programming concepts– Defining a Class – creating objects - access specifiers – Function in C++ - function and data members default arguments – function overloading – Inline functions - friend functions – constant with class – static member of a class – nested classes – local classes.  <i>Program: Write a C++ program to accept the student detail such as name and 3 different marks by get_data() method and display the name and average of marks using display() method. Define a friend class for calculating the average of marks using the method mark_avg().</i></p>	6+3(P)
III	<p><b>CONSTRUCTOR AND OPERATOR OVERLOADING</b>  Constructors - Default, Copy, Parameterized, Dynamic constructors, Default argument – Destructor. - Function overloading- Operator overloading-Unary, Binary - Binary operators using friend function.  <i>Program: Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere and hence implement the concept of Function Overloading.</i></p>	7+2(P)
IV	<p><b>INHERITANCE AND POLYMORPHISM</b>  Inheritance – Public, Private and Protected derivations– Single– Multiple– Multilevel– Hybrid– Hierarchical - Virtual base class – abstract class – composite objects- Runtime polymorphism – virtual functions – pure virtual functions.  <i>Program: Demonstrate Simple Inheritance concept by creating a base class FATHER with data members SurName and BankBalance and creating a derived class SON, which inherits SurName and BankBalance feature from base class but provides its own feature FirstName and DOB. Create and initialize F1 and S1 objects with appropriate constructors and display the Father &amp; Son details. (Hint : While creating S1 object, call Father base class parameterized constructor through derived class by sending values).</i></p>	7+2(P)
V	<p><b>TEMPLATES AND EXCEPTION HANDLING</b>  Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and Unexpected functions – Uncaught exception.  <i>Program: Write a C++ program to create a template function for Bubble Sort and demonstrate sorting of integers and doubles.</i></p>	7+2(P)
<b>Total Instructional Hours</b>		<b>45(30+15)</b>

**Course  
Outcome**

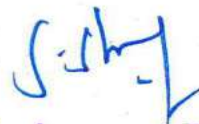
- CO1:**Able to develop simple applications in C using basic constructs.  
**CO2:**Able to apply solutions to real world problems using basic characteristics of C++.  
**CO3:**Able to write object-oriented programs using operator overloading, constructors and destructors.  
**CO4:**Able to develop programs with the concepts of inheritance and polymorphism.  
**CO5:**Able to understand and define solutions with C++ advanced features such as templates and exception handling.

**TEXT BOOKS:**

- T1:**E.Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw HillPublication, 2016.  
**T2:**E.Balagurusamy, "Object Oriented Programming with C++", 7th Edition, McGraw Hill Publication, 2017.

**REFERENCE BOOKS:**

- R1:**Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.  
**R2:**RohitKhurana, "Object Oriented Programming with C++",Vikas Publishing, 2<sup>nd</sup> Edition, 2016.  
**R3:** B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.



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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19ME2154	ENGINEERING GRAPHICS	1	0	4	3

- Course Objective**
- To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
  - To learn about the orthogonal projections of straight lines and planes.
  - To acquire the knowledge of projections of simple solid objects in plan and elevation.
  - To learn about the projection of sections of solids and development of surfaces.
  - To study the isometric projections of different objects.

Unit	Description	Instructional Hours
	<b>PLANE CURVES</b> Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales.	
I	Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
	<b>PROJECTIONS OF POINTS, LINES AND PLANE SURFACES</b> Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method.	
II	Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
	<b>PROJECTIONS OF SOLIDS</b> Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	
III		12
	<b>SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES</b> Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section.	
IV	Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
	<b>ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS</b> Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	
V		12
<b>Total Instructional Hours</b>		<b>60</b>

**COURSE OUTCOMES:**

- CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.  
CO2: Draw the orthogonal projections of straight lines and planes.  
CO3: Interpret the projections of simple solid objects in plan and elevation.  
CO4: Draw the projections of section of solids and development of surfaces of solids.  
CO5: Draw the isometric projections and the perspective views of different objects.

**TEXT BOOK:**

- K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5<sup>th</sup> edition New Age International Publishers, New delhi 2016.
- K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaxmi Publishers, Chennai.

**REFERENCES:**

- Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited, New Delhi 2008.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19ME2001	ENGINEERING PRACTICES	0	0	4	2

**OBJECTIVES:**

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**S.No Description of the Experiments**

**CIVIL AND MECHANICAL ENGINEERING PRACTICES**

- 1 Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
- 2 Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for right angle corner junction.
- 3 Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for T junction.
- 4 Preparation of arc welding of Butt joints, Lap joints and Tee joints.
- 5 Practice on sheet metal Models– Trays and funnels
- 6 Hands-on-exercise in wood work, joints by sawing, planning and cutting.
- 7 Practice on simple step turning, taper turning and drilling.
- 8 Demonstration on Smithy operation.
- 9 Demonstration on Foundry operation.
- 10 Demonstration on Power tools.

**GROUP B (ELECTRICAL)**

**S.No Description of the Experiments**

**ELECTRICAL ENGINEERING PRACTICES**

- 1 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2 Fluorescent lamp wiring.
- 3 Stair case wiring.
- 4 Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
- 5 Measurement of energy using single phase energy meter.
- 6 Soldering practice using general purpose PCB.
- 7 Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
- 8 Study of Energy Efficient Equipment's and Measuring Instruments.

**Total Practical Hours 45**

**COURSE OUTCOME:**

At the end of the course the students shall be able to

**CO1:** Fabricate wooden components and pipe connections including plumbing works.

**CO2:** Fabricate simple weld joints.

**CO3:** Fabricate different electrical wiring circuits and understand the AC Circuits

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II (COMMON TO ALL BRANCHES)	0	0	2	1

- Course Objective
- ✓ To improve communication skills and Professional Grooming.
  - ✓ To impart deeper knowledge of English Language and its practical application in different facets of life.
  - ✓ To equip the techniques of GD, Public Speaking, debate etc.

Unit	Description	Instructional Hours
I	<b>Listening</b> Listening for gist and respond – Listen for detail using key words to extract specific meaning – listen for phonological detail – Listen and identify the main points for short explanations and presentation.	3
II	<b>Reading</b> Strategies for effective reading – read and recognize different text types – Genre and Organization of Ideas – Quantifying reading – reading to comprehend – Interpreting sentences – contrasting, summarizing or approximating	3
III	<b>Speaking</b> Speak to communicate – Make requests and ask questions to obtain personal information – use stress and intonation – articulate the sounds of English to make the meaning understood – speaking to present & Interact – opening and closing of speech.	3
IV	<b>Writing</b> Plan before writing – develop a paragraph: topic sentences, supporting sentences – write a descriptive paragraph – elements of good essay – descriptive, narrative, argumentative – writing emails – drafting resumes – project writing – convincing proposals.	3
V	<b>Language Development</b> Demonstration at level understanding of application of grammar rules – revision of common errors : preposition, tenses, conditional sentences –reference words – pronouns and conjunctions.	3
<b>Total Instructional Hours</b>		<b>15</b>

- Course Outcome
- CO1- Introduced to different modes and types of communication.
  - CO2- Practiced to face and react to various professional situations efficiently.
  - CO3- learnt to practice managerial skills.
  - CO4- Familiarized with proper guidance to writing.
  - CO5- Trained to analyze and respond to different types of communication.

#### REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma, 9<sup>th</sup> edition, Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis, – Print, 1 June 2011.
3. High School English Grammar by Wren and Martin, S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.

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<b>Course code</b>	<b>Course title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
19HE2072	CAREER GUIDANCE LEVEL II	2	0	0	0
<b>Pre-requisite</b>	Personality, Aptitude and Career Development	<b>Syllabus version</b>			
	None	1			

**Course Objectives:**

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]

**Expected Course Outcome:**

Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

**Student Learning Outcomes** 6, 7, 8  
(SLO):

**Module:1 Logical Reasoning** **5 hours** **SLO: 6**

**Word group categorization questions**

Puzzle type class involving students grouping words into right group orders of logical sense

**Cryptarithmic**

**Data arrangements and Blood relations**

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

**Module:2 Quantitative Aptitude** **8 hours** **SLO: 7**

**Ratio and Proportion**

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

**Percentages, Simple and Compound Interest**

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

**NumB.E.r System**

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

**Module:3 Verbal Ability** **7 hours** **SLO: 8**

**Essential grammar for placements**

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives



**Reading Comprehension for placements**

- Types of questions
- Comprehension strategies
- Practice exercises

**Articles, Prepositions and Interrogatives**

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

**Vocabulary for placements**

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

**Total Lecture hours: 20 hours**

**Mode of Evaluation:** Assignments, 3 Assessments with End Semester (Computer Based Test)

Recommended by Board of  
Studies

Approved by Academic  
Council

Date

  
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<b>Programme B.E.</b>	<b>Course Code 19CS2153</b>	<b>Name of the Course JAVA FUNDAMENTALS (COMMON TO CSE, ECE AND AI&amp;ML)</b>	<b>L 2</b>	<b>T 0</b>	<b>P 2</b>	<b>C 3</b>
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- Course Objective**
1. To Understand the Basics of java Programming.
  2. To discuss the packages and interfaces in java programming
  3. To learn IO streams and multithreading in java
  4. To learn generics and collections framework in java
  5. To understand event handling and swing in java

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>INTRODUCTION TO JAVA</b>	
I	JAVA-History of JAVA-Features of JAVA-Hello worlds java program-Setting path-JDK, JRV and JVM-JAVA variables-JAVA data types-Keywords-Operators. <i>Illustrative Programs: Java program to swap two numbers using bitwise operator, Java program to find the smallest three numbers using ternary operator.</i>	5+2(P)
	<b>CONTROL STATEMENTS</b>	
II	Introduction to control statements in programming-If-else-switch-for loop-while loop-do while loop-Break-continue-JAVA comments. <i>Illustrative programs: Find the square root of a number , To determine leap year or not, Java program to find the factorial of number using recursion, Create Generic number calculator using Java.</i>	5+6(P)
	<b>JAVA POLYMORPHISM</b>	
III	Introduction to polymorphism concepts-Method overloading-Method overriding-Covariant return type-Super keyword-Instance Initializer block-final keyword- Runtime polymorphism-Dynamic binding-Instance of operator-Abstract class-interface-abstract Vs interface. <i>Illustrative programs: Method overriding, Abstract classes.</i>	7+2(P)
	<b>ENCAPSUALATION, ARRAY</b>	
IV	Java encapsulation-package-access modifier-Encapsulation-Object cloning- call by value-Java array concepts-Single dimension array-Multi dimension array. <i>Illustrative programs: Java program to check the whether the input character is vowels or not</i>	7+2(P)
	<b>FILES, PACKAGES</b>	
V	File handling in python-Open a file in JAVA-How to read from a file in JAVA-writing to file in JAVA-Exception handling-Java swing-java applet-Java AWT and events-Java collection. <i>Illustrative programs: Find the most frequent words in a text read from a file, Linked List implementation using collections, Program that handles all mouse events, Program using swing.</i>	5+4(P)
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Understanding the OOPS and basic concepts of Java.  
CO2: Understand how to program using user defined packages and interfaces.  
CO3: Apply multithreading concepts based on appropriate problems.  
CO4: Understand generics and collections framework in java  
CO5: Apply event handling classes and swing concepts to create different applications in java

**TEXT BOOKS:**

- T1: Herbert Schildt, "The complete reference java 2", 11th edition, McGraw – Hill 2019.  
T2: "Core Java 2", Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education

**REFERENCE BOOKS:**

- R1: E.Balagurusamy, "Programming with java A Primer", fifth edition, McGraw – Hill 2014.  
R2: H.M.Deitel, P.J.Deitel, "Java: how to program", Eleventh edition, Prentice Hall of India private limited, 2017.

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# **SYLLABUS**

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19MA3104	DISCRETE MATHEMATICS AND GRAPH THEORY (CSE)	3	1	0	4
Course Objective		1. Illustrate logical theory and proportional calculus techniques that will create logical thinking. 2. Generate counting problems using mathematical induction, inclusion and exclusion principles. 3. Examine the Boolean algebra which is used in the Boolean logics and circuits. 4. Describe the basic knowledge of graph theory which is applied in Computer networks. 5. Recognize the concepts of trees in computer engineering.				

Unit	Description	Instructional Hours
	<b>MATHEMATICAL LOGIC</b>	
I	Propositional logic - Tautology and Contradiction - Propositional equivalences - Normal forms - Principal normal forms - Theory of Inference.	12
	<b>COMBINATORICS</b>	
II	Mathematical induction – Recurrence relations – Solving linear recurrence relations - generating functions – principle of inclusion and exclusion – applications.	12
	<b>LATTICES AND BOOLEAN ALGEBRA</b>	
III	Lattices – Properties of lattices – Lattices as algebraic system – Sub lattices - some special lattices – Boolean algebra – Definition and simple properties.	12
	<b>GRAPHS</b>	
IV	Graphs – introduction – types of graphs – matrix representation of graphs – paths, cycles connectivity – connectedness in undirected graphs – Euler and Hamiltonian graphs – connectedness in directed graphs.	12
	<b>TREES</b>	
V	Trees – properties of trees –spanning tree – minimum spanning tree – Rooted and binary trees – properties of binary trees - spanning trees in a weighted graph.	12

**Total Instructional Hours**

Course Outcome	CO1: Evaluate the notion of mathematical thinking, mathematical proofs, and algorithmic thinking and be able to apply them in problem solving.
	CO2: Solve problems using counting techniques and recurrence relations.
	CO3: Understand the knowledge about Lattices and Boolean Algebra.
	CO4: Apply the properties of graphs and related discrete structures in computer networks.
	CO5: Analyze the various types of trees and their properties.

**TEXT BOOKS:**

- T1 - Discrete Mathematics with proof-Eric Gossett-2<sup>nd</sup> Edition 2018.  
 T2- Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, Delhi, 2016.

**REFERENCE BOOKS :**

- R1 - T.Veerarajan, "Discrete Mathematics with Graph Theory and Combinatorics", Tata. McGraw-Hill Education, 15<sup>th</sup> reprint, 2012  
 R2 - Kenneth H.Rosen, "Discrete Mathematics and its Applications", seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2013.  
 R3 - Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications,2010.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS3201	DATA STRUCTURES	3	0	0	3

Unit	Description	Instructional Hours
	<p>1. Understand the fundamental concepts of Programming such as Pointers, Structures and union.</p> <p>2. Understand the concept of various linear data structures like list, stack and queue.</p> <p>3. Understand the various non-linear data structures like binary tree, binary search tree, AVL, splay tree and red black tree.</p> <p>4. Understand the concepts of Sorting, Searching and Hashing techniques</p> <p>5. Understand graph algorithms such as shortest path and minimum spanning tree</p>	
	<b>FUNDAMENTAL CONCEPTS OF PROGRAMMING</b>	
I	Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.	7
	<b>BASIC DATA STRUCTURES</b>	
II	List ADT-Single Linked List-Doubly Linked List-Circular Linked List-Polynomial Addition. Stack ADT-Array Based Implementation-Linked List Implementation-Applications of Stack-Infix to Postfix Conversion, Postfix Evaluation, Matching Parentheses. Queue ADT- Array Based Implementation-Linked List Implementation-Double Ended Queue.	10
	<b>TREES</b>	
III	Tree ADT-Binary Tree-Tree Traversal Algorithms-Search Tree: Binary Search Tree-AVL Tree-Splay Tree-B+ trees-Red-Black Tree. Priority Queues- Binary Heap	9
	<b>SORTING AND SEARCHING</b>	
IV	<b>Sorting Algorithms</b> -Insertion Sort, Bubble Sort, Selection Sort, Radix sort– Shell Sort-Merge Sort-Quick Sort- <b>Searching Algorithm</b> : Linear Search-Binary Search. <b>Hashing</b> - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.	9
	<b>GRAPHS</b>	
V	Graph ADT- Representation of Graphs-Graph Traversals-Topological Sort- Shortest Paths-Dijkstra’s Algorithm-Network Flow Problem- Minimum Spanning Trees- Prims-Algorithm-Kruskal’s Algorithm- Applications of Depth-First Search-Biconnectivity-Euler Circuits. Introduction to NP-Completeness.	10
<b>Total Instructional Hours</b>		<b>45</b>

Course Outcome	CO1: Develop applications in C using pointers, structures and unions.	CO2: Acquire knowledge the most common abstractions for data collections (e.g., stacks, queues, lists).	CO3: Use non linear data structures such as trees to solve problems.	CO4: Apply Algorithms for solving problems like sorting and searching.	CO5: Apply Graph algorithms to find the shortest path cost.

**TEXT BOOKS:**

T1: Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016.


T2: Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 1997.

**REFERENCE BOOKS:**

R1: Aaron M. Tenenbaum, Yeediyah Langsam, Moshe J. Augenstein, ‘Data structures using C’, Pearson Education, 2008.

R2: Stephen G. Kochan, “Programming in C”, Fourth edition, Pearson Education, 2015.

R3: Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS3202	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

- Course Objective**
- To learn the data models, conceptualize and depict a database system using E-R diagram.
  - To learn SQL and relational database design.
  - To understand various normal forms
  - To understand the internal storage structures using different file and indexing techniques.
  - To know the concepts of transaction processing, concurrency control techniques and recovery procedure

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Introduction: Database system application, purpose of database system - View of Data –Database Languages- Data Storage and Querying-Database Architecture – Database design and E-R model: Overview of the design process- The Entity – Relationship Model-Constraints- Removing redundant attributes in Entity Sets- Entity – Relationship Diagram- Reduction to Relational Schemas-Entity Relationship Design Issues.	9
	<b>RELATIONAL MODEL AND DATABASE DESIGN</b>	
II	Introduction to Relational Model – Formal Relational Query Languages - Introduction to SQL: Data definition Basic structure of SQL Queries-Additional Basic operations - Set operations-Aggregate functions-Nested sub queries- Intermediate SQL: Joins- Views – Integrity Constraints.	9
	<b>DATABASE DESIGN AND NORMAL FORMS</b>	
III	Functional Dependencies – Normal Forms Based on primary Keys- General Definition of Second and Third Normal Form - Boyce Codd Normal Form – Algorithms for relational database schema design - Multivalued dependencies and Fourth Normal Form.	9
	<b>DATA STORAGE AND QUERY PROCESSING</b>	
IV	Overview of Physical Storage Media – Magnetic disk Flash storage- RAID - File and Record Organization –Indexing and Hashing: Ordered Indices – B + Tree Index File- Static Hashing – Dynamic Hashing- Query Processing: Overview - measures of Query Cost.	9
	<b>TRANSACTION MANAGEMENT</b>	
V	Transactions: Transaction concept– Transaction Atomicity and Durability- Transaction Isolation – Serializability -Transaction Isolation and Atomicity - Transaction Isolation levels- Implementation of Isolation Levels – Concurrency Control: Lock based protocols - Deadlock handling - Multiple Granularity - Time stamp based protocols – Recovery system: Failure classification – Storage - Recovery and atomicity – Recovery Algorithms.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Construct an Entity Relationship (ER) diagram for an application.  
CO2: Create a normalized relational database model and write queries to generate reports from it.  
CO3: Determine whether the transaction satisfies the ACID properties.  
CO4: Apply various storage organization and query processing  
CO5: Design various protocols and algorithms to manage the transactions and concurrency control

**TEXT BOOKS:**

- T1- Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata Mc Graw Hill, 2011.  
T2- Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education, 2008.

**REFERENCE BOOKS :**

- R1 - C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.  
R2- Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, Tata Mc Graw Hill, 2010.  
R3- Rob Cornell, “Database Systems Design and Implementation”, Cengage Learning, 2011.  
R4- Atul Kahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.  
R5- Alexis Leon and Mathews Leon, “Database Management Systems”, Vikas Publishing House Private  
R6- G.K.Gupta, “Database Management Systems”, Tata Mc Graw Hill, 2011

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	P	T	C
B.E.	19CS3203	COMPUTER ARCHITECTURE	3	0	0	3

- Course Objective**
1. To conceptualize the basic structure and operations of a digital computer.
  2. To study the design of arithmetic and logic unit and implementation of fixed-point and floating-point arithmetic operations.
  3. To understand the basic design principles of Pipelining for CPU performance improvement.
  4. To develop a deeper understanding of parallel processors and multi-core processors.
  5. To familiarize the concepts of hierarchical memory system, cache memories, virtual memories, I/O Communication, Interrupts and Standard Interfaces.

Unit	Description	Instructional Hours
	<b>BASIC STRUCTURE OF A COMPUTER SYSTEM</b>	
I	Functional Units –Basic Operational Concepts-Performance – Instructions: Language of the Computer – Operations, Operands – Representing Instructions– Logical operations – Decision making – MIPS Addressing.	9
	<b>ARITHMETIC FOR COMPUTERS</b>	
II	Addition and Subtraction – Multiplication – Division – Floating Point- Floating Point Representation – Floating Point Operations – Subword Parallelism	8
	<b>PROCESSOR AND CONTROL UNIT</b>	
III	Basic MIPS implementation – Building Datapath – Control Implementation Scheme – Pipelining –Pipelined Datapath and Control – Handling Data hazards & Control hazards – Exceptions	10
	<b>PARALLEL PROCESSORS</b>	
IV	The Difficulty of Creating Parallel Processing Programs – Flynn’s Classification-SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing	9
	<b>MEMORY AND I/O SYSTEMS</b>	
V	Memory Hierarchy - Memory Technologies – Cache Memory – Measuring and Improving Cache Performance – Virtual Memory, TLB’s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus Structure – Bus Operation – Arbitration – Interface Circuits - USB	9
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- CO1: Understand the basics structure of computers, operations and instructions  
CO2: Practice the arithmetic operations performed by ALU.  
CO3: Design and analyze pipeline for consistent execution of instructions with hazards.  
CO4: Explain the structure of parallel processing architectures  
CO5: Demonstrate knowledge about state-of-the-art I/O, memory , Interrupts and Interfaces

**TEXT BOOKS:**

- T1: David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.  
T2: Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, fifth Edition, Tata McGraw Hill, 2014

**REFERENCE BOOKS:**

- R1: William Stallings, Computer Organization and Architecture, Pearson Education, 2016.  
R2: John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2017 Paperback version.  
R3: John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Sixth Edition, 2019 Paperback version.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS3251	DIGITAL PRINCIPLES AND SYSTEM DESIGN (Common to CSE and IT)	3	0	2	4

- Course Objective**
- To understand different methods used for the simplification of Boolean functions.
  - To study combinational circuits.
  - To learn synchronous sequential circuits.
  - To understand asynchronous sequential circuits.
  - To study the fundamentals of HDL.

Unit	Description	Instructional Hours
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**MINIMIZATION TECHNIQUES**

I	Number systems: Decimal, Binary, Octal, Hexadecimal-Number-Base conversion-Complements of Numbers: 1's and 2's complements- Boolean algebra and laws-De-Morgan's Theorem-Principle of Duality-Minimization of Boolean expressions – Minterm – Maxterm – Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions (2variable, 3variable & 4-variable)-Tabulation method.	10
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**COMBINATIONAL CIRCUITS**

II	Circuits for arithmetic operations: adder: Half adder, Full adder, subtractor: Half subtractor, Full subtractor-BCD adder-Magnitude comparator-Encoders, Decoders-Multiplexers, Demultiplexers, Code converters: Binary to Gray, Gray to Binary <i>1. Experimental Design and implementation of Half Adder &amp; Half Subtractor.</i> <i>2. Experimental Design and implementation of Binary to Gray and Gray to Binary Conversion.</i> <i>3. Experimental Design and implementation of Multiplexers and Demultiplexers</i>	9+6(P)
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**SYNCHRONOUS SEQUENTIAL CIRCUITS**

III	Flip flops: SR, JK, D, T - Design of synchronous sequential circuits: State diagram - State table - State minimization - State assignment. Shift registers: SISO, SIPO, PIPO, PISO – Counters: BCD, Up down counter. <i>Experimental Design and implementation of Synchronous and Asynchronous Counters</i>	9+4(P)
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**ASYNCHRONOUS SEQUENTIAL CIRCUITS**

IV	Analysis and design of asynchronous sequential circuits-Reduction of state and flow tables– Race-free state assignment–Hazards.	9
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**HARDWARE DESCRIPTION LANGUAGE**

V	Introduction to Hardware Description Language (HDL)- HDL for combinational circuits- Half adder, Full adder, Multiplexer, De-multiplexer, HDL for Sequential Circuits- Flip flops, Synchronous and Asynchronous Counters, Registers. <i>1. Coding Combinational/Sequential circuits using HDL</i>	9+4(P)
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**Total Instructional Hours 60**

- Course Outcome**
- CO1: Simplify Boolean functions using different methods  
CO2: Analyse, design and implement combinational logic circuits  
CO3: Analyse, design and implement Synchronous sequential logic circuits  
CO4: Analyse, design and implement Asynchronous sequential logic circuits  
CO5: Simulate and implement combinational and sequential circuits using HDL

**TEXT BOOKS:**

T1 Morris Mano M. and Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL", V Edition, Pearson Education, 2013. ISBN-13: 978-0-13-277420-8

**REFERENCE BOOKS :**

R1-.S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", Fourth Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012. ISBN: 978-93-259-6041-1

R2-.Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2013

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS3001	DATA STRUCTURES LABORATORY	0	0	3	1.5

- Course Objective**
1. To learn the methodical way of solving problem.
  2. To comprehend the different methods of organizing large amount of data.
  3. To efficiently implement the different data structures.

**S. No. Description Of The Experiments**

- 1 a) Singly linked list  
b) Doubly linked list
- 2 a) Implementation of Stack using linked list.  
b) Implementation of Queue using linked list.
- 3 a) Infix expression into its postfix Equivalent.  
b) Implementation of deque using linked lists.
- 4 Binary search tree and traversal.
- 5 AVL tree.
- 6 Heaps using priority queue.
- 7 Hashing.
- 8 Implement the following sorting algorithms  
a) Merge Sort  
b) Quick Sort
- 9 Implementation of the following graph traversal algorithms:  
a) Depth first traversal  
b) Breadth first traversal
- 10 Minimum spanning tree using prim's and kruskal's algorithm.

**Total Practical Hours: 45**

- Course Outcome**
- CO1: Apply good programming design methods for program development.
- CO2: Apply the different data structures for implementing solutions to practical problems.
- CO3: Develop recursive programs using trees and graphs.



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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS3002	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	3	1.5

- Course Objective**
1. To understand data definitions and data manipulation commands.
  2. To learn the use of nested and join queries
  3. To understand views and constraints
  4. To understand functions, procedures and procedural extensions of data bases
  5. To understand design and implementation of typical database applications

S. No.	Description Of The Experiments
1	Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables
2	Data Control and Transaction Control statements
3	Database Querying – Simple queries, Nested queries, Sub queries and Joins
4	Integrity Constraints
5	Views, Sequences, Synonyms
6	Database Programming: Implicit and Explicit Cursors
7	Procedures and Functions
8	Triggers
9	Exception Handling
10	Development of mini-projects with front end of your choice.

**Total Practical Hours: 45**

For the above experiments consider real time scenarios like

1. A new supermarket will be opened in 3 months. The owner wants to have a software to manage the supermarket data (inventory, customers, sales,...). Design a database to insert, retrieve, update data. ex. When a product is sold to a customer, the database changes may need to be done reducing the inventory. Real world need for creating views. Provide different Users different roles for separate DB.
2. Design database for university which should include details about student, faculty, course, department. Create, populate the database, perform updates and retrieval. Create views and triggers that does not allow manipulation during holidays. Provide different privileges to different users

Course Outcome	CO1: Use typical data definitions and manipulation commands
	CO2: Design applications to test Nested and Join Queries
	CO3: Implement simple applications that use Views
	CO4: Critically analyze the use of Tables, Views, Functions and Procedures
	CO5: Implement applications that require a Front-end Tool

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19MC3191	INDIAN CONSTITUTION	2	0	0	0

**COURSE OBJECTIVES**

1. Sensitization of student towards self, family (relationship), society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
3. Strengthening of self reflection.
4. Development of commitment and courage to act.

UNIT	DESCRIPTIVE	INSTRUCTIONAL HOURS
<b>UNIT I : BASIC FEATURES AND FUNDAMENTALE PRINCIPLES</b>		<b>4</b>

Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.

<b>UNIT II : FUNDAMENTAL RIGHTS</b>	<b>4</b>
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Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.

<b>UNIT III : PARLIAMENTARY FORM OF GOVERNMENT</b>	<b>4</b>
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The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions : National emergency, President rule, Financial emergency.

<b>UNIT IV: LOCAL GOVERNANCE</b>	<b>4</b>
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Local self government -constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article19 – scope of the right to life and personal liberty under article 21.

<b>UNIT V : INDIAN SOCIETY</b>	<b>4</b>
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Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

**TOTAL INSTRUCTIONAL HOURS: 20**

**OUTCOMES:**

1. Understand the history of Indian Constitution.
2. Understand the fundamental rights and amendment of Government.
3. Understand the functions of the Indian government.
4. Understand and abide the rules of the Indian constitution.
5. Understand the various constitutional schemes of Indian government.

**TEXT BOOKS:**

- T1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
- T2. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
- T3. Maciver and Page, "Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
- T4. K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

**REFERENCE BOOKS:**

- R1. Sharma, Brij Kishore, "Introduction to the Constitution of India: Prentice Hall of India, New Delhi.
- R2. U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
- R3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS4201	JAVA PROGRAMMING	3	0	0	3

- Course Objective**
1. Learn the basics of java programming language
  2. Discuss the packages and interfaces in java programming
  3. Learn IO streams and multithreading in java
  4. Learn generics and collections framework in java
  5. Understand event handling and swing in java

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> Review of Object oriented programming-Introduction to java programming-Features of Java Language, JVM -The Java Environment-Primitive Data types-variables-arrays-control statements-classes and objects-access specifier-methods-constructor-finalize method-strings-Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes.	9
I	<b>INTERFACES AND PACKAGES</b> Interfaces-Defining an interface-implementing an interface-applying interface-variables in interface-extended interface-- Packages-defining package-access protection-importing packages - Exception Handling-exception types-uncaught exception-multiple catch-nested try-throw and finally-built-in exceptions-user defined exception.	9
II	<b>IO STREAMS AND MULTITHREAD</b> I/O basics-reading console input-writing console output-reading and writing files-Serialization-Multithreaded programming-java thread model-thread priorities-synchronization-thread class and runnable interface-creating multiple threads- inter thread communication.	9
III	<b>GENERIC AND COLLECTIONS FRAMEWORK</b> Generics- simple Generic example-Generic class with parameters-The General Form of a Generic Class-Bounded Types-Creating Generic method-Generic interfaces- Generic class hierarchies-Generic restrictions. Collections overview-interfaces-classes-an iterator.	9
IV	<b>EVENT HANDLING AND SWING</b> Window fundamentals-layout managers-working with 2D shapes-Using color, fonts and images-The Delegation Event Model-Event Classes-The ActionEvent Class-The AdjustmentEvent Class-The ComponentEvent Class- -The KeyEvent Class- The MouseEvent Class -Event Listener Interfaces-The ActionListener Interface-The AdjustmentListener Interface-The ComponentListener Interface- The KeyListener Interface - The MouseListener Interface- The MouseMotionListener Interface -Introduction to Swing-Swing components-Text Fields, Text Areas-Buttons-Check Boxes-Radio Buttons-Lists-Choices-Scrollbars-windows-Menus-Dialog Boxes.	9
V		
<b>Total Instructional Hours</b>		<b>45</b>

**Course Outcome**

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


CO1: To Understand the Basics of java Programming  
CO2: Design program using user defined packages and interfaces  
CO3: Develop applications using multithreading concepts in java  
CO4: Design real time applications using generics and collection frameworks.  
CO5: Apply event handling classes and swing concepts to create different applications in java

**TEXT BOOKS:**

- T1 Herbert Schildt, "The complete reference java 2", 11<sup>th</sup> edition, McGraw – Hill 2019.
- T2 "Core Java 2", Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.

**REFERENCE BOOKS :**

- R1 - E.Balagurusamy, "Programming with java A Primer", fifth edition, McGraw – Hill 2014.  
R2 - H.M.Deitel, P.J.Deitel, "Java: how to program", Eleventh edition, Prentice Hall of India private limited, 2017.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS4202	SOFTWARE ENGINEERING	3	1	0	4

Course Objective
1. Compare different process models.
2. Concepts of requirements engineering and Analysis Modeling.
3. Apply systematic procedure for software design and deployment.
4. Compare and contrast the various testing and maintenance.
5. Manage project schedule, estimate project cost and effort required.

Unit	Description	Instructional Hours
	<b>SOFTWARE PROCESS AND AGILE DEVELOPMENT</b>	
I	Introduction to Software Engineering-Definitions of Software Engineering- The Serial or Linear Sequential Development Model -Iterative Development Model-The incremental Development Model-The Parallel or Concurrent Development Model-Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.-Introduction and Evolving Role of Software- Software Characteristics-Software Applications.	12
	<b>REQUIREMENTS ANALYSIS AND SPECIFICATION</b>	
II	Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management- Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.	12
	<b>SOFTWARE DESIGN</b>	
III	Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.	12
	<b>TESTING AND MAINTENANCE</b>	
IV	Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.	12
	<b>PROJECT MANAGEMENT</b>	
V	Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS	12
<b>Total Instructional Hours</b>		<b>60</b>

Course Outcome
CO1: Compare different process models.
CO2: Concepts of requirements engineering and Analysis Modeling.
CO3: Apply systematic procedure for software design and deployment.
CO4: Compare and contrast the various testing and maintenance.
CO5: Manage project schedule, estimate project cost and effort required.

#### TEXT BOOKS:

- T1 Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011  
T2 Roger S. Pressman, —Software Engineering – A Practitioner's Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.

#### REFERENCE BOOKS:

- R1: Rajib Mall, —Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.  
R2: Pankaj Jalote, —Software Engineering, A Precise Approach, Wiley India, 2010.  
R3: Kelkar S.A., —Software Engineering, Prentice Hall of India Pvt Ltd, 2007.

  
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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS4203	<b>NAME OF THE COURSE</b> OPERATING SYSTEMS	<b>L</b> 3	<b>P</b> 0	<b>T</b> 0	<b>C</b> 3
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- Course Objective**
1. Study the basic concepts and Understand the structure of operating systems
  2. Learn about Processes, Scheduling algorithms and Deadlocks.
  3. Learn various memory management schemes.
  4. Study I/O management and File systems.
  5. Learn the Distributed operating systems

Unit	Description	Instructional Hours
	<b>OPERATING SYSTEMS OVERVIEW</b>	
I	Computer System Overview - Basic Elements, Instruction Execution, Interrupts-operating systems overview- Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot	7
	<b>PROCESS MANAGEMENT</b>	
II	Processes-Process Concept, Process Scheduling, Interprocess Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Threads Overview, Multicore Programming, Multithreading Models. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; Deadlock-System model, Deadlock-Prevention, Avoidance and Recovery.	11
	<b>STORAGE MANAGEMENT</b>	
III	Memory Hierarchy, Cache Memory, Main Memory-Swapping-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory	9
	<b>FILE SYSTEM IMPLEMENTATION &amp; MASS STORAGE STRUCTURE</b>	
IV	Mass Storage Structure- Overview, Disk Structure, Disk Scheduling and Management; File System Interface- File Concepts, Access methods, Directory Structure, Organization and implementation, File System Structure - File System Implementation-, File Sharing and Protection; Allocation Methods, Free Space Management- I/O Systems.	9
	<b>TYPES OF OPERATING SYSTEMS</b>	
V	Single processor systems – Multiprocessor Systems – Clustered Systems – Real Time Systems – Open source operating system- Distributed Systems –Distributed operating systems – Distributed file systems –Distributed Synchronization. Case study: Linux Systems Virtualization.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Design various Scheduling algorithms.  
CO2: Design deadlock, prevention and avoidance algorithms.  
CO3: Compare and contrast various memory management schemes.  
CO4: Design and Implement a prototype file systems.  
CO5: Study the distributed operating systems.

**TEXT BOOK:**

- T1: Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10<sup>th</sup> Edition, John Wiley and Sons Inc., 2018.  
T2: Tom Adelstein, Bill Lubanovic , "Linux System Administration Solve Real-life Linux Problems Quickly", 2007, O'Reilly Media.

**REFERENCE BOOKS:**

- R1: Andrew S. Tanenbaum, "Modern Operating Systems", 4/E, Pearson Publications, Paperback 2019.  
R2: Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.  
R3: D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Third Edition, TataMcGraw-Hill Education,  
R4: William Stallings, "Operating Systems - Internals and Design Principles", 9/E, Pearson Publications, 2018.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19MA4151	PROBABILITY, STATISTICS AND QUEUEING THEORY	3	0	2	4

- Course Objectives**
1. Construct a well defined knowledge of random variables.
  2. Explain the concept of two dimensional random variables and determine covariance.
  3. Illustrate the relation between two random variables by using correlation concepts along with R studio.
  4. Describe some basic concepts of statistical methods for testing the hypothesis together with R studio.
  5. Apply the basic characteristic features of a queuing system and analyze queuing models.

Unit	Description	Instructional Hours
I	<b>PROBABILITY AND RANDOM VARIABLE</b> Random variable –Discrete and continuous random variables – Probability mass function - Probability density function – Cumulative distribution functions - Moment generating functions. <b>Introduction to R programming and Application of descriptive statistics – Mean, Median, Mode, variance and Box plot</b>	9+3
II	<b>TWO DIMENSIONAL RANDOM VARIABLES</b> Joint probability mass function - Joint probability density function – Marginal Probability mass function – Marginal probability density function - Conditional Probability mass function - Conditional Probability density function – Independent random variables. <b>Application of Normal distribution</b>	9+3
III	<b>CORRELATION AND REGRESSION</b> Correlation – Karl Pearson’s correlation coefficient – Spearman’s Rank Correlation – Regression lines (problems based on Raw data only). <b>Applications of Correlation and Regression</b>	9+3
IV	<b>HYPOTHESIS TESTING</b> Large sample test based on Normal distribution – test of significance for single mean and difference of means - Small sample test – t test for single mean and difference of mean - F distribution for variance, Chi – Square test for independence of attributes – Goodness of fit. <b>Application of Student t- test for Single mean and difference of means</b> <b>Application of Chi – square test</b>	9+6
V	<b>QUEUEING THEORY</b> Markovian models: Single and Multiple server queuing models (Excluding proof) – (M/M/1):(∞/FCFS), (M/M/1):(N/FCFS), (M/M/C):(∞/FCFS) and (M/M/C):(N/FCFS).	9
<b>Total Instructional Hours</b>		<b>45+15</b>
<b>Total(45+15)</b>		<b>60</b>

- Course Outcomes**
- CO1: Understand the concepts of random variables.
  - CO2: Express the phenomenon of two dimensional random variables..
  - CO3: Compute correlation and predict unknown values using regression together with R studio.
  - CO4: Understand the concepts of statistical methods for testing the hypothesis along with R studio.
  - CO5: Identify the queuing models in the given system, analyze the result.

**TEXT BOOKS:**

- T1 - Gupta S. P, “Statistical Methods”, Sultan Chand & Sons Publishers, 2017.  
T2 – Medhi J, “stochastic Processes”, New Age International Publishers, New Delhi, 2014.

**REFERENCE BOOKS:**

- R1 - Applied statistics and Probability for Engineers by C.Mont Gomery ,6<sup>th</sup> Edition, Wiley Publications.  
R2 - A.O. Allen, “Probability, Statistics and Queueing Theory with Computer Applications”, Elsevier, Second Edition, 2012.  
R3 - Walpole R. E., Myers S.L. & Keying Ye, “Probability and Statistics for Engineers and Scientists”, Pearson Education Inc, 9th edition, 2012.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS4251	DESIGN AND ANALYSIS OF ALGORITHM	3	0	2	4

- Course Objective**
1. Learn the algorithm analysis techniques.
  2. Become familiar with the different algorithm design techniques
  3. Learn greedy technique to solve problems
  4. Understand backtracking and iterative development of algorithms
  5. Understand the limitations of Algorithm power

Unit	Description	Instructional Hours
<b>I</b>	<b>ANALYSIS OF ALGORITHM</b> Introduction – Algorithms - Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving- Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms	9
<b>II</b>	<b>BRUTE FORCE AND DIVIDE AND CONQUER</b> Brute Force – Closest-Pair and Convex-Hull Problems-Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem- Sequential Search and String Matching - Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers <i>Program: 1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.</i> <i>2. Implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.</i>	9+4(P)
<b>III</b>	<b>DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE</b> Computing a Binomial Coefficient – All Pairs Shortest Path Algorithm -Warshall's and Floyd' algorithm – Multistage Graphs - Optimal Binary Search Trees – Knapsack Problem and Memory functions - Greedy Technique– MST - Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm- Huffman Trees. <i>Program: 1. Implement 0/1 Knapsack problem using Dynamic Programming</i> <i>2. Find a subset of a given set <math>S = \{s_1, s_2, \dots, s_n\}</math> of n positive integers whose sum is equal to a given positive integer d. For example, if <math>S = \{1, 2, 5, 6, 8\}</math> and <math>d = 9</math> there are two solutions <math>\{1, 2, 6\}</math> and <math>\{1, 8\}</math>. A suitable message is to be displayed if the given problem instance doesn't have a solution.</i> <i>3. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it determine the speed-up achieved.</i>	10+6(P)
<b>IV</b>	<b>ITERATIVE IMPROVEMENT</b> The Simplex Method-The Maximum-Flow Problem – maximum Matching in Bipartite Graphs- The Stable marriage Problem.	9
<b>V</b>	<b>BACKTRACKING, BRANCH AND BOUND</b> The General Method – 8-Queens Problem- Sum of Subsets – Graph Coloring- Hamiltonian Cycle - Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Decision Trees-P, NP and NP-Complete Problems Approximation Algorithms for NP – Hard Problems. <i>Program: 1. Implement any scheme to find the optimal solution for the TravelingSales Person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.</i> <i>2. Implement N Queen's problem using Back Tracking.</i>	9+4(P)

**TOTAL HOURS 60 (46+14)**

- Course Outcome**
- CO1: Design algorithms for various computing problems
  - CO2: Analyze the time and space complexity of algorithms
  - CO3: Critically analyze the different algorithm design techniques for a given problem
  - CO4: Modify existing algorithms to improve efficiency
  - CO5: Apply algorithm techniques for real time applications

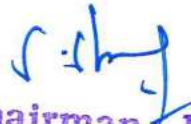


**TEXT BOOKS:**

- T1- AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.  
T2- Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

**REFERENCE BOOKS:**

- R1 - Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.  
R2- Donald E. Knuth, "The Art of Computer Programming", Volumes 1 & 3 Pearson Education, 2009.  
R3 - Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS4001	JAVA PROGRAMMING LABORATORY	0	0	3	1.5

**Course Objective**

1. To practice implementing Object Oriented Concepts, Package creation in Java using appropriate coding standards
2. To explore inheritance, interface and exception handling techniques.
3. To practice multithread programming.
4. To practice writing generic programs and collection classes in Java.
5. To develop simple applications using Event handling and swing concepts.

**S. No.**

**Description of the Experiments**

1.
  - a. Simple JAVA program with the user input.
  - b. Concept of classes, objects, methods and constructor.
  - c. Method overriding.
2.
  - a. Abstract classes.
  - b. Multi-Level Inheritance.
  - c. Multiple Inheritance using interfaces.
3. Packages with necessary exception handling mechanisms.
4. Illustrate multi threads.
5. Object serialization.
6.
  - a. Create Generic number calculator using Java.
  - b. Linked List implementation using collections
7. Employee details using collection. OR JAVA application program using collection.
8. Program to illustrate file I/O concept.
9. Program that handles all mouse events.
10. Program using swing.
11. Simple OPAC system for library using event-driven and concurrent programming paradigms with JDBC.

**Total Practical Hours 45**

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

Course Outcome

CO1: Understand the basics of Java Programming

CO2: Design program using Inheritance, interface and exception handling techniques.

CO3: Develop applications using multithread programming.

CO4: Implement data structure concepts using Generic programs and collection classes.

CO5: Design real time applications using Event handling and Swing.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS4002	OPERATING SYSTEM LABORATORY	0	0	3	1.5

- Course Objective**
1. Learn shell programming and the use of filters in the UNIX environment.
  2. Be familiar with implementation of CPU Scheduling Algorithms and file allocation strategies.
  3. Gain knowledge in simulating page replacement algorithms.
  4. Be familiar with inter process communication.
  5. Learn to use the paging techniques in memory management.

**S. Description of the Experiments**

**No.**

- 1 Basics of UNIX commands.
- 2 Shell Programming.
- 3 Create new process to overlay an executable binary image on an existing process using fork and exec.
- 4 Simulate inter process communication between related processes using pipes.
- 5 Implement the following CPU scheduling algorithms  
a.Round Robin b. SJF c. FCFS
- 6 Implement bankers Algorithm for Dead Lock Detection
- 7 Implement bankers Algorithm for Dead Lock Avoidance
- 8 Simulate the producer consumer problem/Dining philosopher problem using semaphore.
- 9 Simulate paging technique of memory management.
- 10 Simulate page replacement algorithms  
a.FIFO b. LRU c. LFU
- 11 Implement all file allocation strategies  
a.Sequential b. Indexed c. Linked

**Total Practical Hours: 45**

**Course Outcome**

- CO1: Apply the basic Unix commands and shell concepts in real time.
- CO2: Compare the performance of various CPU Scheduling Algorithms and file allocation strategies.
- CO3: Create programs using system calls.
- CO4: Analyze the performance of the various page replacement algorithms
- CO5: Develop process synchronization using semaphore.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19MC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE/VALUE EDUCATION	2	0	0	0

**Course Objectives:**

- 1) The course aims at imparting basic principles of thought process, reasoning and inferencing.
- 2) Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- 3) Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- 4) The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.

UNIT	DESCRIPTIVE	INSTRUCTIONAL HOURS
UNIT I :	Basic Structure of Indian Knowledge System	4
UNIT II :	Modern Science and Indian Knowledge System	4
UNIT III :	Yoga and Holistic Health care	4
UNIT IV :	Philosophical tradition	4
UNIT V :	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies.	4

**TOTAL INSTRUCTIONAL HOURS: 20**

**Course Outcomes:**

- 1) Ability to understand the structure of Indian system of life.
- 2) Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.
- 3) Understanding the holistic life style of yoga.
- 4) Understanding the tradition of philosophy.
- 5) Understanding the Indian linguistic and artistic tradition.

**REFERENCE BOOKS:**

- R1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
- R2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
- R3. Fritzof Capra, Tao of Physics
- R4. Fritzof Capra, The wave of Life.
- R5. V N Jha ( Eng. Trans.), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am
- R6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
- R7. GN Jha ( Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
- R8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
- R9. P R Sharma ( English translation), Shodashang Hridayam.

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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS5201	<b>NAME OF THE COURSE</b> THEORY OF COMPUTING	<b>L</b> 3	<b>T</b> 1	<b>P</b> 0	<b>C</b> 4
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- Course Objective**
- To understand the basic concepts of automata theory and finite automaton
  - To extend the concepts of automata theory in regular languages and expressions
  - To study about context free grammars and the normalizations of CFG
  - To learn the essence of push down automata with stack presentations and modeling turing machines
  - To discover the knowledge in decidability and tractability and to study the complexity classes

Unit	Description	Instructional Hours
	<b>Automata Theory</b> Introduction-Need of automata theory-Formal proof- Additional Forms of Proof-Inductive Proofs-Central Concepts of Automata Theory-DFA and NFA-Finite Automaton with $\epsilon$ -Transitions-Equivalence of DFA and NFA-Applications of Finite Automata.	12
	<b>Regular Expressions</b> Regular Languages-Regular Expressions-Equivalence of finite Automaton and regular expressions-Minimization of DFA-Closure Properties and Decision Properties of Regular Languages-Problems based on Pumping Lemma-Applications of Regular Expressions.	12
	<b>Context Free Grammars</b> Chomsky hierarchy of languages-Context-Free Grammar (CFG)-Parse Trees- Ambiguity in grammars and languages-Normal forms for CFG-Chomsky Normal Form (CNF)-Greibach Normal Form (GNF)-Pumping Lemma for Context Free Language (CFL)-Applications of Context Free Grammar.	12
	<b>PushDown Automata and Turing Machines</b> Definition of the Pushdown automata-Types of PDA-Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG-Definitions of Turing machines-Models- Computable languages and functions-Techniques for Turing machine construction-Multi head and Multi tape Turing Machines.	12
	<b>Undecidability</b> The Halting problem – Partial Solvability- Undecidability- Decidable and undecidable problems- Basic Definition and properties of Recursive (RL) and Recursively enumerable (REL) languages. Intractable Problems- the Class P and NP-Introduction to NP-Hardness and NP-Completeness	12
<b>Total Instructional Hours</b>		<b>60</b>

<b>Course Outcome</b>	CO1: Understand the theoretical concepts of automata and equivalence of automata
	CO2: Remember the automata in applying to obtain regular expressions and languages
	CO3: Apply the normalization in context free grammar to obtain optimized CFG
	CO4: Understand PDA and turing machines and apply for making mathematical models
	CO5: Understand the decidability and tractability problems and apply for developed models

**TEXT BOOKS:**

- T1: Hopcroft J.E., Motwani R. and Ullman J.D., "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2016.
- T2: John C Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

**REFERENCE BOOKS:**

- R1: Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", Third Edition, Prentice Hall of India, 2016.
- R2: Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2015.
- R3: Peter Linz, "An Introduction to Formal Language and Automata", Sixth Edition, Jones & Bartlett Learning, 2016.

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PROGRAM ME B.E.	COURSE CODE 19CS5202	NAME OF THE COURSE COMPUTER NETWORKS (COMMON TO CSE & IT)	L	T	P	C
			3	0	0	3

- Course Objective**
1. To study the Protocol Layering and Physical Level Communication.
  2. To understand the Data Communication System and the purpose of Layered Architecture.
  3. To analyze the concepts of Routing Methods and Sub-netting.
  4. To learn the functions of Network Layer and the various Routing Protocols.
  5. To familiarize the functions and Protocols of the Transport Layer.

Unit	Description	Instructional hours
	<b>OVERVIEW &amp; PHYSICAL LAYER</b>	
I	Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission Media – Switching – Circuit-switched Networks – Packet Switching.	9
	<b>DATA LINK LAYER</b>	
II	Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC– PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction –IEEE 802.11, Bluetooth – Connecting Devices.	9
	<b>NETWORK AND ROUTING</b>	
III	Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.	9
	<b>TRANSPORT LAYER</b>	
IV	Process to process delivery, User datagram protocol (UDP), Transmission control protocol (TCP), Data traffic, Congestion, Congestion control, Quality of service, Techniques to improve QOS, Integrated services, Differentiated services, QOS in switched networks.	9
	<b>APPLICATION LAYER</b>	
V	Client server model, Socket interface, Name space, Domain name space, Distribution of name space, DNS in the internet, Resolution, DNS messages, DDNS, Encapsulation, Electronic mail, File transfer, HTTP, World wide web (WWW), Digitizing audio and video, Audio and video compression, Streaming stored audio/video, Streaming live audio/video, Real time interactive audio/video, Voice over IP.	9
<b>Total Instructional Hours</b>		<b>45</b>

**Course Outcome**

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

CO1: Learn about the Protocol Layering and Physical Level Communication  
CO2: Understand the Data Communication System and the purpose of Layered Architecture.  
CO3: Analyze the concepts of Routing Methods and Subnetting.  
CO4: Design protocols for various functions in the Network.  
CO5: Understand the functions and Protocols of the Transport Layer.

**TEXT BOOK:**

T1: Larry Peterson, Bruce Davie, "Computer Networks: A Systems Approach", Elsevier, Online Edition, 2019.  
T2: Paul Goransson, Chuck Black and Timothy Culver, "Software Defined Networks - A Comprehensive Approach", Elsevier, Second Edition, 2017.

**REFERENCES:**

R1: James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Pearson Education, Seventh Edition, 2017.  
R2: Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, Second Edition, 2015.  
R3: Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw – Hill, Fifth Edition, 2013.  
R4: Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publishers, 2011.

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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS5203	<b>NAME OF THE COURSE</b> DATA MINING	<b>L</b> 3	<b>P</b> 0	<b>T</b> 0	<b>C</b> 3
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- Course Objective**
1. To introduce students to the basic concepts and techniques of Data Mining.
  2. To develop skills of using recent data mining software for solving practical problems.
  3. To gain experience of doing independent study and research.
  4. To learn the concepts of data processing.
  5. To perform data mining tasks with relevant tools

Unit	Description	Instructional Hours
<b>I DATA MINING</b>	Motivation -Steps in Data Mining – Architecture - Data Mining and Databases – Data Warehouses – Data Mining functionalities – Classification – Data Mining Primitives – Major issues. DATA PREPROCESSING: Descriptive data summarization -Data Cleaning – Data integration and transformation – Data Reduction – Data discretization and concept hierarchy generation.	9
<b>II DATA WAREHOUSE and OLAP TECHNOLOGY</b>	Need for Data Warehouse- multidimensional data model- Data Warehouse architecture - Data Warehousing to Data mining. MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Frequent item sets, Association rules – mining various kinds of Association rules.	9
<b>III WEKA TOOL</b>	Introduction – Installation- Visualisation – filtering- selecting attributes- other popular packages. CLASSIFICATION TASK: Introduction – Decision trees – Naïve Bayes’ classification Artificial Neural Networks and Support Vector Machines.	9
<b>IV CLUSTERING AND ESTIMATION</b>	CLASSIFICATION AND PREDICTION: Issues regarding classification and prediction -Accuracy and error measures – Evaluating the accuracy of classifiers and predictors. CLUSTER ANALYSIS: Types of data – Partitioning Methods: k means and k Medoids.	9
<b>V MINING OF TIME SERIES</b>	Trend analysis – similarity search – sequence patterns in transactional data bases sequential pattern mining: concepts and primitives. MINING TEXT, MULTIMEDIA AND THE WORLD WIDE WEB: Text data analysis and information retrieval- Dimensionality reduction for text – text mining approaches – similarity search in multimedia data.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Develop understanding level in basic mining concepts and techniques
- CO2: Develop skills using data mining OLAP and Weka tools
- CO3: Enhance knowledge in mining software for solving practical problems
- CO4: Represent concepts of data preprocessing
- CO5: Read and write own mining algorithms and concepts for research.

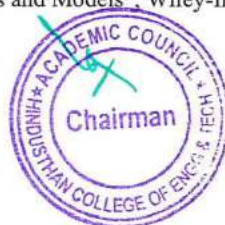
**TEXT BOOKS:**

- T1: HanJiawei, Micheline Kamber and Jian Pei “Data Mining: Concepts and Techniques”, Morgan Kaufmann, 2011.
- T2: Shawkat Ali A B M, Saleh A. Wasimi, “Data Mining: Methods and Techniques”, Fifth Indian Reprint, Cengage Learning, 2011.

**REFERENCE BOOKS:**

- R1: Soman K. P., Shyam Diwakar, Ajay V. “Insight into Data Mining Theory and Practice”, Fifth Printing, PHI Learning, 2011.
- R2: Arun K Pujari, “Data Mining Techniques”, University Press, 2013.
- R3: G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
- R4: Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19EC5231	PRINCIPLES OF MICROPROCESSORS AND MICRO CONTROLLERS	3	0	0	3

- Course Objective**
1. Study the Architecture of 8085 and 8086 microprocessor.
  2. Learn the design aspects of I/O and Memory Interfacing circuits.
  3. Study about communication and bus interfacing.
  4. Study the Architecture of 8051 microcontroller
  5. Study the concepts of microcontroller interfacing

Unit	Description	Instructional Hours
	<b>8086 MICROPROCESSOR</b>	
I	Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming – Modular Programming - Interrupts and interrupt service routines. Case study: I5 and I7 processors	9
	<b>8086 SYSTEM BUS STRUCTURE</b>	
II	8086 signals – Basic configurations – System bus timing –System design using 8086 – Introduction to Multiprogramming – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.	9
	<b>I/O INTERFACING</b>	
III	Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer Interface – Keyboard /display controller – Interrupt controller – DMA controller.	9
	<b>8051 MICROCONTROLLER</b>	
IV	Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.	9
	<b>PROGRAMMING/INTERFACING MICROCONTROLLER</b>	
V	Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Design and implement programs on 8086 microprocessor.  
CO2: Design I/O circuits.  
CO3: Design Memory Interfacing circuits.  
CO4: Design and implement 8051 microcontroller based systems.  
CO5: Design various interfacing and its programming methodologies

**TEXT BOOKS:**

- T1 Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Prentice Hall of India, 2011.  
T2 Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011

**REFERENCE BOOKS:**

- R1: Douglas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012  
R2: A.K.Ray,K.M.Bhurchandi,”Advanced Microprocessors and Peripherals”,3<sup>rd</sup> Edition,Tata McGrawHill,2012.  
R3: Sunil Mathur and Jeebananda Panda,”Microprocessor and Microcontrollers”,PHI Learning Pvt Ltd,2016.

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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS5252	<b>NAME OF THE COURSE</b> OBJECT ORIENTED ANALYSIS AND DESIGN	<b>L</b> 2	<b>T</b> 0	<b>P</b> 2	<b>C</b> 3
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- Course Objective**
1. To express software design with UML diagrams
  2. To design software applications using OO concepts.
  3. To identify various scenarios based on software requirements
  4. To transform UML based software design into pattern based design using design patterns
  5. To understand the various testing methodologies for OO software

Unit	Description	Instructional Hours
	<b>UNIFIED PROCESS AND USE CASE DIAGRAMS</b>	
I	Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization. Experiments: Document the Software Requirements Specification (SRS) for the Student information system.	6+3
	<b>STATIC UML DIAGRAMS</b>	
II	Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams. Experiments: Identify use cases and develop the Use Case model for Student information system. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that for Recruitment system.	6+3
	<b>DYNAMIC AND IMPLEMENTATION UML DIAGRAMS</b>	
III	Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modeling – When to use State Diagrams - Activity diagram – When to use activity diagrams - Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams. <i>Experiments: Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams for Airline/Railway reservation system. Draw relevant State Chart and Activity Diagrams for the same system for Exam registration.</i>	6+3
	<b>DESIGN PATTERNS</b>	
IV	GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code. <i>Experiments: Improve the reusability and maintainability of the software system by applying appropriate design pattern</i>	5+4
	<b>TESTING</b>	
V	Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans <i>Experiments: Implement the modified system and test it for various scenarios</i>	6+3
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

<b>Course Outcome</b>	CO1: Express software design with UML diagrams
	CO2: Design software applications using OO concepts.
	CO3: Identify various scenarios based on software requirements.
	CO4: Transform UML based software design into pattern based design using design patterns
	CO5: Understand the various testing methodologies for OO software

**TEXT BOOKS:**

- T1: Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development!, Third Edition, Pearson Education, 2005.

T2: Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

**REFERENCE BOOKS :**

- R1: Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
- R2: Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003.
- R3: Simon Bennett, Steve Mc Robb and Ray Farmer, “Object Oriented Systems Analysis and Design Using UML”, Fourth Edition, Mc-Graw Hill Education, 2010.
- R4: Paul C. Jorgensen, “Software Testing:- A Craftsman”s Approach”, Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19EC5031	PRINCIPLES OF MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	0	0	3	1.5

**Course Objective**

1. To introduce ALP concepts and features
2. To write ALP for arithmetic and logical operations in 8086 and 8051
3. To generate waveforms using Microprocessors. CO4: Execute Programs in 8051
4. To explain the difference between simulator and Emulator
5. To write ALP Programs for Arithmetic Operations

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**Description of the Experiments**

**Using 8086 Micro processor and MASM software**

1. Basic arithmetic and Logical operations.
  2. Code conversion and decimal arithmetic.
  3. Matrix operations
  4. Searching
  5. Sorting
- Using 8086 Micro processor and Interfacing
6. Parallel interface
  7. Serial interface
  8. Key board and Display interface
  9. A/D and D/A interface
- Using 8051 Micro controller
10. Basic arithmetic and Logical operations.
  11. Square and Cube program, Find 2's complement of a number
  12. Stepper motor control interface

**Total hours 45**

**Course Outcome**

- CO1: Write ALP Programmes for Arithmetic Operations  
 CO2: Write ALP for arithmetic and logical operations in 8086 and 8051  
 CO3: Generate waveforms using Microprocessors. CO4: Execute Programs in 8051  
 CO4: Explain the difference between simulator and Emulator  
 CO5: Write ALP Programmes for Arithmetic Operations

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PROGRAMME	COURSE CODE	COURSE TITLE	L	T	P	C
B.E.	19HE5071	SOFT SKILLS - I	1	0	0	1
<b>Course Objectives:</b>	1.To employ soft skills to enhance employability and ensure workplace and career success. 2.To enrich students' numerical ability of an individual and is available in technical flavor. 3.To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.					
<b>Unit</b>	<b>Description</b>					<b>Instructional Hours</b>
I	<b>Introduction to Soft Skills:</b> Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management-Critical Thinking-Reflective thinking and writing- p2p Interaction					3
II	<b>Art of Communication:</b> Verbal Communication - Effective Communication - Active listening -Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.					4
III	<b>World of Teams:</b> Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.					3
IV	<b>Quantitative Aptitude:</b> Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams					3
V	<b>Logical Reasoning:</b> Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency					2
<b>Course Outcome:</b>	CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path. CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others CO3: Students will understand how teamwork can support leadership skills CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them. CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.					

**REFERENCE BOOKS:**

- R1: Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz  
 R2: How to prepare for data interpretation for CAT by Arun Sharma.  
 R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.  
 R4: A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali  
 R5: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

  
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PROGRAM ME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19HE5072	DESIGN THINKING	1	0	0	1

**OBJECTIVES:**

**Course Objective**

- To expose students to the design process
- To develop and test innovative ideas through a rapid iteration cycle.
- To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
<b>DESIGN ABILITY</b>		
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	4
<b>DESIGNING TO WIN</b>		
II	Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
<b>DESIGN TO PLEASE AND DESIGNING TOGETHER</b>		
III	Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
<b>DESIGN EXPERTISE</b>		
IV	Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert	3
<b>Total Instructional Hours</b>		<b>15</b>

**Course Outcome**  
 Upon completion of the course, students will be able to  
 CO1: Develop a strong understanding of the Design Process  
 CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.  
 CO3: Develop teamwork and leadership skills

**TEXT BOOKS:**

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

**REFERENCE BOOKS:**

R1 - Tom Kelley, "Creative Confidence", 2013.  
 R2 - 3. Tim Brown, "Change by Design", 2009.

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PROGRAMME	COURSE CODE	COURSE NAME	L	T	P	C
B.E.	19CS6181	PRINCIPLES OF MANAGEMENT	3	0	0	3
<b>Course Objective</b>	1. To study the evolution of Management and learn the functions and responsibilities of managers. 2. To Plan and know the tools and techniques to be used in the performance of the managerial job. 3. To enable them to analyze and understand the environment of the organization. 4. To understand the proper vocabulary to communicate effectively. 5. To comprehend the cognizance of the importance of control methods.					
<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>				
I	<b>INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS</b> Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.	9				
II	<b>PLANNING</b> Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.	9				
III	<b>ORGANISING</b> Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management	9				
IV	<b>DIRECTING</b> Foundations of individual and group behavior – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication –communication and IT.	9				
V	<b>CONTROLLING</b> System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.	9				
		<b>Total Instructional Hours</b>	<b>45</b>			
<b>Course Outcome</b>	CO1: Understand the functions and responsibilities of managers. CO2: Interpret the planning, policies, various tools and techniques. CO3: Solve organizational problems and develop optimal managerial decisions. CO4: Importance of proper vocabularies to articulate ones own position and communicate effectively. CO5: Grasp both qualitative and quantitative information and formulate best control methods.					

**TEXT BOOKS:**

- T1: Stephen P. Robbins & Mary Coulter, —ManagementI, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.  
 T2: JAF Stoner, Freeman R.E and Daniel R Gilbert —ManagementI, Pearson Education, 6th Edition, 2004.

**REFERENCE BOOKS:**

- R1: Stephen A. Robbins & David A. Decenzo & Mary Coulter, —Fundamentals of ManagementI Pearson Education, 7th Edition, 2011.  
 R2: Robert Kreitner & Mamata Mohapatra, — ManagementI, Biztantra, 2008.  
 R3: Harold Koontz & Heinz Weihrich —Essentials of managementI Tata McGraw Hill,1998.  
 R4: Tripathy PC & Reddy PN, —Principles of ManagementI, Tata McGraw Hill, 1999.

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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS6201	<b>NAME OF THE COURSE</b> ARTIFICIAL INTELLIGENCE	<b>L</b> 3	<b>T</b> 1	<b>P</b> 0	<b>C</b> 4
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- Course Objective**
1. To understand the various characteristics of Intelligent agents
  2. To learn the different search strategies in AI
  3. To learn to represent knowledge in solving AI problems
  4. To understand the different ways of designing software agents
  5. To know about the various applications of AI.

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO ARTIFICIAL INTELLIGENCE</b>	
I	Introduction-Definition – The Foundations of Artificial Intelligence - The History of Artificial Intelligence - Future of Artificial Intelligence – Agents and Environments - Good Behavior: The Concept of Rationality - The Nature of Environments - The Structure of Agents.	10
	<b>SOLVING PROBLEMS BY SEARCHING</b>	
II	Problem - Solving Agents - Example Problems - Searching for Solutions - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions. BEYOND CLASSICAL SEARCH: Local Search Algorithms and Optimization Problems - Local Searching Continuous Spaces - Searching with Non-deterministic Actions - Searching with Partial Observations. ADVERSARIAL SEARCH: Stochastic Games.	13
	<b>KNOWLEDGE AND REASONING</b>	
III	Knowledge - Based Agents - The Wumpus World - Logic -Propositional Logic: A Very Simple Logic - Propositional Theorem Proving - Effective Propositional Model Checking - Agents Based on Propositional Logic. <b>FIRST ORDER LOGIC:</b> Representation Revisited - Syntax and Semantics of First - Order Logic - Using First - Order Logic - Knowledge Engineering in First - Order Logic.	13
	<b>PLANNING AND ACTING IN THE REAL WORLD</b>	
IV	Time, Schedules, and Resources - Hierarchical Planning -Planning and Acting in Non-deterministic Domains - Multi-agent Planning. <b>KNOWLEDGE REPRESENTATION:</b> Ontological Engineering - Categories and Objects - Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information - The Internet Shopping World.	12
	<b>APPLICATIONS</b>	
V	AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware –Perception – Planning – Moving	12
	<b>Total Instructional Hours</b>	<b>60</b>

<b>Course Outcome</b>	CO1:	Understand the various characteristics of Intelligent agents
	CO2:	Learn the different search strategies in AI
	CO3:	Learn to represent knowledge in solving AI problems
	CO4:	Understand the different ways of designing software agents
	CO5:	Learn about the various applications of AI.

**TEXT BOOKS:**

- T1: S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
- T2: I. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

**REFERENCE BOOKS:**

- R1: M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science), Jones and Bartlett Publishers, Inc
- R2: Nils J. Nilsson, —The Quest for Artificial Intelligence, Cambridge University Press, 2009.
- R3: William F. Clocksin and Christopher S. Mellish, | Programming in Prolog: Using the ISO Standard, Fifth Edition, 2003.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	P	T	C
B.E.	19CS6202	MOBILE COMPUTING	3	0	0	3

- Course Objective**
1. To understand the basic concepts of mobile computing.
  2. To learn the basics of mobile telecommunication system.
  3. To be familiar with the network layer protocols and Ad-Hoc networks.
  4. To know the basis of transport and application layer protocols.
  5. To gain knowledge about different mobile platforms and application development.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.	9
	<b>MOBILE TELECOMMUNICATION SYSTEM</b>	
II	Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security.	9
	<b>MOBILE NETWORK LAYER</b>	
III	Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security.	9
	<b>MOBILE TRANSPORT AND APPLICATION LAYER</b>	
IV	Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML	9
	<b>MOBILE PLATFORMS AND APPLICATIONS</b>	
V	Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android– MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Explain the basics of mobile telecommunication systems.
- CO2: Illustrate the generations of telecommunication systems in wireless networks.
- CO3: Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
- CO4: Explain the functionality of Transport and Application layers.
- CO5: Develop a mobile application using android/blackberry/ios/Windows SDK

**TEXT BOOKS:**

- T1: Jochen Schiller, —Mobile CommunicationsI, PHI, Second Edition, 2003.
- T2: Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile ComputingI, PHI Learning Pvt.Ltd, New Delhi – 2012

**REFERENCE BOOKS:**

- R1: Dharma Prakash Agarwal, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd,
- R2: Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile ComputingI, Springer,
- R3: William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital SystemsII, Second Edition,TataMcGraw
- R4: C.K.Toh, —AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002.

  
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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS6251	<b>NAME OF THE COURSE</b> COMPILER DESIGN	<b>L</b> 2	<b>T</b> 0	<b>P</b> 3	<b>C</b> 3.5
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- Course Objective**
1. To learn the design principles of a Compiler.
  2. To learn about the Lexical analysis.
  3. To learn about Syntax analysis.
  4. To apply the concepts for syntax directed translation and run time environment.
  5. To apply the concepts of code optimization and code generation.

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO COMPILERS</b> Introduction - Analysis of the source program -Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools. <i>Illustrative programs: Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs, comments and new lines. Design a LEX code to construct a DFA which accepts the language: all the strings ending with "11" over inputs '0' and '1'.</i>	4+2
I	<b>LEXICAL ANALYSIS</b> Lexical Analysis-Need and Role of Lexical Analyzer- Lexical Errors- Specification and Recognition of tokens -Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA-Minimization of DFA-Language for Specifying Lexical Analyzers-LEX. Case Study: Flex, Flex++ a fast scanner generator. <i>Illustrative programs: Implementation of Lexical Analyzer using JLex, flex or other lexical analyzer generating tools</i>	8+3
II	<b>SYNTAX ANALYSIS</b> Syntax analysis -Need and Role of the Parser- Top Down Parsing - Recursive Descent Parser Predictive Parser-LL(1) Parser-Bottom Up Parsing-Shift Reduce Parser- LR(0), SLR(1), LALR(1), CLR(1) parsers - Error Handling and Recovery in Syntax Analyzer-Case Study: Bison, YACC compatible Parser Generator. <i>Illustrative programs: Implementation of LR(0), SLR(1) Parsing-Implementation of Symbol Table and YACC. Implement an YACC program for Binary to Decimal Conversion, Write YACC program to recognize string with grammar { anbn   n≥0 }</i>	8+6
III	<b>SYNTAX DIRECTED TRANSLATION &amp; RUN TIME ENVIRONMENT</b> Syntax directed Definitions-S-attributed definitions - L-attributed definitions -Construction of Syntax Tree- Bottom-up and Top-down translation - type checking-Type Conversions. Case Study: Applying Syntax directed Translation in python language to generate syntax tree RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Parameter Passing-Symbol Tables- Dynamic Storage Allocation- <i>Illustrative programs: Implement type checking: Implement any one storage allocation strategies(Heap,Stack,Static).</i>	8+6
IV	<b>CODE OPTIMIZATION AND CODE GENERATION</b> Intermediate code generation - Intermediate languages - Declarations - Assignment statements-DAG -Introduction to code optimization – Principal sources of optimization - Optimization of Basic Blocks -Introduction to global data-flow analysis- Implement control flow analysis and Data flow Analysis- Construction of DAG. <i>Illustrative programs: Implementation of Simple Code Optimization Techniques (Constant Folding, Constant Propagation, Common Sub-Expression Elimination, Code Movement, Dead Code Elimination, Strength Reduction)</i>	3+6
V		
<b>Total Instructional Hours</b>		<b>54</b>

- Course Outcome**
- CO1: Learn the design principles of a Compiler.
- CO2: Learn about the Lexical analysis.
- CO3: Learn about Syntax analysis.
- CO4: Apply the concepts for syntax directed translation and run time environment.
- CO5: Apply the concepts of code optimization and code generation.

**TEXT BOOKS:**

- T1: Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.
- T2: Aho A. V., Ullman J.D. Principles of Compiler Design, Narosa

**REFERENCE BOOKS:**

- R1: Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
- R2: Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
- R3: Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
- R4: Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS6001	MOBILE APPLICATION DEVELOPMENT LABORATORY	0	0	3	1.5

- Course Objective**
1. To develop mobile applications using GUI and Layouts. To understand how to work with various mobile application development frameworks.
  2. To develop mobile applications using Event Listener.
  3. To develop mobile applications using Databases.
  4. To develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multi-threading and GPS.
  5. To analyze and discover own mobile app for simple needs.

S. No.	Description of the Experiments
1.	Develop an application that uses GUI components, Font and Colours
2.	Develop an application that uses Layout Managers and event listeners.
3.	Write an application that draws basic graphical primitives on the screen.
4.	Develop an application that makes use of databases.
5.	Develop an application that makes use of Notification Manager
6.	Implement an application that uses Multi-threading
7.	Develop a native application that uses GPS location information
8.	Implement an application that writes data to the SD card.
9.	Implement an application that creates an alert upon receiving a message
10.	Create an android application using Fragments
11.	Develop an Android Application that creates Alarm Clock
12.	Develop a Mobile application for simple needs (Mini Project)

**Total hours 45**

- Course Outcome**
- CO1: Develop mobile applications using GUI and Layouts.
- CO2: Develop mobile applications using Event Listener.
- CO3: Develop mobile applications using Databases.
- CO4: Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multi-threading and GPS.
- CO5: Analyze and discover own mobile app for simple needs.

  
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PROGRAMME	COURSE CODE	COURSE TITLE	L	T	P	C
B.E.	19HE6071	SOFT SKILL-II	1	0	0	1
<b>Course Objectives:</b>	1. To make the students aware of the importance, the role and the content of softskills through instruction, knowledge acquisition, demonstration and practice. 2. To learn everything from equations to probability with a completely different approach. 3. To make the students learn on an increased ability to explain the problem comprehensively.					
Unit	Description	Instructional Hours				
I	<b>Group Discussion &amp; Presentation Skills:</b> GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do’s & Don’ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4				
II	<b>Interview Skills and Personality Skills:</b> Interview handling Skills – Self preparation checklist – Grooming tips: do’s & don’ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3				
III	<b>Business Etiquette &amp; Ethics:</b> Etiquette – Telephone & E-mail etiquette – Dining etiquette – do’s & Don’ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	3				
IV	<b>Quantitative Aptitude:</b> Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	3				
V	<b>Logical Reasoning:</b> Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2				
<b>Course Outcome:</b>	CO1: Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict. CO2: Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations CO3: Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment CO4: Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems. CO5: Students will excel in complex reasoning.					

**REFERENCE BOOKS:**

- R1: Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent- Bruce Tulgan  
 R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha  
 R3: How to crack test of Reasoning - Jaikishan and Premkishan  
 R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj

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PROGRAMME	COURSE CODE	COURSE TITLE	L	T	P	C
B.E.	19HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

- Course Objectives:**
- To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
  - To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
  - To disseminate knowledge on copyrights and its related rights and registration aspects.
  - To disseminate knowledge on trademarks and registration aspects.
  - To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO INTELLECTUAL PROPERTY</b>	
I	Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	3
	<b>PATENTS</b>	
II	Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non -Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	3
	<b>COPYRIGHTS</b>	
III	Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	3
	<b>TRADEMARKS</b>	
IV	Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks - Registration of Trademarks.	3
	<b>DESIGN AND GEOGRAPHICAL INDICATION</b>	
V	Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks -Procedure for registration.	3

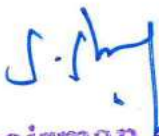
- Course Outcome:**
- CO1: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
- CO2: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- CO3: Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.
- CO4: Identify different types of trademarks and procedure for registration
- CO5: Recognize the concept of design, geographical indication and procedure for registration

**TEXT BOOKS:**

- T1- Neeraj, P., & Khushdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
- T2- V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

**REFERENCE BOOKS:**

- R1- Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
- R2- Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

  
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**PROFESSIONAL ELECTIVE I**

<b>Programme</b> B.E.	<b>Course Code</b> 19CS5351	<b>Course Name</b> INTERNET AND WEB TECHNOLOGY	<b>L</b> 2	<b>T</b> 0	<b>P</b> 2	<b>C</b> 3
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<b>Course Objective</b>	1. To understand the concepts of object oriented programming paradigm.	
	2. To learn the basics involved in publishing content on the World Wide Web.	
	3. To expose students to the basic tools and applications used in Web publishing.	
	4. To understand how web pages are connected to database through JDBC.	
	5. To know about server side programming	
<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
I	<p><b>INTRODUCTION TO OBJECT ORIENTED PROGRAMMING</b> Objected oriented concepts – object oriented programming (review only) — advanced concept in OOP – relationship – inheritance – abstract classes – polymorphism – Object Oriented design methodology – approach – best practices. UML class diagrams – interface – common base class. <i>Illustrative Programs: Polymorphism and inheritance</i></p>	5+2
II	<p><b>NETWORKING AND SECURITY</b> Internetworking – Working with TCP/IP – IP address – sub netting – DNS – VPN – proxy servers – firewalls – Client/Server concepts - World Wide Web – components of web application – MIME types, browsers and web servers – types of web content – URL – HTML – HTTP protocol – Web applications – performance – Application servers – Web security. User Experience Design – Basic UX terminology – UXD in SDLC – Rapid prototyping in Requirements. <i>Illustrative programs: write an HTML page that has one input, which can take multiline text and a submit button. Once the user clicks the submit button it should show the number of characters, words and lines in the text entered using an alert message.</i></p>	6+3
III	<p><b>HTML AND CSS</b> Client Tier using HTML – Basic HTML tags – Look and feel using CSS – Client side scripting using Java Script and Validations - Document Object Model (DOM). <i>Illustrative programs: Create an XML template to describe the result of students in an examination. The description should include the students roll number, name, three subject names and marks, total marks, percentage and result.</i></p>	6+3
IV	<p><b>JDBC</b> Business tier using POJO (Plain Old Java Objects) – Introduction to Frameworks – Introduction to POJO – Multithreaded Programming – Java I/O – Java Database Connectivity (JDBC). <i>Illustrative programs :Write a program for maintaining database by sending queries. Design and implement a servlet book query with a help of JDBC and SQL. Create MS-Acess database, create on ODBC link, complie and execute java JDBC socket.</i></p>	6+4
V	<p><b>SERVLETS</b> Presentation tier using JSP – Role of Java EE in Enterprise applications – Basics of Servlets - To introduce server side programming with JSP - Standard Tag Library. <i>Illustrative programs: Write a servlet program to connect database and extract data from the tables and display them, Authenticate the user when he/she submits the login form using the user name and password from the database using JSP.</i></p>	6+4
<b>Total Instructional Hours</b>		<b>29+16=45</b>
<b>Course Outcome</b>	<p>CO1: Understand the concepts of OOP paradigm.</p> <p>CO2: Understand the basics of world wide web.</p> <p>CO3: Understand the Principles behind the design and construction of Web applications.</p> <p>CO4: Apply the concepts of JDBC.</p> <p>CO5: Understand about server side programming.</p>	

**TEXT BOOKS:**

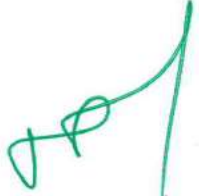
- T1: Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
- T2: Raj Kamal, "Internet and Web Technologies", Tata McGraw-Hill

**REFERENCE BOOKS:**

- R1: Douglas E Comer, Internet Book, The: Everything You Need to Know About Computer Networking and How the Internet Works, 4/E, Prentice Hall, 2007.
- R2: Jeffrey C. Jackson, Web Technologies: A Computer Science Perspective, Prentice Hall, 2007.
- R3: Herbert Schildt, Java: The Complete Reference, McGraw-Hill Professional, 2006.
- R4: Ted Wugofski, XML Black Book 2nd Edition , Certification Insider Press

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS5352	ADVANCED JAVA PROGRAMMING	2	0	2	3

**Course Objective**

- To learn GUI concepts using Swing and JavaFX.
- To learn network programs using java
- To understand concepts needed for distributed and multi-tier applications
- To understand Servlets and JDBC to develop web pages.
- To understand bean concepts for enterprise application development

Unit	Description	Instructional Hours
	<b>GUI INTRODUCTION</b>	
I	Introducing Swing- swing menus-Introducing JavaFX-Exploring JavaFX Controls- JavaFX Menus. <i>Illustrative Programs: Calculator using Swing, GUI application with controls menus and event handling using JavaFX</i>	4+4(P)
	<b>NETWORK PROGRAMMING IN JAVA</b>	
II	Networking classes and Interfaces-InetAddress- URL classes – URL Connection-Reading data from the server –Reading the Header- writing data to server –Sockets – Client Socket-Server Socket- secure sockets - UDP datagram and Sockets - multicast sockets - sending Email. <i>Illustrative Programs: chat application using TCP/IP, client/server application using UDP Communication, send email from java application.</i>	5+4(P)
	<b>APPLICATIONS IN DISTRIBUTED ENVIRONMENT</b>	
III	Remote method invocation - Activation models - RMI custom sockets - Object serialization - RMI- Iiop implementation -CORBA - IDL technologies - Naming services - CORBA programming model. <i>Illustrative Programs: simple calculator application using RMI, Client/Server Application (Bank Details) using CORBA</i>	5+6(P)
	<b>MULTI-TIER APPLICATION DEVELOPMENT:</b>	
IV	Introduction to servlet - servlet life cycle - Developing and deploying servlets - handling request and response - Introduction to JDBC-JDBC drivers and architectures - CURD operation using JDBC-connecting to non conventional database. <i>Illustrative Programs: Login form validation using servlet, implement CURD operations on student database.</i>	4+4(P)
	<b>ENTERPRISE APPLICATIONS:</b>	
V	Introduction to J2EE – J2EE Architecture and specifications, Client server application, web application, enterprise applications, 2,3 and n-tier applications. J2EE Frameworks: Struts MVC, Hibernate, Spring, J2EE Containers- Web Services Support- Packaging Application. <i>Illustrative Programs: Create Application Helloworld with struts on netbeans, create J2EE Application by integrating Strut+Spring+Hibernate.</i>	5+4(P)
<b>Total Instructional Hours</b>		<b>(23 + 22) 45</b>

<b>Course Outcome</b>	CO1:	To make use of GUI concepts in java programs.
	CO2:	Use the methods of network programming to create an application.
	CO3:	To make the students to develop distributed business applications and multitier applications
	CO4:	To develop web pages using advanced server-side programming through servlets and JDBC.
	CO5:	To use bean concepts for developing enterprise application.

#### TEXT BOOKS:

- T1: J. McGovern, R. Adatia, Y. Fain, 2003, J2EE 1.4 Bible, Wiley-dreamtech India Pvt. Ltd, New Delhi.  
T2: H. Schildt, 2002, Java 2 Complete Reference, 5th Edition, Tata McGraw Hill, New Delhi.

#### REFERENCE BOOKS:

- R1: Hortsman & Cornell, "core Java 2 Advanced Feature, 9th Edition", Pearson Education, 2013.  
R2: Ed Roman, "Mastering Enterprise Java Beans", John Wiley & sons Inc., 1999.  
R3: Elliotte Rusty Harold, "Java Network programming", O'Reilly publishers, 2000.  
R4: Patrick Naughton, "Complete Reference: Java 2, 9th Edition", Tata McGraw-Hill, 2003

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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS5353	<b>NAME OF THE COURSE</b> FUNDAMENTALS OF OPEN SOURCE SOFTWARE	<b>L</b> 2	<b>T</b> 0	<b>P</b> 2	<b>C</b> 3
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- Course Objective**
1. To understand open source operating systems and application
  2. To understand MYSQL database with Query
  3. To learn programming using a Server Side Script language.
  4. To study python programming language and understand the features.
  5. To understand how object oriented database is connecting to python.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> Introduction to Open sources – Need of Open Sources – Advantages of Open Sources– Application of Open Sources. List of open source software and open source hardware -Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux. <i>Illustrate Programs: Windows and Linux installation with dual boot, Micro kernel installation like MYSQL, PHP and PYTHON.</i>	6+3
I		
	<b>OPEN SOURCE DATABASE</b> MySQL: Introduction – Setting up account – Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata – Using sequences –MySQL and Web. <i>Illustrate Programs: DML and DDL command using MYSQL</i>	6+3
II		
	<b>OPEN SOURCE PROGRAMMING LANGUAGES</b> PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Debugging and error handling, case study- Symfony. <i>Illustrate Programs: Running PHP: Simple applications like login form, File handling ,Exception handling and Database connectivity using PHP</i>	6+3
III		
	<b>PYTHON: Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment. <i>Illustrate Programs: control flow statement, string manipulation and function by using python, create class and object using python, File handling and Exception handling using python.</i></b>	5+4
IV		
	<b>PYTHON DATABASES AND PERSISTENCE</b> Persistence options in python-DBM Files-Pickled Objects-Shelve Files-The ZODB Object-Oriented Database-SQL Database Interfaces- ORMs: Object Relational Mappers- PyForm: A Persistent Object Viewer. <i>Illustrate Programs: Database connectivity.</i>	6+3
V		
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

- Course Outcome**
- CO1. Understand open source operating systems and application.
  - CO2. Develop MYSQL query.
  - CO3. Develop PHP program with database connection.
  - CO4. Create a python program using exception.
  - CO5. Develop a python application using database.

**TEXT BOOKS:**

- T1.Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2003  
T2.Steve Suchring, "MySQL Bible", John Wiley, 2002

**REFERENCE BOOKS :**

- R1: Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002  
R2: Wesley J. Chun, "Core Python Programming", Prentice Hall, 2001  
R3: Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.  
R4: Vikram Vaswani, "MYSQL: The Complete Reference", 2nd Edition, Tata McGraw- Hill Publishing Company Limited, Indian Reprint 2009.

  
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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS5354	<b>NAME OF THE COURSE</b> R PROGRAMMING	<b>L</b> 2	<b>T</b> 0	<b>P</b> 2	<b>C</b> 3
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- Course Objective**
1. To learn the basics of R Programming and R overview.
  2. To learn the R functions and R strings.
  3. To discuss about the R package and R files.
  4. To understand the R data base and R charts.
  5. To learn the concepts of R linear & non linear regression, R distribution.

Unit	Description	Instructional Hours
I	<b>R Overview:</b> Evolution of R – Features of R - What is R - Why R- Installing R - R environment – R basic syntax – R data types – R variables – R constants- R operators. <i>Illustrative programs: Take input from the user, Addition of two numbers.</i>	9
II	<b>R Functions and Strings:</b> R Decision Making – R Loops – R Functions – R Strings – R Vectors – R List – Matrices – R Arrays – R Factors – R data frame. <i>Illustrative programs: factorial of given number, Prime Number, Sum of natural numbers, Create an array two 3x3 matrices.</i>	9
III	<b>R Package and R Files:</b> R Packages – R Data reshaping – R CSV Files - R Excel File – R Binary files – R XML Files – R JSON Files. <i>Illustrative programs: Joining column and rows in data frame, Create and read the XML file for employee details.</i>	9
IV	<b>R Data base and R charts:</b> R Web data – R data base – R Pie chart – R Bar chart – R Box Plots – R histogram – R Line Graphs – R Scatter plots – R Mean , Median, Mode. <i>Illustrative programs: pie chart in the current R working directory, boxplot graph for the relation between mpg (miles per gallon) and cyl (number of cylinders).</i>	9
V	<b>R Linear Regression, Non Linear Regression, R Distribution:</b> R Linear Regression - R Multiple Regression - R Logistic Regression - R Normal, Binominal distribution – R Poisson regression – R Time series analysis – R Nonlinear least square – R decision tree. <i>Illustrative programs: height of the probability distribution at each point for a given mean and standard deviation.</i>	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Understand the fundamentals of R Programming.  
CO2: Design the program using R functions and R String.  
CO3: Develop the application using R packages and R files.  
CO4: Understand and design the application using R database and R charts.  
CO5: Design the application using R linear & non linear regression, R distribution.

**TEXT BOOKS:**

- T1: "Hands-On Programming with R", Garrett Grolemond, First Edition.  
T2: Lawrence Leemis. *Learning Base R*. Lightning Source, 2016.

**REFERENCE BOOKS:**

- R1: Torsten Hothorn and Brian S. Everitt. *A Handbook Using R*. Chapman & Hall/CRC Press, Boca Raton, Florida, USA, 3rd edition, 2014.  
R2: Ruey S. Tsay. *Multivariate Time Series Analysis With R and Financial Applications*. John Wiley, New Jersey, 2014.

  
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Programme B.E.	Course Code 19CS5355	Name of the Course COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
			2	0	2	3
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To understand about graphics devices, software and basic algorithms for geometric objects.</li> <li>To understand two dimensional transformation techniques.</li> <li>To understand three dimensional transformation techniques.</li> <li>To gain knowledge about illumination methods, rendering and color models.</li> <li>To understand the fundamental concepts of multimedia.</li> </ol>					
<b>UNIT</b>	<b>Description</b>					<b>Instructional Hours</b>
I	<b>INTRODUCTION AND OVERVIEW OF GRAPHICAL SYSTEMS</b> Video Display Devices -Raster Graphics Systems -Graphics software and standards. Graphics primitives generation algorithms: Line drawing algorithms-Direct method-DDA- Bresenham's line drawing algorithm-Midpoint circle and Ellipse drawing Algorithm. Filling algorithms: Scan-line polygon filling, inside-outside test, boundary and flood-fill. <i>Illustrative Programs: Implementation of Line, Circle and Ellipse Drawing Algorithms.</i>					7+2(P)
II	<b>TWO DIMENSIONAL GRAPHICS</b> Transformations: Translation, rotation, scaling, reflection and shearing, Homogenous Coordinates, Composition of Transformations. 2D viewing pipeline, Window to viewport transformation. Clipping Algorithms: Point clipping, line clipping and polygon clipping algorithms. <i>Illustrative Programs: Implementation of 2D Transformation, viewing and Line Clipping Algorithm.</i>					5+4(P)
III	<b>THREE DIMENSIONAL GRAPHICS</b> 3D object Representation-Polygon surfaces- Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces, Blobby objects, Parametric Curves: Cubic Splines, Bezier Curves and B-Splines, Transformations: Translation, rotation, scaling. 3D viewing pipeline, Projection. <i>Illustrative Programs: Graphics programming using OPENGL - Creating 3D Objects and scenes. Implementation of 3D Transformation.</i>					5+4(P)
IV	<b>VISIBLE SURFACE DETERMINATION, ILLUMINATION AND COLOR MODELS</b> Visible line determination algorithms, Illumination Models: Diffuse, Specular and Ambient Reflection. Polygon-Rendering Methods, Flat Shading, Gouraud Shading and Phong Shading, Ray-Tracing Methods, Adding Surface Detail-texture mapping. Color models: properties of light, XYZ, RGB, YIQ and CMY color models. <i>Illustrative Programs: Implementation of color models.</i>					7+2(P)
V	<b>INTRODUCTION TO MULTIMEDIA:</b> Introduction, applications, Text: Introduction about Fonts and Faces - Using Text in Multimedia – Hypermedia and Hypertext. Images: Making Still Images –Images File Formats. Animation: The Power of Motion, Principles of Animation, Animation by Computer, morphing, tweening. The Internet and Multimedia- Designing for the World Wide Web. <i>Illustrative Programs: Using Flash/Maya perform different operations (rotation, scaling move etc.) on objects. Create an object using Key frame animation and Path animation.</i>					5+4(P)
<b>Total Instructional Hours</b>						<b>45</b>

- Course Outcome**
- CO1: Apply various algorithms to scan, convert the basic geometrical primitives and area filling.
  - CO2: Apply two dimensional transformations and clipping techniques to graphics
  - CO3: Learn the basic concepts of 3D object representation, transformations and projection.
  - CO4: Apply the concepts of color models, lighting and shading models, textures, ray tracing, hidden surface elimination and rendering to graphics objects.
  - CO5: Learn about the basics of multimedia concepts.

**TEXT BOOKS:**

- T1: Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007
- T2: Tay Vaughan, Multimedia: Making it Work, 8th Edition, McGraw Hill Education 2011.

**REFERENCE BOOKS:**

- R1: Hearn, Baker, Carithers "Computer Graphics with OpenGL", 4<sup>th</sup> Edition, Pearson Education, 2014  
R2: Francis S Hill, Jr. Stephen M Kelley., "Computer Graphics using OpenGL", 3<sup>rd</sup> Edition, Pearson Education, 2007.  
R3 K.R. Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Prentice Hall, 2014  
R4: Ralf Steinmetz, Klara Nahrstedt, Multimedia Systems, 2013, Springer Science & Business Media.

  
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PROGRAMME	COURSE CODE	PROFESSIONAL ELECTIVE II				
		NAME OF THE COURSE	L	T	P	C
B.E.	19CS6301	BUSINESS INTELLIGENCE – DATA WAREHOUSING AND ANALYTICS	3	0	0	3

- Course Objective**
1. To study about Transaction Processing and Analytical applications.
  2. To demonstrate Business Intelligence framework.
  3. To demonstrate Data Warehouse implementation and methodology.
  4. To apply a business scenario, identify the metrics, indicators to achieve the business goal
  5. To apply application of concepts using open source/MS Office

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO BUSINESS INTELLIGENCE</b>	9
I	Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP).	
	<b>BUSINESS INTELLIGENCE PROCESS AND FRAMEWORK</b>	9
II	BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.	
	<b>BASICS OF DATA INTEGRATION (EXTRACTION TRANSFORMATION LOADING)</b>	9
III	Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data - types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle)	
	<b>INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING</b>	9
IV	Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using Microsoft Excel	
	<b>BASICS OF ENTERPRISE REPORTING</b>	9
V	A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards	
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Understand difference between Transaction Processing and Analytical applications and describe the need for Business Intelligence
- CO2: Demonstrate to understand technology and processes associated with Business Intelligence framework
- CO3: Demonstrate to understand Data Warehouse implementation methodology and project life cycle
- CO4: Formulate given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal
- CO5: Demonstrate application of concepts using open source/MS Office

**TEXT BOOKS:**

T1: "Fundamentals of Business Analytics" by R.N.Prasad and Seema Acharya, Wiley 2011.

T2: "Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr

**REFERENCE BOOKS:**

R1: Business Intelligence by David Loshin, Second Edition, Elsevier, 2012.

R2: Business intelligence for the enterprise by Mike Biere, IBM Press, 2003.

R3: Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre, Addison-Wesley Professional, 2003.

R4: "Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales" by Victor Finch

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS6302	EMBEDDED SYSTEMS	3	0	0	3

- Course Objective**
1. Learn the architecture and programming of ARM processor.
  2. Be familiar with the embedded computing platform design and analysis.
  3. Be exposed to the basic concepts of real time Operating system design.
  4. Learn the system design techniques and networks for embedded systems
  5. Learn the basic concepts of embedded system to develop the realtime applications.

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO EMBE.DDED COMPUTING AND ARM PROCESSORS</b>	
I	Complex systems and micro processors– Embedded system design process – Design example: Model train controller- Instruction sets preliminaries – ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.	9
	<b>EMBE.DDED COMPUTING PLATFORM DESIGN</b>	
II	The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis – Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.	9
	<b>PROCESSES AND OPERATING SYSTEMS</b>	
III	Introduction – Multiple tasks and multiple processes – Multirate systems-Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.	9
	<b>SYSTEM DESIGN TECHNIQUES AND NETWORKS</b>	
IV	Design methodologies- Design flows – Requirement Analysis – Specifications- System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.	9
	<b>CASE STUDY</b>	
V	Data compressor – Alarm Clock – Audio player – Software modem-Digital still camera – Telephone answering machine-Engine control unit – Video accelerator.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Understand the architecture and programming of ARM processor.
- CO2: Understand and remember the concepts of embedded computing platform design and analysis.
- CO3: Understand the basic concepts of real time Operating system design.
- CO4: Apply the system design techniques to develop software for embedded systems.
- CO5: Apply the embedded-system concepts to develop the real time applications.

**TEXT BOOKS:**

- T1: Marilyn Wolf, “Computers as Components – Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
- T2: Shibu. K.V, “Introduction to Embedded Systems”, 2e, Mc graw Hill, 2017.

**REFERENCE BOOKS:**

- R1: Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
- R2: David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
- R3: Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall,1999.
- R4: C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997.

  
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<b>PROGRAMME</b> B.E.	<b>COURSE CODE</b> 19CS6303	<b>NAME OF THE COURSE</b> INTERNET OF THINGS	<b>L</b> 3	<b>P</b> 0	<b>T</b> 0	<b>C</b> 3
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- Course Objective**
- To understand the basic concepts and various building blocks of Internet of Things
  - To understand Smart Objects and IoT Architectures
  - To build simple IoT Systems using Raspberry Pi
  - To understand data analytics in the context of IoT and security issues in IoT
  - To develop IoT infrastructure for popular applications

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO INTERNET OF THINGS</b>	
I	Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT Levels and Deployment Templates	9
	<b>IOT NETWORK ARCHITECTURE AND DESIGN</b>	
II	Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack, The "Things" in IoT	9
	<b>DEVELOPING INTERNET OF THINGS</b>	
III	IoT Design Methodology, IoT Physical Devices and Endpoints: Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT devices	9
	<b>DATA ANALYTICS AND SECURING IOT</b>	
IV	DATA ANALYTICS: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics. SECURING IOT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	9
	<b>CASE STUDIES</b>	
V	Smart and Connected Cities: Smart City IoT Architecture, Street Lighting Architecture, Smart Parking Architecture and Smart Traffic Control Transportation: An IoT Architecture for Transportation, Connected Roadways Network Architecture, Connected Fleet Architecture, Connected Roadways Security Weather monitoring system, Air Pollution Monitoring	9
<b>Total Instructional Hours</b>		<b>45</b>

<b>Course Outcome</b>	CO1: Explain the concept of IoT and various building blocks
	CO2: Understand various architectures and working of state-of-the-art IoT systems
	CO3: Design IoT system using Rasperry Pi
	CO4: Apply data analytics related to IoT and evaluate security issues related to the Internet of Things
	CO5: Analyze applications of IoT in real time scenario.

**TEXT BOOKS:**

- T1 Arshdeep Bahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015
- T2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.

**REFERENCE BOOKS:**

- R1 Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.
- R2 Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine -to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1<sup>st</sup> Edition, Academic Press, 2014.
- R3 Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) [Kindle Edition] by CunoPfister ,2011
- R4: Adrian McEwen &Hakim Cassimally , "Designing the Internet of Things"- (Nov 2013) .

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS6304	BIG DATA ANALYTICS AND TOOLS	3	0	0	3

- Course Objective**
1. To know the fundamental concepts of big data and analytics
  2. To explore various tools and practices for working with big data
  3. To learn about stream computing and its importance
  4. To know about the applications and researches in integration of large amounts of data
  5. To apply the logics of security in handling large amount of data

Unit	Description	Instructional Hours
I	<b>INTRODUCTION TO BIG DATA:</b> Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data Storage – A General Overview of High-Performance Architecture – HDFS – MapReduce and YARN – Map Reduce Programming Model	9
II	<b>ACHIEVING ORGANIZATIONAL ALIGNMENT FOR BIG DATA ANALYTICS:</b> The Culture Clash Challenge- Aspects of Adopting- Right Decision Makers -Roles-Developing a strategy for Integrating Big data Analytics into Enterprise- Strategic Plan-Practices- Acceptability- Scalability- Data Reuse- Oversight and Governance-Mainstream Technology. <i>Case Study: Enterprise Integration- Exercises</i>	9
III	<b>MINING AND MAPREDUCE CONCEPTS:</b> Data Mining- Statistical Limits on Data Mining- MapReduce and the New Software Stack-Distributed File Systems- MapReduce- Algorithms Using MapReduce-Extensions to MapReduce- Applications of Near- Neighbor Search- Shingling of Documents- Similarity- Preserving Summaries of Sets	9
IV	<b>STREAM MEMORY:</b> Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications. <i>Case Studies – Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics</i>	9
V	<b>NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION:</b> NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases <i>Case Study: Google’s Big Table and its security.</i>	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Better understanding to work with big data tools and its analysis techniques
- CO2: Explore about various tools and practices for working with big data
- CO3: Learn about stream computing and its importance
- CO4: Understand about the applications and researches in integration of large amounts of data
- CO5: Apply the logics of security in handling large amount of data

**TEXT BOOKS:**

- T1: Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
- T2: David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/El sevier Publishers, 2013.

**REFERENCE BOOKS:**

- R1: EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
- R2: Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
- R3: Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
- R4: Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS6305	SOFT COMPUTING	3	0	0	3

- Course Objective**
- To learn the basic concepts of Soft Computing.
  - To apply Artificial Neural Networks and various categories of ANN.
  - To become familiar with various techniques like neural networks.
  - To apply fuzzy systems, fuzzy logic and its techniques to solve problems.
  - To learn the concepts of Genetic algorithms based solutions for real-world and engineering problems.

Unit	Description	Instructional Hours
I	<b>INTRODUCTION TO SOFT COMPUTING:</b> Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network-Adaline Network-Madaline Network.	9
II	<b>ARTIFICIAL NEURAL NETWORKS:</b> Back propagation Neural Networks – Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network – Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines – Spike Neuron Models.	9
III	<b>FUZZY SYSTEMS:</b> Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification – Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning – Introduction to Fuzzy Decision Making.	9
IV	<b>GENETIC ALGORITHMS:</b> Basic Concepts- Working Principles -Encoding-Fitness Function – Reproduction -Inheritance Operators – Cross Over – Inversion and Deletion -Mutation Operator – Bit-wise Operators -Convergence of Genetic Algorithm.	9
V	<b>HYBRID SYSTEMS:</b> Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination – LR-Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP- Inference by Fuzzy BP – Fuzzy ArtMap: A Brief Introduction – Soft Computing Tools – GA in Fuzzy Logic Controller Design – Fuzzy Logic Controller.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Apply various soft computing concepts for practical applications.  
CO2: Choose and design suitable neural network for real time problems.  
CO3: Explain the importance of optimization techniques and neural networks.  
CO4: Use fuzzy rules and reasoning to develop decision making and expert system.  
CO5: Review the various hybrid soft computing techniques and apply in real time problems.

**TEXT BOOKS:**

- T1: N.P.Padhy, S.P.Simon, “Soft Computing with MATLAB Programming”, Oxford University Press, 2015.  
T2: S.N.Sivanandam, S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2nd Edition, 2011.

**REFERENCE BOOKS:**

- R1: Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, —Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.  
R2: Kwang H.Lee, —First course on Fuzzy Theory and Applications, Springer, 2005.  
R3: George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.

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OPEN ELECTIVE						
PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	19CS6401	INTRODUCTION TO JAVA PROGRAMMING	3	0	0	3

- Course Objective**
1. To understand basic characteristics of Java
  2. To understand Object Oriented Programming concepts and inheritance
  3. To know the principles of polymorphism and interfaces
  4. To define exceptions and use I/O streams
  5. To develop a java application with threads and generic classes

Unit	Description	Instructional Hours
I	<b>INTRODUCTION TO JAVA FUNDAMENTALS</b> Introduction to java programming-Features of Java Language-JVM -The Java Environment-Fundamental Programming Structures in Java – Comments -Primitive Data types-variables-operators - control statements- arrays- Packages-defining package-access protection-importing packages- JavaDoc comments.	9
	<b>INTRODUCTION TO OOP AND INHERITANCE</b> Object Oriented Programming – Class and Objects - Constructor - Inheritance – Super classes-sub classes –Protected members – constructors in sub classes- the Object classes- Method overloading -method over riding –Abstract class and Method – Encapsulation-Garbage collection- static –final keyword.	9
	<b>INHERITANCE AND INTERFACES</b> Polymorphism-aggregation-association - Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning - inner classes, Array Lists – Strings	9
	<b>EXCEPTION HANDLING AND I/O</b> Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	9
	<b>MULTITHREADING AND GENERIC PROGRAMMING</b> Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1:Understand basic Java programs with concepts
  - CO2:Develop Java programs using OOP principles and inheritance
  - CO3:Develop Java programs with the concepts interfaces
  - CO4:Build Java applications using exceptions and I/O streams
  - CO5:Develop Java applications with threads and generic classes

**TEXT BOOKS:**

- T1- Herbert Schildt, —Java The complete referencel, 8th Edition, McGraw Hill Education, 2011.
- T2 - Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentalsl, 9th Edition, Prentice Hall, 2013.

**REFERENCE BOOKS :**

- R1 - Paul Deitel, Harvey Deitel, —Java SE 8 for programmersl, 3rd Edition, Pearson, 2015.
- R2 - Steven Holzner, —Java 2 Black bookl, Dreamtech press, 2011.
- R3 -Timothy Budd, —Understanding Object-oriented programming with Javal, Updated Edition, Pearson
- R4 -C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	P	T	C
B.E.	19CS6402	GREEN COMPUTING	3	0	0	3

- Course Objective**
1. To learn the fundamentals of Green Computing.
  2. To enhance the skill in energy saving practices in their use of hardware.
  3. To analyze the Green computing Grid Framework.
  4. To understand the issues related with Green compliance.
  5. To study and develop various case studies.

Unit	Description	Instructional Hours
	<b>FUNDAMENTALS</b>	
I	Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.	9
	<b>GREEN ASSETS AND MODELING</b>	
II	Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.	9
	<b>GRID FRAMEWORK</b>	
III	Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.	9
	<b>GREEN COMPLIANCE</b>	
IV	Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.	9
	<b>CASE STUDIES</b>	
V	The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.	9
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- CO1: Knowledge about the fundamentals of Green Computing  
CO2: Enhance the skill in energy saving practices in their use of hardware.  
CO3: Analyze the Green computing Grid Framework  
CO4: Understand the issues related with Green compliance.  
CO5: Understand and develop various case studies.

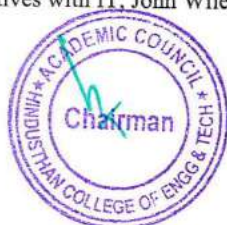
**TEXT BOOKS:**

- T1: Bhuvan Unhelkar, —Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.  
T2: Woody Leonhard, Katherine Murray, —Green Home computing for dummies, August 2012.

**REFERENCE BOOKS:**

- R1: Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journey, Shroff/IBM rebook, 2011.  
R2: John Lamb, —The Greening of IT, Pearson Education, 2009.  
R3: Jason Harris, —Green Computing and Green IT- Best Practices on regulations & industry, Lulu.com, 2008  
R4: Carl speshocky, —Empowering Green Initiatives with IT, John Wiley & Sons, 2010.

  
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# **SYLLABUS**

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5201	COMPUTER NETWORKS (CSE & IT)	3	0	0	3

- Course Objective**
- Understand the division of network functionalities into layers.
  - Be familiar with the components required to build different types of networks
  - Be expose to the required functionality at each layer
  - Learn the flow control and congestion control algorithms
  - Have knowledge in different applications that use computer networks

Unit	Description	Instructional hours
I	<b>INTRODUCTION &amp; DATA LINK LAYER</b> Building a network – Requirements – Layering and protocols – Internet Architecture – networking devices – modems, routers, switches, gateways; Link layer Services – Framing – Error Detection – Flow control- media access control.	10
II	<b>DATA COMMUNICATION</b> Signal characteristics – Data transmission – Physical links and transmission media – Signal encoding techniques - Channel access techniques – TDM – FDM-CDM	8
III	<b>NETWORK AND ROUTING</b> Circuit switching – packet switching – virtual circuit switching – Routing— RIP – OSPF – IPv6-Metrics- IP – Global Address — Subnetting – CIDR - ARP – DHCP.	9
IV	<b>TRANSPORT LAYER</b> Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements	9
V	<b>APPLICATION LAYER</b> Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP	9

**TOTAL INSTRUCTIONAL HOURS**

<b>Course Outcome</b>	CO1: Understand the components required to build different types of networks and aware of media access control	45
	CO2: Understand the data communication system and the purpose of layered architecture	
	CO3: Understand the concepts of Routing methods and Subnetting	
	CO4: Apply the Congestion control mechanism and Connection methods	
	CO5: Understand protocols such as SMTP, HTTP, POP3, DNS for various application	

**TEXT BOOK:**

- T1: Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.  
T2: Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

**REFERENCES:**

- R1: James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.  
R2: Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.  
R3: Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.  
R4: Andrew S Tanenbaum, David J. Wetherall "Computer Networks", Prentice Hall of India Pearson Education, New Delhi, 2010.

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PROGRAMME B.E.	COURSE CODE	NAME OF THE COURSE	L	T	P	C
	16CS5202	FREE OPEN SOURCE SOFTWARE I	3	0	0	3

- Course Objective**
6. This course provides an overview of the historical and modern context and operation of free and open source software (FOSS) communities and associated software projects.
  7. The practical objective of the course is to teach students how they can begin to participate in a FOSS project in order to contribute to and improve aspects of the software that they feel are wrong.
  8. Students will learn some important FOSS tools and techniques for contributing to projects and how to set up their own FOSS projects.
  9. Students will learn some important FOSS versions and its working in real time projects
  10. Students will learn some important FOSS programming language.

Unit	Description	Instructional Hours
<b>I</b>	<b>INTRODUCTION</b> Introduction to Open sources – Need of Open Sources – Advantages of Open Sources– Application of Open Sources. List of open source software and open source hardware -Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux.	8
<b>II</b>	<b>OPEN SOURCE DATABASE</b> MySQL: Introduction – Setting up account – Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata – Using sequences –MySQL and Web.	10
<b>III</b>	<b>OPEN SOURCE PROGRAMMING LANGUAGES</b> PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security – Templates. case study- Symfony.	10
<b>IV</b>	<b>PYTHON</b> Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.	10
<b>V</b>	<b>PYTHON DATABASES AND PERSISTENCE</b> Persistence options in python-DBM Files-Pickled Objects-Shelve Files-The ZODB Object- Oriented Database-SQL Database Interfaces- ORMs: Object Relational Mappers- PyForm: A Persistent Object Viewer	7
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Understand the concepts of open-source software and apply the procedure to install categories of software.
- CO2: Understand and apply the concepts of SQL/MYSQL to gather information using own programs in connection with record sequences
- CO3: Understand the scripts and basics of PHP, SQL database and apply in connecting the databases with various dynamic webpage development.
- CO4: Understand the notions of python programming and apply the knowledge of programming in executing the constrained environment development
- CO5: Understand the concepts of various python databases, objects and apply them in managing files and object viewers

**TEXT BOOKS:**

- T1.Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2003  
T2.Steve Suchring, "MySQL Bible", John Wiley, 2002  
T3.Mark Lutz, "Programming Python 4<sup>th</sup> Edition", O'Reilly Publication, 2010

**REFERENCE BOOKS :**

- R1- Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002  
R2- Wesley J. Chun, "Core Python Programming", Prentice Hall, 2001  
R3- Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5203	COMPUTER ARCHITECTURE	3	0	0	3

- Course Objective**
1. Give students a broad and deep knowledge of contemporary computer architecture issues and techniques.
  2. Give students knowledge of advanced hardware-based techniques for exploiting instruction level parallelism.
  3. Give students ability to apply the learned knowledge to conduct computer architecture research using performance simulators.
  4. Give the students ability to learned knowledge to work in various computer components.
  5. Give the student about the wide knowledge about the current system working with the existing mechanisms.

Unit	Description	Total Instructional Hours
	<b>INTRODUCTION &amp; INSTRUCTIONS</b>	
I	Brief history of computers- Eight ideas – Components of a computer system – Technology – Performance – Power wall –Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions– Logical operations – control operations – Addressing and addressing modes.	9
	<b>COMPUTER ARITHMETIC</b>	
II	The Arithmetic and Logic Unit (ALU) - Integer Representation - Integer Arithmetic - Floating-Point Representation - Floating-Point Arithmetic	8
	<b>PROCESSOR AND CONTROL UNIT</b>	
III	Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining –Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions	10
	<b>PARALLELISM</b>	
IV	Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardwaremultithreading – Multicore processors	9
	<b>MEMORY AND I/O SYSTEMS</b>	
V	Computer Memory System Overview - Cache Memory Principles – Elements of Cache Design - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts	9
	<b>TOTAL INSTRCTIONAL HOURS</b>	<b>45</b>

- Course Outcome**
- CO1: Understand the basic instructions and addressing modes.  
CO2: Apply Arithmetic and Logic Unit operations.  
CO3: Understand the concepts of pipelined control units.  
CO4: Understand the parallel processing architectures.  
CO5: Understand the performance of memory systems

**TEXT BOOKS:**


- T1. David A. Patterson and John L. Hennessey, "Computer organization and design", MorganKauffman / Elsevier, Fifth edition, 2014.  
T2. William Stallings "Computer Organization and Architecture", Eighth Edition, PearsonEducation, 2010.

**REFERENCE BOOKS :**

- R1. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VIth edition, Mc Graw-Hill Inc, 2012.  
R2. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education,  
R3. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5204	THEORY OF COMPUTATION (CSE & IT)	3	0	0	3

- Course Objective**
1. Understand about Finite State Machine
  2. Learn Regular expressions
  3. Understand the various types of Grammars and Pushdown Automata
  4. Expose the Turing Machine concept
  5. Understand about Decidability and Un-decidability of various problems.

Unit	Description	Instructional Hours
	<b>FINITE AUTOMATA</b>	
I	Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with $\epsilon$ - moves- Equivalence of DFA and NFA- NFA to DFA conversion-Applications of finite automata.	9
	<b>REGULAR EXPRESSIONS</b>	
II	Regular Languages- Regular Expression- Converting Regular Expression to FA- Converting FA to Regular Expression - Equivalence of finite Automaton and regular expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.	9
	<b>GRAMMARS AND PUSHDOWN AUTOMATA</b>	
III	Chomsky hierarchy of languages-Context-Free Grammar (CFG) - Parse Trees - Ambiguity in grammars and languages - Definition of the Pushdown automata - Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata- Normal forms for CFG – Chomsky Normal Form (CNF) – Greibach Normal Form (GNF) - Pumping Lemma for Context Free Language (CFL) - Closure Properties of CFL.	9
	<b>TURING MACHINE</b>	
IV	Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines - The Halting problem – Partial Solvability – Problems on Turing machine.	9
	<b>COMPUTATIONAL COMPLEXITY</b>	
V	Undecidability- Basic definitions- Decidable and undecidable problems-Properties of Recursive and Recursively enumerable languages – PCP – MPCP. Introduction to Computational Complexity: Definitions-Time and Space complexity of TMs–Complexity classes – Introduction to NP-Hardness and NP-Completeness	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Understand the finite state machine and to check given regular expression is regular or not..  
CO2: Understand a grammar for the given language and evaluate the ambiguous conditions  
CO3: Apply pushdown automata for given language in real time applications.  
CO4: Apply Turing machine concept for the real time applications.  
CO5: Understand about decidability and undecidability of various problems

**TEXT BOOKS:**


- T1- Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2008.  
T2- John C Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata Mc Graw Hill Publishing Company, New Delhi, 2007.

**REFERENCE BOOKS :**

- R1 - Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", Third Edition, Prentice Hall of India, 2004.  
R2- Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.  
R3- Peter Linz, "An Introduction to Formal Language and Automata", Third Edition, Narosa Publishers

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5001	NETWORKS LABORATORY (CSE & IT)	0	0	4	2

- Course Outcome**
1. Use simulation tools.
  2. Implement the various protocols.
  3. Analyse the performance of the protocols in different layers.
  4. Analyze various routing algorithms.
  5. Analyze various real time problems for projects.

**Expt. No. Description of the Experiments**

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol
2. Study of Socket Programming and Client – Server model
3. Write a code simulating ARP /RARP protocols
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting
8. Applications using TCP Sockets like
  - a. Echo client and echo server
  - b. Chat
  - c. File Transfer
9. Applications using TCP and UDP Sockets like
  - d. DNS
  - e. SNMP
  - f. File Transfer
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
  - a. Link State routing
  - b. Flooding
  - c. Distance vector

**Total Practical Hours 45**

- Course Outcome**
- CO1: Use simulation tools  
 CO2: Implement the various protocols  
 CO3: Analyze the performance of the protocols in different layers  
 CO4: Analyze various routing algorithms  
 CO5: Learn about the network simulation

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**SOFTWARE**

- Turbo C++ Compiler
- Operating System (Windows, UNIX, Linux...)

**HARDWARE**

Standalone desktops : 30 Nos

REFERENCE : spoken-tutorial.org

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5002	OPEN SOURCE PROGRAMMING LABORATORY	0	0	4	2

**Course Objective**

1. Common open source software licenses, open source project structure, distributed team software development, and current events in the open source world
2. Explain common open source licenses and the impact of choosing a license
3. Installation of open source software and tools.

**S.NO DESCRIPTION OF THE EXPERIMENTS**

- 1 Windows and Linux installation with dual boot.
- 2 Micro kernel installation like MYSQL, PHP and PYTHON
- 3 Running PHP: Simple applications like login forms  
To implement the following the concept using PHP
- 4 File handling  
Exception handling  
Database connectivity
- 5 Writing Python: some simple exercise – e.g. control flow statement, string manipulation and function
- 6 To implement Python's data structures - lists, dictionaries, and tuples in detail.  
To implement the following the concept using PYTHON
- 7 File handling  
Exception handling  
Database connectivity
- 8 To implement PYTHON GUI program using Django

**TOTAL INSTRUCTIONAL HOURS**

**45**

CO1: Understand the concepts of open-source software and learn to install the kernel and micro-kernel installation..

**Course Outcome**

CO2: Understand and apply the concepts of SQL/MYSQL to gather information using own programs in connection with record sequences  
CO3: Understand the scripts and basics of PHP, Python, SQL database and apply in connecting the databases with various dynamic webpage development

**REFERENCE:**

Spoken-tutorial.org

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**SOFTWARE:** Latest distribution of Linux

**HARDWARE:** Standalone desktops 30 Nos

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5701	TECHNICAL PRESENTATION	0	0	4	2

- Course Objective**
1. To encourage the students to study advanced engineering developments.
  2. To prepare and present technical reports.
  3. To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative model.
  4. To promote and develop presentation skills and import a knowledgeable society.
  5. To set the stage for future recruitment by potential employers.

**Expt. No.**

**Description of the Experiments**


1. During the seminar session each student is expected to present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, the students have to submit a report on their topic of seminars. The Report will be evaluated and marks will be given. A faculty guide will be allotted to monitor the progress of the student and also to maintain attendance.

**Total Practical Hours 45**

- Course Outcome**
- Upon completion of this course, the students will be able to
- CO1: Ability to review, prepare and present technological developments
  - CO2: Ability to face the placement interviews
  - CO3: Develops Communication Confidence skills
  - CO4: Builds Confidence
  - CO5: Utilize Technical Resources

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6201	FREE OPEN SOURCE SOFTWARE - II	3	0	0	3

- Course Objective**
1. Provides an overview of the historical and modern context of free and open source software (FOSS)
  2. Gain Knowledge about Web server and Web Services
  3. To learn about NS2 Simulator
  4. Study important FOSS tools and techniques
  5. To learn knowledge about Python Programming

Unit	Description	Instructional Hours
<b>I</b>	<b>WEB SERVICE</b> Web Server: Apache Web server – Working with Web Server – Configuring and Using apache web services MDA: Introduction to MDA – Genesis of MDA – Meta Object Facility – UML – UML Profiles – MDA Applications. case study: Apache Spark	9
<b>II</b>	<b>NS2</b> Introduction to Network Simulator 2-Linkage Between OTcl and C++ in NS2-Network Objects: Creation, Configuration, and Packet Forwarding	9
<b>III</b>	<b>PYTHON REGULAR EXPRESSION</b> Introducing Regular Expressions-Regular Expressions with Python-Grouping-Look Around-Performance of Regular Expressions.	9
<b>IV</b>	<b>PYTHON NLP</b> Language Processing and Python - Accessing Text Corpora and Lexical Resources-Processing Raw Text-Writing Structured Programs-Categorizing and Tagging Words	9
<b>V</b>	<b>PYTHON NLP</b> Learning to Classify Text-Extracting Information from Text-Analyzing Sentence Structure-Analyzing Sentence Structure-Analyzing the Meaning of Sentences-Managing Linguistic Data.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Apply the concepts of Apache Web server installation, Apache configuration services and Understand the Model Driven Architecture, UML profiles and Apache Spark
- CO2: Understand the basics of network simulator NS2 and configuration of simulator for packet forwarding
- CO3: Understand regular expression in python and apply python for grouping of regular expressions.
- CO4: Understand language processing in python and apply python to process raw text and text categorization
- CO5: Understand text classification and information extraction to analyze the sentence structure and meaning of the sentence

**TEXT BOOKS:**

- T1 - Issariyakul, Teerawat, Hossain, Ekram "Introduction to Network Simulator NS2", Springer, 2012
- T2 - Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python", oreilly, 2009

**REFERENCE BOOKS:**

- R1 - Mark Lutz, "Learning Python" 5th Edition. Published by O'Reilly Media 2013
- R2 - Eitan Altman "NS simulator for beginners"

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6202	COMPILER DESIGN	3	0	0	3

- Course Objective**
1. Learn the design principles of a Compiler.
  2. To introduce the various techniques involved in the translation of source programs into object programs by a compiler
  3. Learn the various parsing techniques and different levels of translation
  4. To understand the inner working of a compiler using the various data structures used in the translation process
  5. Learn how to optimize and effectively generate machine codes

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO COMPILERS</b>	
I	Introduction - Analysis of the source program -Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools.	5
	<b>LEXICAL ANALYSIS</b>	
II	Lexical Analysis-Need and Role of Lexical Analyzer- Lexical Errors- Specification of tokens - Recognition of tokens -Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language	9
	<b>SYNTAX ANALYSIS</b>	
III	Syntax analysis -Need and Role of the Parser-Context Free Grammars -Top Down Parsing - General Strategies-Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser- LR (0)Item-Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language	10
	<b>SYNTAX DIRECTED TRANSLATION &amp; RUN TIME ENVIRONMENT</b>	
IV	Syntax directed Definitions-S-attributed definitions - L-attributed definitions -Construction of Syntax Tree- Bottom-up and Top-down translation - type checking - Design of predictive translator - Type Systems-Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions.RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation-Access to non- local names-Parameter Passing-Symbol Tables-Dynamic Storage Allocation	12
	<b>CODE OPTIMIZATION AND CODE GENERATION</b>	
V	Intermediate code generation - Intermediate languages - Declarations - Assignment statements – Boolean Expressions - Procedure calls - Introduction to code optimization – Principal sources of optimization - DAG- Optimization of Basic Blocks -Introduction to global data-flow analysis - Introduction to code generation - Issues in the design of a code generator - The target machine - A simple code generator	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Able to know the various techniques involved in translation  
CO2: Able to design and implement a prototype compiler  
CO3: Able to apply various code optimization techniques  
CO4: Able to apply various code generation techniques  
CO5: Able to use the different compiler construction tools

**TEXT BOOKS:**

T1 - Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.

**REFERENCE BOOKS:**

- R1 - Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.  
R2 - Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.  
R3 - Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann

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- Publishers Elsevier Science, 2004.
- R4 - Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008
  - R5 - Aho A. V., Ullman J.D. Principles of Compiler Design, Narosa
  - R6 - Holub A.I., Compiler Design in C, Prentice Hall India
  - R7 - Appel A.W., Modern Compiler Implementation in C, Cambridge University Press
  - R8 - Dick Grune, Henri E Bal, Cerial J.H Jacobs, Koen G Langendoen, Modern Compiler design, Dreamtech.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6203	INTERNET OF THINGS	3	0	0	3

- Course Objective**
1. Learn the components of IOT
  2. Learn about the IOT objects
  3. Understand the components and the protocols in Internet.
  4. Understand the various modes of communications with internet.
  5. Understand the various cloud services for IOT

Unit	Description	Instructional Hours
I	<b>INTRODUCTION TO INTERNET OF THINGS</b> Definition and Characteristics of IoT, Physical Design of IoT-n IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies-Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates.	9
II	<b>PROTOTYPING IOT OBJECTS USING MICROPROCESSOR/MICROCONTROLLER</b> Overview of Microprocessor and Microcontroller, Basics of Sensors and actuators-examples and working principles of sensors and actuators, Equivalent Microcontroller platform-Setting up the board-Programming for IOT-Reading from Sensors, Communication: Connecting microcontroller with mobile devices-communication through bluetooth, wifi, Ethernet.	11
III	<b>IOT ARCHITECTURE AND PROTOCOLS</b> Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model-Zigbee, RFID, BLE, NFC , BACnet , 6LowPAN, RPL, CoAP, MQTT.	9
IV	<b>DEVICE DISCOVERY</b> Device Discovery capabilities-Registering a device, De-register a device, Querying for devices. Technologies available -IBM Foundation Device Management Service, Intel IOTivity, XMPP Discovery extension.	8
V	<b>CLOUD SERVICES FOR IOT</b> Introduction to Cloud Storage models and communication APIs Web server -Web server for IoT, Cloud for IoT- Create a unmanned supermarket for a common man to procure items using IoT concepts.	8
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Identify the components of IOT  
CO2: Design a portable IOT using appropriate boards  
CO3: Explore the IOT architecture and protocols  
CO4: Develop schemes for device discovery.  
CO5: Explicate the use of cloud services for IOT

**REFERENCE BOOKS:**

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine -to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2. Vijay Madiseti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1stEdition, VPT, 2014.
3. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013
4. Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things Key applications and Protocols,
5. Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) [Kindle Edition] by CunoPfister ,2011
6. Designing the Internet of Things (Nov 2013) by Adrian McEwen &Hakim Cassimally

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6204	SOFTWARE QUALITY ASSURANCE	3	0	0	3

- Course Objective**
1. Understand the quality management framework and related quality program concepts
  2. Understand commercial standards and the impact on quality assurance
  3. Study the relationship of process and product quality assurance (PPQA) to SQA
  4. Learn the quality management in information technology
  5. Study the metrics for software quality assurance

Unit	Description	Instructional Hours
	<b>ORGANIZING QUALITY MANAGEMENT</b>	
I	Quality management framework - Quality program concepts - Organizational aspects of quality program -Quality Program organizational relationship-Mapping quality program functions to project organizational entities	7
	<b>SOFTWARE QUALITY ASSURANCE STANDARDS</b>	
II	Software Quality Assurance (SQA) in ISO standards-SQA in IEEE standards IEEE STD 730 - 2002-IEEE STD 829-1998-IEEE STD 1028-1997- ITIL standards- ANSI/EIA Standards and RTLA/DO standards	8
	<b>SOFTWARE QUALITY ASSURANCE</b>	
III	Identifying SQA personnel needs-Characteristics of a good SQA engineer-SQA engineering staff-Pareto principle applied to SQA-Software inspections and walkthroughs-Measurements-Transition of cost to quality - Software audit-Performing the audit - Software safety and its relation to SQA-PPQA relationship to SQA	11
	<b>QUALITY MANAGEMENT IN IT</b>	
IV	ITSM Processes-IT best practices-ITSM standards-Process improvement models-Customer requirements- Monitoring and measuring ITSM performance - Procurement quality-IT quality professional-Cost of software quality system CoSQ system to organization	11
	<b>SQA METRICS</b>	
V	Software quality indicators-PSM -CMMI- PSP and TSP-Six sigma - Seven quality control tools: traditional and modern tools-check sheet-Pareto diagram-Histogram-Run chart-Scatter diagram-Control chart	8
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1. Identify the quality management framework and related quality program concepts.
  - CO2. Analyze the commercial standards and the impact on quality assurance.
  - CO3. Analyze the relationship of process and product quality assurance (PPQA) to SQA.
  - CO4. Explore the quality management in information technology.
  - CO5. Elucidate Software quality metrics methodology and software quality control tools.

#### REFERENCES

1. Schulmeyer G. Gordon, Handbook of Software Quality Assurance. London: Artech House Inc, 2008
2. Daniel Galin, Software Quality Assurance from theory to implementation, Pearson Education Limited, 2009
3. Stephen H. Kan. Metrics and Models in Software Quality Engineering, Addison-Wesley Professional, 2003
4. Murali Chemuturi, Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers, J. Ross Publishing Inc, 2011
5. Murali Chemuturi, Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers, J. Ross Publishing Inc, 2011

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6001	OPEN SOURCE PROGRAMMING LABORATORY - II	0	0	4	2

**Course Objective**

- 1.To expose students to FOSS environment
2. To introduce the use of open source packages.
3. To provide practical experience in software development using open source tools like Perl, Python, PHP and MySql

**Expt. No. Description of the Experiments**

1. Develop a necessary class and method of sorting algorithms such as bubble sort, insertion sort, merge sort, and quick sort.
2. Develop a Linked List Class and its Methods and implement Stack and Queue concept.
3. Develop a database connection program and implement the following concept
  - a. Inheritance
  - b. Overloading
  - c. Overriding
  - d. Data hiding
4. To implement the following concept using regular expression
  - a. Remove duplicate word
  - b. Find a phone number in a list
  - c. Validate E-mail address
5. Install the NLP package and implement the following concept
  - a. Extracting Information from Text
  - b. Learning to Classify Text
  - c. Building Feature Based Grammars
6. Mini project (Application Development using PYTHON / MYSQL)
  - a. Inventory Control System.
  - b. Material Requirement Processing.
  - c. Hospital Management System.
  - d. Railway Reservation System.
  - e. Personal Information System.
  - f. Web Based User Identification System.
  - g. Timetable Management System.
  - h. Hotel Management System

**TOTAL PRACTICAL HOURS 45**

**Course Outcome**

CO1: Understand, analyze and apply the role of languages like HTML, DHTML, CSS, JavaScript and PHP  
 CO2: Analyze a web page and identify its elements and attributes  
 CO3: Create web pages using HTML, DHTML and Cascading Style Sheets  
 CO4: Create dynamic web pages using JavaScript, XML.  
 CO5: Build web applications using PHP

**REFERENCE:**  
 Spoken-tutorial.org

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**SOFTWARE:** Latest distribution of Linux  
**HARDWARE:** Standalone desktops 30 Nos

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6002	COMPILER DESIGN LABORATORY	0	0	4	2

**Course Objective**

1. Be exposed to compiler writing tools.
2. Learn to implement the different Phases of compiler
3. Be familiar with control flow and data flow analysis.

**Expt. No.**

**Description of the Experiments**

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs, comments and new lines. Although the syntax specification states that the identifiers can be arbitrary long, you may restrict the length to some reasonable value. Simulate the same in C language
2. Implementation of Lexical Analyzer using JLex, flex or other lexical analyser generating tools  
Generate YACC specification for a few syntactic categories.
  - a. Program to recognize a valid arithmetic expression that uses operator +, -, \* and /.
  - b. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
  - c. Implementation of Calculator using LEX and YACC
4. Implementation of LALR Parsing
5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree
6. Implementation of Symbol Table
7. Implement type checking
8. Implement control flow analysis and Data flow Analysis
9. Implement any one storage allocation strategies(Heap,Stack,Static)
10. Construction of DAG
11. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler.The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.
12. Implementation of Simple Code Optimization Techniques (Constant Folding., etc.)

**Total Practical Hours 45**

**Course Outcome**

- CO1: Understand about the working of different phases of compiler with the compiler tools..  
 CO2: Understand about the control flow and data flow through code optimization and generation.  
 CO3: Apply the optimization techniques to have a better code for code generation.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C / C++ / Java / Equivalent compiler : 30 Nos.  
 (or)

Server with C / C++ compiler and Compiler writing tools supporting 30 terminals or more-LEX and YACC

**TEXT BOOKS:**

- T1. Enterprise Cloud Computing by Gautam Shroff, Cambridge,2010
- T2. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley - India, 2010 , ISBN:978-0-470-58987-8
- T3. Getting Started with OwnCloud by Aditya Patawar , Packt Publishing Ltd, 2013
- T4. www.openstack.org

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with PHP, HTML, JOSSO and own Cloud, Microsoft azure. 30 Nos.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5301	ADVANCED JAVA PROGRAMMING	3	0	0	3

- Course Objective**
1. To learn advanced java programming concepts like interface, threads, swings etc.
  2. To develop network programs in java
  3. To understand concepts needed for distributed and multi-tier applications
  4. To understand issues in enterprise application development
  5. To demonstrate approaches for performance and effective coding

Unit	Description	Instructional hours
<b>JAVA FUNDAMENTALS</b>		
I	Object oriented programming concepts - Extending classes and inheritance - packages - user interfaces - graphic programming - exception handling and debugging - array and string - multithreading - collections - Java I/O streaming-filter and pipe streams - byte code interpretation - threading - swing - applets	9
<b>NETWORK PROGRAMMING IN JAVA</b>		
II	Sockets - secure sockets - custom sockets - UDP datagrams - multicast sockets - URL classes - Reading data from the server - writing data - configuring the connection - Reading the header - sending Email - telnet application - Java messaging services.	9
<b>APPLICATIONS IN DISTRIBUTED ENVIRONMENT</b>		
III	Remote method invocation - Activation models - RMI custom sockets - Object serialization - RMI- Iiop implementation -CORBA - IDL technologies - Naming services - CORBA programming model - JAR file creation - Case studies.	9
<b>MULTI-TIER APPLICATION DEVELOPMENT</b>		
IV	Web application Basics - Architectures and challenges of Web application - Introduction to servlet - servlet life cycle - Developing and deploying servlets - Exploring deployment - descriptor(web.xml),handling request and response - Intoduction to JDBC-JDBC drivers and architectures - CURD operation using JDBC-connecting to non conventional database - Applet to Applet communication-applet to servlet communication - multimedia streaming applications - Java media framework.	9
<b>ENTERPRISE APPLICATIONS</b>		
V	Server side component architecture - Introduction to J2EE - session beans - entity beans - persistent entity beans - case studies.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1. To cover topics in various java technologies.
  - CO2. Use the methods of the Applet and Component classes required for a basic applet
  - CO3. To make the students to develop distributed business applications and multitier applications
  - CO4. To develop web pages using advanced server-side programming through servlets and java server pages.
  - CO5. Develop program using javax.servlet package

**TEXT BOOKS:**

- T1. Elliotte Rusty Harold,"Java Network programming",o'Reilly publishers,2000(unit II)
- T2. Ed Roman,"Mastering Enterprise Java Beans",John Wiley & sons Inc.,1999.(unit III and unit V)
- T3. Hortsman & Cornell,"core Java 2 Advanced Feature,Vol II",pearson Education,2002

**REFERENCE BOOKS:**

- R1. Http://Java.Sun.Com
- R2. Patrick Naughton,"Complete Reference: Java2",Tata McGraw-Hill,2003

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5302	VISUALIZATION TECHNIQUES	3	0	0	3

- Course Objective**
- To learn about different Visualization Techniques
  - To study the Interaction techniques in information visualization fields
  - To study about Multi dimension visualization Techniques
  - To understand various abstraction mechanisms
  - To create interactive visual interfaces

Unit	Description	Instructional hours
	<b>FOUNDATION OF DATA VISUALIZATION</b>	
I	Introduction to visualization, Visualization stages, Experimental semiotics on perception, Gibson's affordance theory, Limitation of Gibson's affordance theory, Model of perceptual processing, Cost and benefits of visualization, Type of data, Abstraction.	9
	<b>COMPUTER VISUALIZATION</b>	
II	Computer Visualization and Non-Computer Visualization, Exploring the complex information space, Fisheye view applications, Comprehensible Fisheye Views, Fisheye views for 3D data, Non linear magnification, Comparing visualization of information space, Abstraction in computer graphics, Abstraction in user interface.	9
	<b>MULTI DIMENSIONAL VISUALIZATION</b>	
III	Single dimension, Two dimension, Three dimension, Trees, Web works, Data Mapping, Document Visualization, Work space.	9
	<b>TEXTUAL METHOD OF ABSTRACTION</b>	
IV	From graphics to full text, Figure captions in visual interfaces, Interactive 3D illustration with image and text, Consistency of rendering, Images and its textual labels, Architecture, Zoom Technique for illustration purpose, Interactive handling of images and text.	9
	<b>ABSTRACTION IN TIME AND INTERACTIVE SYSTEMS</b>	
V	Animating non Photo realistic Computer Graphics, Interaction Facilities and High Level Support for Animation Design, Zoom Navigation in User Interfaces, Interactive Medical Illustrations, Rendering Gestural Expressions, Animating design for Simulation, Tactile Maps for Blind People – Synthetic holography, Abstraction Versus Realism, Integrating Spatial and Non Spatial Data..	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1. Ability to understand the data visualization concepts
  - CO2. Ability to understand modern visualization techniques
  - CO3. Ability to understand various interaction techniques
  - CO4. Ability to understand various textual methods of abstraction
  - CO5. Ability to create interactive visual interface applications

**TEXT BOOKS:**

- T1. Colin Ware "Information Visualization Perception for Design", 3rd edition, Morgan Kaufman 2012. ( UNIT 1)
- T2. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, "Readings in Information Visualization Using Vision to think", Morgan Kaufmann Publishers, 1999. (UNIT 3)
- T3. Thomas Strothotte, "Computer Visualization–Graphics Abstraction and Interactivity", Springer Verlag Berlin Heiderberg 1998. (UNIT 2, 4, 5)

**REFERENCE BOOKS:**

- R1. Chaomei Chan, "Information Visualization", Beyond the horizon, 2nd edition, Springer Verlag, 2004.
- R2. Pauline Wills, "Visualisation: A Beginner's Guide", Hodder and Stoughlon, 1999.
- R3. Benedikt. M, "Cyberspace: Firot Steps", MIT Press, 1991.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5303	SERVICE ORIENTED ARCHITECTURE	3	0	0	3

- Course Objective**
1. To learn service oriented analysis techniques
  2. To learn technology underlying the service design
  3. To learn advanced concepts such as service composition, orchestration and Choreography
  4. To know about various Web Service specification standards
  5. To learn about SOA Platforms

Unit	Description	Instructional Hours
I	<b>INTRODUCTION</b> Roots of SOA ,Characteristics of SOA, Comparing SOA to client-server and distributed internet architectures, Anatomy of SOA, How components in an SOA interrelate , Principles of service orientation	9
II	<b>SERVICE ORIENTED ARCHITECTURE IN WEB SERVICES</b> Web services, Service descriptions, Messaging with SOAP, Message exchange Pattern, Coordination, Atomic Transactions, Business activities, Orchestration , Choreography, Service layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer	9
III	<b>BUILDING SOA</b> Service oriented analysis, Business-centric SOA, Deriving business services, service modeling, Service Oriented Design, WSDL basics, SOAP basics, SOA composition guidelines, Entity-centric business service design, Application service design, Task centric business service design.	9
IV	<b>SOA PLATFORMS</b> SOA platform basics, SOA support in J2EE, Java API for XML-based web services (JAX-WS), Java architecture for XML binding (JAXB), Java API for XML Registries (JAXR) , Java API for XML based RPC (JAX-RPC), Web Services Interoperability Technologies (WSIT), SOA support in .NET , Common Language Runtime, ASP.NET web forms, ASP.NET web services, Web Services Enhancements (WSE).	9
V	<b>SOA DESIGN</b> Web Service, BPEL- process, elements, functions, Web Service, Coordination, overview, elements, web service business activity & atomic transaction coordination type , Business process design Web Service , Choreography, Web Service, Policy-elements, Web Service Security, XML, Signature element	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1. Ability to understand service oriented architecture
  - CO2. Ability to build service oriented architecture applications
  - CO3. Ability to understand various service oriented architecture techniques
  - CO4. Ability to understand service oriented architecture platforms
  - CO5. Ability to understand service oriented architecture design

**TEXT BOOKS:**

- T1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2009.
- T2. Thomas Erl, "SOA Principles of Service Design" (The Prentice Hall Service- Oriented Computing Series from Thomas Erl), 2005.

**REFERENCE BOOKS:**

- R1. Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
- R2. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services, An Architect's Guide", Pearson Education, 2005.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5304	INFORMATION STORAGE MANAGEMENT	3	0	0	3

- Course Objective**
1. Understand about the storage system
  2. Learn the storage networking technologies
  3. Describe the core elements in a data center.
  4. Learn the Cloud computing characteristics and benefits
  5. Understand RAID and its various levels for data backup.

Unit	Description	Instructional Hours
I	<b>STORAGE SYSTEM</b> Introduction to information storage, Virtualization and cloud computing, Key data center elements, Compute, application, and storage virtualization, Disk drive & flash drive components and performance, RAID, Intelligent storage system and storage provisioning (including virtual provisioning)	9
II	<b>STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION</b> Fibre Channel SAN components, FC protocol and operations, Block level storage virtualization, iSCSI and FCIP as an IP-SAN solutions, Converged networking option FcoE, Network Attached Storage (NAS) components, protocol and operations, File level storage virtualization, Object based storage and unified storage platform.	9
III	<b>BACKUP, ARCHIVE AND REPLICATION</b> Business continuity terminologies, planning and solutions, Clustering and multipathing to avoid single points of failure, Backup and recovery methods, targets and topologies, data deduplication and backup in virtualized environment, fixed content and data archive, Local replication in classic and virtual environments, Remote replication in classic and virtual environments, Three-site remote replication and continuous data protection.	9
IV	<b>CLOUD COMPUTING CHARACTERISTICS AND BENEFITS</b> Cloud Enabling Technologies - Characteristics of Cloud Computing- Benefits of Cloud Computing-Cloud Service Models Cloud deployment models- Cloud Computing Infrastructure-Cloud Challenges, Cloud migration considerations	9
V	<b>SECURING AND MANAGING STORAGE INFRASTRUCTURE</b> Security threats, and countermeasures in various domains, Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle Management (ILM) and storage tiering.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1. Explain physical and logical components of a storage infrastructure including storage subsystems, RAID and intelligent storage systems.
- CO2. Describe storage networking technologies such as FC-SAN, IP-SAN, FCoE, NAS and object based, and unified storage.
- CO3. Illustrate and articulate business continuity solutions, backup and replications, along with archive for managing fixed content.
- CO4. Explain key characteristics, services, deployment models, and infrastructure components for a cloud computing.
- CO5. Implement the concept of security storage infrastructure management.

**REFERENCE BOOKS:**

- R1: Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments, 2nd Edition, EMC Education Services, Wiley, May 2012.
- R2: Information Storage and Management: Storing, Managing, and Protecting Digital Information, EMC Education Services, Wiley, January 2010
- R3: Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Hausteil, "Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE, 2nd Edition, Wiley, July 2009

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5305	TCP/IP PRINCIPLES AND ARCHITECTURE	3	0	0	3

- Course Objective**
1. To learn the principles of TCP / IP and its Architecture.
  2. To understand the basic concepts of TCP/IP Architecture
  3. To enhance the knowledge to UDP and its applications
  4. To provide knowledge on TCP features and SMTP
  5. To understand the concepts on Transport layer

Unit	Description	Instructional hours
I	<b>INTRODUCTION</b> Intermediate communication entities- Layering network addresses-DNS-Client server model- Port numbers- Standardization process-RFC's-Standard simple services- Application programming interfaces-Ethernet & IEEE 802 – encapsulation-SLIP-PPP-loop back interface-MTU-path MTU-ARP cache – Packet format – proxy ARP & Gratuitous ARP – ARP command – RARP- Structure TCP/IP s/w in operating system.	9
II	<b>NETWORK LAYER AND APPLICATION</b> Introduction- IP header- IP routing - Subnet addressing- Subnet mask- Special case IP addresses – Examples- Ifconfig – Netstat- routing principles - ICMP host and Network unreachable errors - ICMP redirect errors – ICMP router discovery messages- Dynamic routing - UNIX routing daemons- routing information protocol (RIP)-OSPF-CIDR – Case study: Voice over IP for two way Communication.	9
III	<b>UDP AND APPLICATIONS</b> Introduction- UDP header- UDP checksum- examples-IP fragmentation - ICMP unreachable errors – Path MTU discovery- Interaction between UDP and ARP-UDP datagram size- ICMP source quench error- Broad casting and Multi casting - IGMP- NFS- TFTP-BOOTP	9
IV	<b>TCP</b> Introduction- TCP services- TCP header – Connection establishment and termination – Maximum size – TCP half close – TCP state transition diagram – Reset segments- Simultaneous open and close – TCP options – Interactive input – Delayed acknowledgement – Nagle algorithm – Window size advertisement- Normal data flow – Sliding window – Window size - PUSH flag – Slow start- Bulk data throughput – Urgent mode	9
V	<b>TRANSPORT LAYER RELIABILITY AND APPLICATION</b> CP/IP time out – Retransmission – Roundtrip time measurement – Congestion avoidance algorithms – Fast retransmit and fast recover algorithm – Repackitization - ICMP errors- TCP persistent – TCP features and performance – Telnet and rlogin - SMTP – TCP dump	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	45
<b>Course Outcome</b>	CO1. Able to learn the principles of TCP / IP and its Architecture. CO2. Able to understand the basic concepts of TCP/IP Architecture CO3. Able to understand UDP and its applications. CO4. Able to understand the sliding window and delayed acknowledgement methodologies. CO5. Able to enhance the knowledge on broadcasting and multi casting in UDP.	

**TEXT BOOKS:**

- T1. W. Richard Stevens, "TCP/IP Illustrated, The Protocol-Volume I", Addison-Wesley Pub Co, 1st Edition, 1994
- T2. Douglas E. Comer, "Internetworking with TCP/IP-Principles, Protocols & Architecture", Pearson education, 4th Edition, 2000

**REFERENCE BOOKS:**

- R1. Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill, 2000
- R2. Michael Santifaller, "TCP/IP – ONC/NFS, Internetworking in UNIX Environment", Addison Wesley Professional, 2<sup>nd</sup> Edition, 1994.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS5306	SYSTEM SOFTWARE	3	0	0	3

- Course Objective**
1. To understand the relationship between system software and machine architecture.
  2. To know the design and implementation of assemblers
  3. To know the design and implementation of loaders and linkers
  4. To have an understanding of compilers, interpreters, and macro processors.
  5. To have an understanding of system software tools.

UNIT	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
	<b>INTRODUCTION</b>	
I	Language processors, Language processing activities–fundamentals of language processing– System software and machine architecture – The Simplified Instructional Computer (SIC) - Machine architecture - Data and instruction formats - addressing modes - instruction sets	8
	<b>ASSEMBLERS</b>	
II	Basic assembler functions - A simple SIC assembler – Assembler algorithm and data structures - Machine dependent assembler features - Instruction formats and addressing modes – Program relocation - Machine independent assembler features - Literals – Symbol-defining statements – Expressions - One pass assemblers and Multi pass assemblers - Implementation example - MASM assembler.	10
	<b>LOADERS AND LINKERS</b>	
III	Basic loader functions - Design of an Absolute Loader – A Simple Bootstrap Loader - Machine dependent loader features - Relocation – Program Linking – Algorithm and Data Structures for Linking Loader - Machine-independent loader features - Automatic Library Search – Loader Options - Loader design options - Linkage Editors – Dynamic Linking – Bootstrap Loaders - Implementation example - MSDOS linker.	9
	<b>COMPILERS AND INTERPRETERS - MACROS</b>	
IV	Compilers and Interpreters: Aspects of compilation–memory allocation–compilation of expressions–compilation of control structure code optimization–interpreters. Macro definition and Call macro expression–nested macro calls–advanced macro facilities–design of macro processors.	9
	<b>SYSTEM SOFTWARE TOOLS</b>	
V	Text editors - Overview of the Editing Process - User Interface – Editor Structure. - Interactive debugging systems - Debugging functions and capabilities – Relationship with other parts of the system – User-Interface Criteria.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1. Understands the language processing activities
  - CO2. Understands How to implement the assemblers
  - CO3. Understands the concept of loaders and linkers
  - CO4. Understands how to implement compilers, interpreters and macros
  - CO5. Understands the system software tools

**TEXT BOOKS:**

T1..D.M. Dhamdhere–System programming & operating system, Tat McGraw Hill Publishing Co., 1997.Reference Books

T2. J.J.Donovan, System programming, Tata McGraw Hill , 1996.


T3. Leland L. Beck, “System Software – An Introduction to Systems Programming”, 3<sup>rd</sup> Edition, Pearson Education Asia, 2007.

**REFERENCE BOOKS:**

R1. D. M. Dhamdhere, “Systems Programming and Operating Systems”, Second Revised Edition, Tata McGraw-Hill, 1999.

R2.John J. Donovan “Systems Programming”, Tata McGraw-Hill Edition, 2001

R3. John R. Levine, Linkers & Loaders – Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, 2000.

  
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## ELECTIVE- II

PROGRAM	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6301	ENTERPRISE COMPUTING	3	0	0	3

<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. Understand the concepts of enterprise computing.</li> <li>2. Learn the incepting enterprise Applications</li> <li>3. Understand how to design an enterprise architecture.</li> <li>4. Construct and roll out the designed architecture as application.</li> <li>5. Testing and rolling out on the enterprise Application.</li> </ol>
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Unit	Description	Instructional Hours
<b>I</b>	<b>INTRODUCTION</b> Enterprise Applications-Software Engineering Methodologies-Life Cycle of Raising Enterprise Applications-Three Key Determinants of Successful Enterprise Applications	9
<b>II</b>	<b>INCEPTING ENTERPRISE APPLICATIONS</b> Enterprise Analysis-Business Modeling-EM Bank-A Case Study-Requirement Elicitation and Analysis-Actors and Use Cases-User Prototypes-Non-Functional Requirements-Requirements Validation	9
<b>III</b>	<b>ARCHITECTING AND DESIGNING ENTERPRISE APPLICATIONS</b> Architecture, Views and Viewpoints-Enterprise Application-An Enterprise Architecture Perspective-Logical Architecture-Technical Architecture and Design -Data Architecture and Design-Infrastructure Architecture and Design	9
<b>IV</b>	<b>CONSTRUCTING ENTERPRISE APPLICATIONS</b> Construction Readiness-Introduction to Software Construction Map-Constructing the Solution Layers-Code Review-Static Code Analysis-Build Process and Unit Testing.	9
<b>V</b>	<b>TESTING AND ROLLING OUT ENTERPRISE APPLICATIONS</b> Testing Enterprise Applications-Enterprise Application Environments-Integration Testing-System Testing-User Acceptance Testing	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

<b>Course Outcome</b>	<p>CO1: Identify information systems used in the functional units of an enterprise.</p> <p>CO2: Analyze the integrated information systems used throughout an enterprise.</p> <p>CO3: Create and manage large-scale computing systems for an organization.</p> <p>CO4: Demonstrate skills to understand business environment.</p> <p>CO5: Analyze the applications of testing on the enterprise environment..</p>
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### REFERENCE BOOKS:

- R1. Anubhav Pradhan, B.Satheesha Nanjappa, Senthil Nallasamy and E.Veerakumar, "Raising Enterprise Applications : A Software Engineering Perspective", Wiley India Pvt Ltd, 2010
- R2. Paul J Perrone, Venkata S.R. Krishna R and Chayanti, "Building Java Enterprise Systems with J2EE", Techmedia, New Delhi, 2000.
- R3. Tom Valesky -"Enterprise Java Beans"-Addison Wesley Longman Inc. New Delhi, 2000.
- R4. Ed Roman-"Mastering EJB"-John Wiley & Sons, New Delhi, 2001.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6302	SOCIAL NETWORK ANALYSIS	3	0	0	3

- Course Objective**
- To understand the components of web based social networks
  - To model and visualize the social networks in various aspects
  - To mine the users community in social networks.
  - To understand the evolution of social networks through various models
  - To mine the opinions of the users in social networks

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks	9
	<b>MODELING AND VISUALIZATION</b> Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.	9
	<b>MINING COMMUNITIES</b> Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.	9
	<b>EVOLUTION</b> Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models	9
	<b>TEXT AND OPINION MINING</b> Text Mining in Social Networks -Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining – Review Classification – Tracking sentiments towards topics over time.	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

- Course Outcome**
- CO1: Work on the internals components of social networks  
CO2 : Model and visualize social networks  
CO3 : Mine the behavior of the users in social networks  
CO4 : Predict the possible next outcome of social networks  
CO5 : Mine the opinions of the user social networks.

**TEXT BOOKS:**


- T1 - Charu C. Aggarwal, “Social Network Data Analytics”, Springer; 2011  
T2 - Peter Mika, “Social Networks and the Semantic Web”, Springer, 1st edition, 2007.  
T3 - Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 1<sup>st</sup> edition, 2010.

**REFERENCE BOOKS :**

- R1 - Guandong Xu , Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, 1st edition, 2011.  
R2 - Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010.  
R3 - . Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2009.  
R4 - . Toby Segaran, “Programming Collective Intelligence”, O’Reilly, 2012

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6303	EMBEDDED SYSTEMS	3	0	0	3

- Course Objective**
1. To be familiar with 8051 microcontroller.
  2. Understand the basic Memory and I/O managements.
  3. Learn about the Process and OS
  4. Learn the embedded software.
  5. Design and develop embedded systems

Unit	Description	Total instructional hours
I	<b>EMEDDED COMPUTING</b> Challenges of Embedded Systems - Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor - Architecture, Instruction sets and programming.	9
II	<b>MEMORY AND I/O MANAGEMENT</b> Programming Input and Output - Memory system mechanisms - Memory and I/O devices and interfacing- Interrupts handling.	9
III	<b>PROCESSES AND OPERATING SYSTEMS</b> Multiple tasks and processes - Context switching - Scheduling policies - Interprocess communication mechanisms - Performance issues.	9
IV	<b>EMBEDDED SOFTWARE</b> Programming embedded systems in assembly and C - Meeting real time constraints - Multi-state systems and function sequences. Embedded software development tools - Emulators and debuggers.	9
V	<b>EMBEDDED SYSTEM DEVELOPMENT</b> Design issues and techniques - Case studies - Complete design of example embedded systems.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Explore the concepts of embedded computing with 8051 microcontroller.  
CO2: Illustrate the memory and I/O operations.  
CO3: Explain the processes and operating system concepts.  
CO4: Elucidate the embedded software concepts.  
CO5: Develop embedded systems using case studies. to develop web-based multimedia applications.

**REFERENCE BOOKS:**

1. Wayne Wolf, Computers as Components: Principles of Embedded Computer System Design, Elsevier, 2008.
2. Michael J. Pont, Embedded C, Pearson Education, 2007.
3. Steve Heath, Embedded System Design, Elsevier, 2005.
4. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2nd edition, 2007.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6304	TOTAL QUALITY MANAGEMENT	3	0	0	3

- Course Objective**
1. Understand the basic concepts of Total Quality Management
  2. Study principles and philosophies of quality management.
  3. Understand the different quality systems.
  4. Learn the tools and techniques for management.
  5. Understand about the Quality systems and its implementation

Unit	Description	Instructional Hours
I	<b>INTRODUCTION TO QUALITY MANAGEMENT</b> Definitions - TQM framework, benefits, awareness and obstacles. Quality vision, mission and policy statements. Customer Focus -customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality.	9
II	<b>PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT</b> Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques - introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles.	9
III	<b>STATISTICAL PROCESS CONTROL AND PROCESS CAPABILITY</b> Meaning and significance of statistical process control (SPC) -construction of control charts for variables and attributed. Process capability - meaning, significance and measurement - Six sigma concepts of process capability. Reliability concepts -definitions, reliability in series and parallel, and product life characteristics curve. Total productive maintenance (TMP)	9
IV	<b>TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT</b> Quality functions development (QFD) -Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) - requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven old (statistical) tools. Seven new management tools.	9
V	<b>QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION</b> Introduction to IS/ISO 9004:2000 - quality management systems - guidelines for performance improvements. Quality Audits. TQM culture, Leadership - quality council, employee involvement, motivation, empowerment, recognition and reward	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Understand the importance of quality and customer perception of quality  
CO2: Understand the principles and philosophies of total quality management and peculiarities of their implementation.  
CO3: Apply statistical process control to enhance quality  
CO4: Apply various TQM tools and techniques to enhance organization's quality performance..  
CO5: Understand quality standards and management methods for solving problems of organization

**REFERENCE BOOKS:**

1. Dale H. Besterfield, et al, Total Quality Management, Pearson Education Asia, Third Edition
2. James R. Evans and William M. Lindsay, The Management and Control of Quality, 8th Edition, South-Western (Thomson Learning), 2011.
3. Oakland, J.S. TQM Text with Cases, Butterworth Heinemann Ltd., Oxford, 3rd Edition, 2003.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6305	NETWORK AND ROUTING PROTOCOLS	3	0	0	3

- Course Objective**
1. Learn the basics of networks.
  2. Understand the Ethernet Technologies.
  3. Understand about subnetting
  4. Learn the Routing Protocols.
  5. Learn about IPv4 ACLs.

Unit	Description	Instructional Hours
	<b>NETWORKING FUNDAMENTALS</b>	
I	Exploring the Network: Globally Connected-LANs, WANs, and the Internet-The Network as a Platform- The Changing Network Environment-Configuring a Network Operating System: IOS Bootcamp-Getting Basic Addressing Schemes -Network Protocols and Communications: Rules of Communication-Network Protocols and Standards-Moving Data in the Network-Network Access.	9
	<b>TCP/IP LAYER</b>	
II	Ethernet- Network Layer-Transport Layer: Role of the Transport Layer- Conversation Multiplexing- Transport Layer Reliability - Introducing TCP and UDP- IP Addressing: IPv4 Network Addresses-IPv6 Network Addresses- Connectivity Verification.	9
	<b>SUBNETTING</b>	
III	Subnetting IP Networks: Subnetting an IPv4 Network-Addressing Schemes-Design Considerations for IPv6-Application Layer: Application Layer Protocols-Well-Known Application Layer Protocols and Service-The Message Heard Around the World-Introduction to Switched Networks.	9
	<b>VLAN AND ROUTING</b>	
IV	VLANs-Routing Concepts-Inter-VLAN Routing: Inter-VLAN Routing Configuration-Troubleshooting Inter-VLAN Routing-Layer 3 Switching-Static Routing: Static Routing Implementation-Configure Static and Default Routes-Review of CIDR and VLSM-Configure Summary and Floating Static Routes- Troubleshoot Static and Default Route Issues.	9
	<b>ROUTING PROTOCOLS AND ACL</b>	
V	Routing Dynamically-Single-Area OSP: Characteristics of OSPF-Configuring Single-area OSPFv2- Configure Single-area OSPFv3-F-Access Control Lists: IP ACL Operation-Standard IPv4 ACLs Extended IPv4 ACLs-Contextual Unit: Debug with ACLs-Troubleshoot ACLs-Contextual Unit- IPv6 ACLs-DHCP: Dynamic Host Configuration Protocol v4-Dynamic Host Configuration Protocol v6-- Network Address Translation for IPv4: NAT Operation-Configuring NAT-Troubleshooting NAT.	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

- Course Outcome**
- CO1: Explain the basics of networks and cable media.
  - CO2: Demonstrate the TCP/IP layer.
  - CO3: Describe the subnetting IP Networks.
  - CO4: Troubleshoot VLAN and trunk configurations in a switched network.
  - CO5: Configure standard IPv4 ACLs to filter traffic according to networking requirements.

**REFERENCE BOOKS:**

1. Todd Lammle, CCNA Routing and Switching Study Guide, Wiley India Pvt Ltd 2013.
2. Todd Lammle, CCNA Cisco Certified Network Associate Study Guide, Wiley India Pvt Ltd, 7<sup>th</sup> Edition, 2011.
3. Wendell Odom, Cisco CCNA Routing and Switching 200-120 Official Cert Guide Library, Academic Edition, Cisco Systems, 2013.
4. Scott Empson, CCNA Routing and Switching Portable Command Guide, 3rd Edition, Cisco Press, 2013

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6306	SIGNALS AND SYSTEMS	3	0	0	3

- Course Objective**
1. To understand the basic properties of signal and systems and the various methods of classification.
  2. To learn Laplace Transform and Fourier transform and their properties.
  3. To know Z transform and DTFT and their properties.
  4. To characterize LTI systems in the Time domain and various Transform domains.
  5. To know about Discrete Fourier and Z transform.

Unit	Description	Instructional Hours
	<b>CLASSIFICATION OF SIGNALS AND SYSTEMS</b>	
I	Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals - Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - CT systems and DT systems - Classification of systems - Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Noncausal, Stable & Unstable.	9
	<b>ANALYSIS OF CONTINUOUS TIME SIGNALS</b>	
II	Fourier series analysis - spectrum of Continuous Time (CT) signals - Fourier and Laplace Transforms in CT Signal Analysis - Properties.	9
	<b>LINEAR TIME INVARIANT-CONTINUOUS TIME SYSTEMS</b>	
III	Differential Equation - Block diagram representation - impulse response, convolution integrals - Fourier and Laplace transforms in Analysis of CT systems.	9
	<b>ANALYSIS OF DISCRETE TIME SIGNALS</b>	
IV	Baseband Sampling - DTFT - Properties of DTFT - Z Transform - Properties of Z Transform.	9
	<b>LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS</b>	
V	Difference Equations - Block diagram representation - Impulse response - Convolution sum - Discrete Fourier and Z Transform Analysis of Recursive & Non - Recursive systems.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>


- Course Outcome**
- CO1: Analyze the properties of signals and systems.  
CO2: Apply Laplace transform, Fourier transform, Z transform and DTFT in signal analysis.  
CO3: Analyze continuous time LTI systems using Fourier and Laplace Transforms.  
CO4: Analyze discrete time LTI systems using Z transform and DTFT.  
CO5: Apply the fourier and Z transforms of recursive & Non recursive systems.

**TEXT BOOKS:**

T1 - Allan V. Oppenheim, S. Wilsky and S.H. Nawab, "Signals and Systems", Pearson, 2007.

**REFERENCE BOOKS:**

- R1- B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.  
R2- R.E. Zeimer, W.H. Tranter and R.D. Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.  
R3- John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.  
R4- M.J. Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", Tata McGraw Hill, 2007.

  
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OPEN ELECTIVE

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS6402	INTRODUCTION TO JAVA PROGRAMMING	3	0	0	3

Course Objective	
	1. To understand basic characteristics of Java
	2. To understand Object Oriented Programming concepts and inheritance
	3. To know the principles of polymorphism and interfaces
	4. To define exceptions and use I/O streams
	5. To develop a java application with threads and generic classes

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO JAVA FUNDAMENTALS</b>	
I	Introduction to java programming-Features of Java Language-JVM -The Java Environment-Fundamental Programming Structures in Java – Comments -Primitive Data types-variables-operators - control statements- arrays- Packages-defining package-access protection-importing packages- JavaDoc comments	9
	<b>INTRODUCTION TO OOP AND INHERITANCE</b>	
II	Object Oriented Programming – Class and Objects - Constructor - Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object classes- Method overloading -method over riding –Abstract class and Method – Encapsulation-Garbage collection- static –final keyword..	9
	<b>INHERITANCE AND INTERFACES</b>	
III	Polymorphism-aggregation- association - Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning - inner classes, Array Lists – Strings	9
	<b>EXCEPTION HANDLING AND I/O</b>	
IV	Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.	9
	<b>MULTITHREADING AND GENERIC PROGRAMMING</b>	
V	Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

Course Outcome	
	CO1: Understand basic Java programs with concepts
	CO2: Develop Java programs using OOP principles and inheritance
	CO3: Develop Java programs with the concepts interfaces
	CO4: Build Java applications using exceptions and I/O streams
	CO5: Develop Java applications with threads and generic classes

**TEXT BOOKS:**

- T1- Herbert Schildt, —Java The complete referencel, 8th Edition, McGraw Hill Education, 2011.  
 T2 - Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentalsl, 9th Edition, Prentice Hall, 2013

**REFERENCE BOOKS:**

- R1 - Paul Deitel, Harvey Deitel, —Java SE 8 for programmersl, 3rd Edition, Pearson, 2015. R2 - Steven Holzner, —Java 2 Black bookl, Dreamtech press, 2011.  
 R3 -Timothy Budd, —Understanding Object-oriented programming with Javal, Updated Edition, PearsonEducation, 2000.  
 R4 -C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw- Hill Publishing company Ltd., 2006.

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# **SYLLABUS**

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7201	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

Course Objective	Description
	<ol style="list-style-type: none"> <li>To know the methods of conventional encryption.</li> <li>To understand the concepts of public key encryption and number theory</li> <li>To understand authentication and Hash functions.</li> <li>To know the network security tools and applications.</li> <li>To understand the system level security used.</li> </ol>

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	The OSI Security Architecture-Security Attacks, Security Services -Security Mechanisms -A Model for Network Security -Classical Encryption Techniques: Symmetric Cipher Model -Substitution -Transposition Techniques -Basic Concepts in Number Theory and Finite Fields -Euclidean Algorithm -Modular Arithmetic -Polynomial Arithmetic	9
	<b>BLOCK CIPHERS</b>	
II	Symmetric Ciphers Block Cipher Principles - Data Encryption Standard (DES) -DES Example -Strength of DES -Differential and Linear Cryptanalysis -Block Cipher Design Principles -Advanced Encryption Standard(AES) -Structure -Round Functions -Key Expansion -AES Example.	9
	<b>ASYMMETRIC CIPHERS AND KEY MANAGEMENT</b>	
III	Asymmetric Ciphers & Key Management Prime Numbers -Fermat's and Euler's Theorems -Testing for Primality -Discrete Logarithms -Public-Key Cryptography and RSA -Diffie-Hellman Key Exchange -Key Management and Distribution -Symmetric Key Distribution Using Asymmetric Encryption -Distribution of Public Keys -X.509 Certificates -Public Key Infrastructure.	9
	<b>CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS</b>	
IV	Cryptographic Data Integrity Algorithms Cryptographic Hash Functions -Applications -Two Simple Hash Functions -Requirements and Security Hash Functions based on Cipher Block Chaining -Secure Hash Algorithm (SHA) -SHA-3 -Message Authentication Codes -Requirements -Functions -Security of MACs -MACs based on Hash Functions: HMAC -Digital Signatures -Digital Signature Standard (DSS) - Kerberos.	9
	<b>NETWORK &amp; INTERNET SECURITY TRANSPORT LEVEL SECURITY</b>	
V	Network and Internet Security Transport Level Security -Web Security Issues - Secure Sockets Layer (SSL) -Transport Layer Security (TLS)-HTTPS -Secure Shell (SSH) -Electronic Mail Security -Pretty Good Privacy (PGP) -S/MIME -IP Security -Firewalls.	9
<b>Total Instructional Hours</b>		<b>45</b>

Course Outcome	Description
	CO1: Able to design and conduct experiments to analyze and interpret data.
	CO2: Able to use Cryptography in different fields of Engineering and Mathematics.
	CO3: Able to analyze and select a suitable Cipher for an application.
	CO4: Able to use the best solution for a threat
	CO5: Able to analyze the system level security

**TEXT BOOKS:**

T1- William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall of India/Pearson Education, New Delhi, 2010

T2 - Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill Publishing Company, New Delhi, 2007

**REFERENCE BOOKS :**

R1 - Behrouz Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill Publishing Company, New Delhi, 2010.

R2 - Roberta Bragg, Mark Rhodes Ousley, Keith Strassberg, "Network Security: The Complete Reference", McGraw Hill Publishing Company, Singapore, 2004.

R3 - Kaufman, Perlman and Speciner, "Network Security: Private Communication in a public world", Prentice Hall of India/ Pearson Education, New Delhi, 2004.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7202	CLOUD COMPUTING	3	0	0	3

- Course Objective**
1. To layout foundations of Distributed Systems.
  2. To introduce the idea of middleware and related issues
  3. To analyze the components of cloud computing and its business perspective.
  4. To evaluate the various cloud development tools.
  5. To collaborate with real time cloud services

Unit	Description	Instructional Hours
<b>INTRODUCTION TO DISTRIBUTED SYSTEMS</b>		
I	Characterization of Distributed systems - System Models -Inter-process -Communication -Remote Invocation-Indirect Communication-Distributed Object and Components -SOAP-based Web Services and Restful Web Services -Peer-to-Peer Systems	9
<b>CLOUD COMPUTING FUNDAMENTALS</b>		
II	Motivation for Cloud Computing, The Need for Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics..Four Cloud Deployment Models Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force.	9
<b>VIRTUALIZATION FOR CLOUD</b>		
III	Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare , Virtual Box, Hyper-V.	9
<b>SECURITY, STANDARDS, AND APPLICATIONS</b>		
IV	Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud.	9
<b>PROGRAMMING MODEL</b>		
V	Introduction to Hadoop Framework – Map reduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Understanding the knowledge about the state-of-the-art in distributed-systems architectures.  
CO2: Understanding the various service delivery models of a cloud computing architecture.  
CO3: Understanding the performance, scalability, and availability of the underlying cloud technologies and software.  
CO4: Understanding the Identify security and privacy issues in cloud computing.  
CO5: Understanding the ways in which the cloud can be programmed and deployed

**TEXT BOOKS:**

1. Rajkumar Buyya, James BroB.E.rg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", John Wiley & Sons, 2010.
2. Distributed and Cloud Computing. Kal Hwang. Geoffeiy C.Fox. Jack J.Dongarra. Elsevier. 2012.

**REFERENCE BOOKS**

1. Cloud Computing: A Practical Approach. Anthony T.Velte. Toby J.VeFte, Robert Elsenpeter. Tata McGraw Hill. rp2011.
2. Enterprise Cloud Computing Gautam Shroif, Cambridge University Press. 2010.
3. Cloud Computing: Implementation, Management and Security, John W. Rittinouse, James F Ransome. CRC Press, rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. George Reese, O'Redi SPD, rp2011.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7203	MOBILE COMPUTING	3	0	0	3

- Course Objective**
1. Understand the basic concepts of mobile computing
  2. Be familiar with the network protocol stack
  3. Learn the basics of mobile telecommunication system
  4. Be exposed to Ad-Hoc networks
  5. Gain knowledge about different mobile platforms and application development

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.	9
	<b>MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER</b>	
II	Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization – Overview of TCP/IP – Architecture of TCP/IP – Adaptation of TCP Window – Improvement in TCP Performance.	9
	<b>MOBILE TELECOMMUNICATION SYSTEM</b>	
III	In Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).	9
	<b>MOBILE AD-HOC NETWORKS</b>	
IV	Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks ( VANET) – MANET Vs VANET – Security.	9
	<b>MOBILE PLATFORMS AND APPLICATIONS</b>	
V	Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues	9
<b>Total Instructional Hours</b>		<b>45</b>

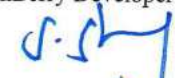
- Course Outcome**
- CO1: Understand the basics of mobile telecommunication system  
CO2: Understand the features of mobile IP and TCP-IP.  
CO3: Understand the various telecommunication systems  
CO4: Apply adhoc based routing and security mechanisms  
CO5: Apply the knowledge gained and build a Mobile Application using the software development kit.

**TEXT BOOKS:**

T1 - Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.

**REFERENCE BOOKS:**

- R1 - Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.  
R2 - Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.  
R3 - Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.  
R4- C.K.Toth, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.  
R5 - Android Developers : <http://developer.android.com/index.html>  
R6 - Apple Developer : <https://developer.apple.com/>  
R7 - Windows Phone Dev Center : <http://developer.windowsphone.com>  
R8 - BlackBerry Developer : <http://developer.blackberry.com/>

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7001	CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY	0	0	4	2

- Course Objective**
1. Be exposed to the different cipher techniques
  2. Learn to implement the algorithms DES, RSA, MD5, SHA-1
  3. Learn to use network security tools like GnuPG, KF sensor, Net Strumbler

Expt. No.	Description of the Experiments	
1.	Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts: a. Caesar Cipher b. Playfair Cipher c. Hill Cipher d. Vigenere Cipher e. Rail fence – row & Column Transformation	9
2.	Implement the following algorithms a. DES b. RSA Algorithm c. Diffie-Hellman d. MD5 e. SHA-1.	12
3.	Implement the SIGNATURE SCHEME - Digital Signature Standard	3
4.	Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).	3
5.	Setup a honey pot and monitor the honeypot on network (KF Sensor)	6
6.	Installation of rootkits and study about the variety of options	3
7.	Perform wireless audit on an access point or a router and decrypt WEP and WPA.( Net Stumbler)	6
8.	Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)	3
<b>Total Practical Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Apply various cipher techniques
- CO2: Apply and develop the various security algorithms
- CO3: Apply the different open-source tools for network security and analysis

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**SOFTWARE:**


C / C++ / Java or equivalent compiler  
GnuPG, KF Sensor or Equivalent, Snort, Net Stumbler or Equivalent

**HARDWARE:**

Standalone desktops - 30 Nos.  
(or)  
Server supporting 30 terminals or more.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7002	CLOUD COMPUTING LABORATORY	0	0	4	2

Course Objective	
	1. To implement Basics, techniques and tools for Cloud Computing
	2. Be familiar with developing web services.
	3. To know the concepts of Cloud Infrastructure and services.
	4. Learn to run virtual machines of different configuration with modern cloud tools.
	5. Understand the concept of Cloud security.

Expt. No.	Description of the Experiments
1.	Implement a method to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
2.	Create procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
3.	Install a C compiler in the virtual machine and execute a sample programs.
4.	Show the virtual machine migration based on the certain condition from one node to the other.
5.	Find procedure to install storage controller and interact with it.
6.	Find procedure to set up the one node Hadoop cluster.
7.	Mount the one node Hadoop cluster using FUSE.
8.	Write a program to use the API's of Hadoop to interact with it.
9.	Write a word count program to demonstrate the use of Map and Reduce tasks

**Total Practical Hours      45**

Course Outcome	
	CO1: Understand the Basic Requirements of cloud
	CO2: Use the cloud infrastructure tool kits
	CO3: Design and implement applications on the Cloud Infrastructure
	CO4: Design and implement applications on the cloud security.
	CO5: Implement the Concept of Cloud Services

  
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### ELECTIVE – III

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7301	C# AND .NET PROGRAMMING	3	0	0	3

- Course Objective**
1. Basics of C# and .NET
  2. C# language constructs and programming
  3. Advanced programming in C#
  4. Fundamental window programming
  5. Build web based applications

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Understanding .NET framework – understanding the .NET runtime environment – Introduction to C# - Examining basic C# components – writing and compiling a simple C# program.	7
	<b>C# &amp; OOP</b>	
II	C# data types – variables – operators – statements – Input/output – control flow – methods – debugging and error handling – namespaces – array – structs – OOP concepts – classes – abstract data type – constructors – destructors – conversions – inheritance – operator overloading.	10
	<b>INTERFACE AND INHERITANCE</b>	
III	Interfaces – Indexes – Delegates – Events – Variable argument Lists – Collection – Reflection – Events – Variable argument lists – collection – reflection – dynamic creation and invocation – Preprocessor.	9
	<b>I/O &amp; WINDOWS PROGRAMMING</b>	
IV	File and Folder operations – Dates and Times – browsing the Internet – Windows Form Controls – Advanced windows – Form features using dialogs.	9
	<b>WEB &amp; DATABASE</b>	
V	Developing Windows Applications – Accessing data with ADO.NET, .NET assemblies, Web programming basics – Web services – Case Study.	10
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

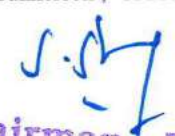
- Course Outcome**
- CO1: To learn the basics of .net Frame work and C# language.  
 CO2: To learn C# elements and OOPS concepts.  
 CO3: To learn interface and inheritance concepts in C# language.  
 CO4: To learn fundamentals of window application programming and create a window application.  
 CO5: To develop web applications and learn advanced features of C#.

**TEXT BOOKS:**

- T1 - Stanley B.Lippman , “C# Primer : A practical approach”, Pearson Education,1991.  
 T2 - David.S.Platt, Introducing Microsoft . Net , Microsoft Press, 3rd, Edition, 2003.

**REFERENCE BOOKS :**

- R1 -Ben Albahari, Pter Drayton, Brad Merrill, “C# Essentials”, Oreilly& Associates, 2001.  
 R2 - E.Balagurusamy, Programming in C # Tata McGraw Hill, 2002.  
 R3 - Conard.J., et.al., Introducing .Net, wrox Press, 2000.  
 R4 - Eric Gunnerson , “A Programmers Introduction to C#”, A Press, 2000.

  
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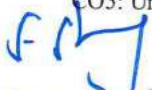
PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7302	BIOMETRICS	3	0	0	3

- Course Objective**
1. To provide students with understanding of biometrics, biometric equipment and standards applied to security.
  2. Perform R&D on biometrics methods and systems
  3. Evaluate and design security systems incorporating biometrics
  4. Understand the technology of biometrics for public policy matters involving security and privacy.
  5. To learn some basic biometrics systems based on the learned techniques.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> Biometric fundamentals – Biometric technologies – Biometrics Vs traditional techniques – Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes: verification, identification and biometric matching – Assessing the privacy risks of biometrics - Designing privacy sympathetic biometric systems, Different biometric standards, Application properties - Performance measures in biometric systems: FAR, FRR, FTE rate, EER and ATV rate.	9
I	<b>PHYSIOLOGICAL BIOMETRICS</b> Physiological Biometric Technologies: Fingerprints - Technical description – characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern - Technical description – characteristics - strengths – weaknesses –deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics.	9
II	<b>AUTOMATED BIOMETRIC SYSTEM AND B.E.HAVIOURAL BIOMETRICS</b> Automated fingerprint identification systems - Leading technologies: Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics - signature and handwriting technology - Technical description – classification - keyboard / keystroke dynamics - Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses- deployment.	9
III	<b>BIOMETRIC APPLICATIONS</b> Categorizing biometric applications – application areas: criminal and citizen identification, surveillance, PC/network access, e-commerce and retail/ATM – costs to deploy – other issues in deployment - Multi biometrics: Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation Plan.	9
IV	<b>PRIVACY AND STANDARDS IN BIOMETRICS</b> Assessing the Privacy Risks of Biometrics – Designing Privacy-Sympathetic Biometric Systems – Need for standards – different biometric standards.	9
V	CASE STUDIES: Physiological, Behavioural and multifactor biometrics in identification systems.	9

**Total Instructional Hours 45**

- Course Outcome**
- CO1: Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
  - CO2: Understand and analyze biometric systems at the component level and be able to analyze and design basic biometric system applications.
  - CO3: Be able to work effectively in teams and express their work and ideas orally and in writing.
  - CO4: Identify the sociological and acceptance issues associated with the design and implementation of biometric systems
  - CO5: Understand various Biometric security issues.

  
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**TEXT BOOKS:**

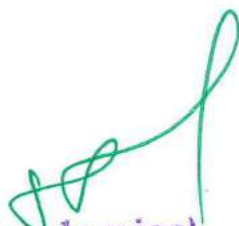
- T1- Samir Nanavati, Michael Thieme, Raj Nanavati, "Biometrics – Identity Verification in a Networked World", Wiley-dreamtech India Pvt Ltd, New Delhi, 2003
- T2- Paul Reid, "Biometrics for Network Security", Pearson Education, New Delhi, 2004.
- T3- John Chirillo and Scott Blaul "Implementing Biometric Security", 1st Edition, Wiley Eastern Publication, 2005.

**REFERENCE BOOKS :**

- R1- John R Vacca, "Biometric Technologies and Verification Systems", Elsevier Inc, 2007
- R2- Anil K Jain, Patrick Flynn, Arun A Ross, "Handbook of Biometrics", Springer, 2008
- R3- Samir Nanavathi, Michel Thieme, and Raj Nanavathi, "Biometrics -Identity verification in a network", Wiley Eastern, 2002.
- R4- John Chirillo and Scott Blaul," Implementing Biometric Security", Wiley Eastern Publications, 2005.
- R5- John Berger," Biometrics for Network Security", Prentice Hall, 2004.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7303	E- COMMERCE	3	0	0	3

- Course Objective**
1. The students can understand basic idea about internet, WWW and its applications
  2. The students can understand basic idea about internet, WWW and its applications
  3. The students will study about Electronic Data Interchange and its applications
  4. The students will study about electronic payment system and its security
  5. The students will study about web based marketing and online advertisement

Unit	Description	Instructional Hours
<b>INTRODUCTION</b>		
I	History of E- Commerce – Overview of E- Commerce framework –E- Business models – Network infrastructure - Role of Internet – E- commerce and World wide Web.	9
<b>E COMMERCE</b>		
II	Packet switched networks – TCP/IP protocol script – Internet utility programmes – SGML, HTML and XML – web client and servers – Web client/server architecture – intranet and extranets.	9
<b>ORGANIZATIONAL COMMERCE AND EDI</b>		
III	Electronic Data Interchange – EDI applications in Business – EDI and E - Commerce – EDI standardization and implementation – Internet based EDI.	9
<b>SECURITY</b>		
IV	Internet security standards – secure electronic payment protocols ; cryptography and authentication – security issues – encryption techniques; e commerce payment mechanisms –SET protocol – electronic check – electronic cash; E-commerce ethics, regulations and social responsibility	9
<b>INTELLIGENT AGENTS</b>		
V	Definition and capabilities – limitation of agents – security – web based marketing – search engines and Directory registration – online advertisements – Portables and info mechanics – website design issues.	9

**TOTAL INSTRUCTIONAL HOURS 45**

<b>Course Outcome</b>	CO1: Understand the importance of E-commerce, network infrastructure and apply the knowledge of E-commerce in various E-business models
	CO2: Remember the concepts of switching networks and understand the basic markup languages for client server communication
	CO3 :Understand the concepts of Electronic Data Interchange, its standardizations and apply the acquired knowledge of EDI into internet-based Data Exchange.
	CO4: Understand the security standards, techniques of internet-based payment systems and apply the concepts in business-oriented E-commerce applications.
	CO5: Understand the notion of intelligent agents and apply it in web-based marketing, web advertisements to handle web design issues

**TEXT BOOKS:**

- T1 - Ravi Kalakota and Andrew B Whinston, “ *Frontiers of Electronic Commerce* “, Pearson Education Asia,  
T2 - Marilyn Greenstein and Todd M Feinman , “ *Electronic commerce: Security, Risk Management and Control* “  
Tata McGraw-Hill , 2000.  
T3 - Gary P Schneider “Electronic commerce”, Thomson learning & James T Pen Cambridge USA, 2001.

**REFERENCE BOOKS :**

- R1 - Pete Lohsin , John Vacca “Electronic Commerce”, New Age International.  
R2 - Goel, Ritendra “E-commerce”, New Age International.  
R3 - Laudon, “E-Commerce: Business, Technology, Society”, Pearson Education.  
R4 - Bajaj and Nag, “E-Commerce the cutting edge of Business”, TMH.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7304	WIRELESS SENSOR NETWORKS	3	0	0	3

- Course Objective**
1. Understand the design issues in ad hoc and sensor networks.
  2. Learn the different types of MAC protocols.
  3. Be familiar with different types of adhoc routing protocols.
  4. Be exposing to the TCP issues in adhoc networks.
  5. Learn the architecture and protocols of wireless sensor networks.

Unit	Description	Instructional Hours
I	<b>INTRODUCTION</b> Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.	9
II	<b>MAC PROTOCOLS FOR WIRELESS NETWORKS</b> Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering	9
III	<b>DATA STORAGE AND MANIPULATION IN WSN</b> Data Storage and Manipulation: Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring.	9
IV	<b>WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS</b> Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.	9
V	<b>WSN ROUTING &amp; QOS</b> Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols. QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks.  
CO2: Analyze the protocol design issues of ad hoc and sensor networks  
CO3: Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues  
CO4: Evaluate the QoS related performance measurements of WIRE LESS sensor networks  
CO5: Introduced to some existing applications of wireless sensor actuator networks

**TEXT BOOKS:**

T1 - C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference, 2008.

**REFERENCE BOOKS:**

- R1 - Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.  
R2 - Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.  
R3 - Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005.  
R4 - Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7305	DATA MINING AND WAREHOUSING	3	0	0	3

- Course Objective**
1. Understand the basic concepts of Data mining
  2. Understand the basic concepts of data warehousing
  3. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems.
  4. To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
  5. Learn about Rule mining and Classification

Unit	Description	Instructional Hours
	<b>DATA MINING</b>	
I	Introduction to Data Mining; Knowledge Discovery in Database (KDD), What can be Data to be Mined, Related Concept to Data Mining, Data Mining Technique, Application and Issues in Data Mining – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.	9
	<b>DATA WAREHOUSING</b>	
II	The Need for Data Warehousing- Benefits of Data Warehousing -Features of a Data Warehouse- Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – The Information Flow Mechanism; Role of Metadata; Classification of Metadata.	9
	<b>BUSSINESS ANALYSIS</b>	
III	Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.	9
	<b>MINING FREQUENT PATTERN AND ASSOCIATION RULE</b>	
IV	Market Basket Analysis- Frequent Itemsets- Closed Itemsets, and Association Rules; Frequent Pattern Mining, Efficient and Scalable Frequent Itemset Mining Methods -The Apriori Algorithm for finding Frequent Itemsets Using Candidate Generation -Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori- A pattern growth approach for mining Frequent Itemsets; Mining Frequent itemsets using vertical data formats-Mining closed and maximal patterns;	9
	<b>ASSOCIATION RULE MINING AND CLASSIFICATION</b>	
V	Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules; From Association Mining to Correlation Analysis, Pattern Evaluation Measures; Classification: Basic Concepts; Classification methods: Decision Tree Induction: Attribute Selection Measures, Tree pruning. 2. Bayesian Classification: Naïve Bayes' Classifier. Prediction: Structure of regression models; Simple linear regression, Multiple linear regression. Model Evaluation & Selection: Accuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap; Comparing Classifier performance using ROC Curves.	9
	<b>Total Instructional Hours</b>	<b>45</b>

<b>Course Outcome</b>	<p>CO1: Enable students to understand and implement classical algorithms in data mining and data warehousing.</p> <p>CO2 students will be able to assess the strengths and weaknesses of the algorithms.</p> <p>CO3: To identify the application area of algorithms, and apply them.</p> <p>CO4: Students would learn data mining techniques as well as methods in integrating and interpreting the data sets</p> <p>CO5: To improve effectiveness, efficiency and quality for data analysis.</p>
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**TEXT BOOKS:**

- T1 - Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd Edition
- T2 - Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
- T3- Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", Wiley India
- T4- Reema Theraja "Data warehousing", Oxford University Press.

**REFERENCE BOOKS :**

- R1- Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining", Person Education, 2007.
- R2- K.P. Soman, Shyam Diwakar and V. Ajay " , Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
- R3- G. K. Gupta, " Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
- R4- Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.
- M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7306	DIGITAL SIGNAL PROCESSING	3	0	0	3

- Course Objective**
1. To understand the structures of Discrete time signals and systems
  2. To introduce discrete Fourier transform and its applications
  3. To learn the Frequency response characteristics and to design FIR filters
  4. To learn the Frequency response characteristics and to design IIR filters
  5. To study the fundamentals of DSP Processor- TMS320C5X

Unit	Description	Instructional Hours
I	<b>SIGNALS AND SYSTEMS</b> Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem –Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution– Correlation.	9
II	<b>FOURIER ANALYSIS AND FOURIER TRANSFORM</b> Discrete Time Fourier Transform(DTFT) – Properties of DTFT – The frequency domain representation of LTI systems- Sampling and Reconstruction of Analog signals- Discrete Fourier Transform – The discrete Fourier series- sampling and reconstruction in the Z domain– Discrete Fourier Transform- Properties of Discrete Fourier transform- Linear convolution using the DFT- Fast Fourier Transform.	9
III	<b>IIR FILTER DESIGN</b> Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.	9
IV	<b>FIR FILTER DESIGN</b> Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques	9
V	<b>UNIT V DSP PROCESSOR FUNDAMENTALS</b> Architecture and features: Features of DSP processors - DSP processor packaging(Embodiments) - Fixed point Vs floating point DSP processor data paths - Memory architecture of a DSP processor (Von Neumann - Harvard) - Addressing modes - pipelining - TMS320 family of DSPs (architecture of C5x).	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Perform frequency transforms for the signals  
CO2: To implement DFTs using Fast Fourier Transforms  
CO3: Design IIR filters  
CO4: Design FIR filters  
CO5: Learn the architecture details and instruction sets of fixed and floating point DSPs

**TEXT BOOKS:**

- T1 - John. G. Proakis and Dimitris C. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications," Pearson Education, Third edition 2006.  
T2 - Venkataramani B., M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", First Edition ,Tata McGraw Hill, New Delhi, 2008.  
T3 - T4 - Hayes M.H., "Digital Signal Processing ", Schaum's Outlines, TATA Mc-Graw Hill, Tata McGraw Hill, Second Edition New Delhi, 2007

**REFERENCE BOOKS :**

- R1 - Emmanuel C.Ifeachor, and Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education, Prentice Hall, 2002.  
R2 - Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Third Edition, Tata Mc Graw Hill, 2007.  
R3 - A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004 & R4 - Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2006.

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**ELECTIVE - IV**

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7307	TEXT MINING	3	0	0	3

- Course Objective**
1. To understand the basic issues and types of text mining
  2. To appreciate the different aspects of text categorization and clustering
  3. To understand the role played by text mining in Information retrieval and extraction
  4. To appreciate the use of probabilistic models for text mining
  5. To appreciate the current trends in text mining

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Preprocessing–Types of Problems-basics of document classification-information retrieval-clustering andOrganizing documents-information extraction-prediction andevaluation-Textual information to numerical vectors-Collectingdocuments-document standardization- tokenization-lemmatization-vector generation for prediction- sentence boundary determination -evaluation performance.	9
I		
	<b>TEXT CATEGORIZATION AND CLUSTERING</b> Text Categorization – Definition – Document Representation –Feature Selection - Decision Tree Classifiers - Rule-based Classifiers - Probabilistic and Naive Bayes Classifiers - Linear Classifiers-Classification of Linked and Web Data - Meta-Algorithms– Clustering –Definition- Vector Space Models - Distance-based Algorithms- Word and Phrase-based Clustering -Semi-Supervised Clustering - Transfer Learning	9
II		
	<b>TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION</b> Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity-webbased document search- matching-Inverted lists- evaluation. Information Extraction- Architecture-Co-Reference-Named Entity and Relation Extraction-TemplateFilling and database construction–Applications.Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations – Pattern Extraction - Apriori Algorithm – FP Tree algorithm	9
III		
	<b>PROBABILISTIC</b> Probabilistic Models for Text Mining -Mixture Models - Stochastic Processes in Bayesian Nonparametric Models - Graphical Models - Relationship Between Clustering, Dimension Reduction and Topic Modeling - Latent Semantic Indexing - Probabilistic Latent Semantic Indexing -Latent Dirichlet Allocation- Interpretation and Evaluation - Probabilistic Document Clustering and Topic Models - Probabilistic Models for Information Extraction - Hidden Markov Models -Stochastic Context-Free Grammars - Maximal Entropy Modeling - Maximal Entropy Markov Models -Conditional Random Fields	9
IV		
	<b>RECENT TRENDS</b> Visualization Approaches - Architectural Considerations - Visualization Techniques in Link Analysis - Example- Mining Text Streams - Text Mining in Multimedia - Text Analytics in Social Media - Opinion Mining and Sentiment Analysis - Document Sentiment Classification – Opinion Lexicon Expansion - Aspect-Based Sentiment Analysis - Opinion Spam Detection – Text MiningApplications and Case studies	9
V		
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- CO1: Identify the different features that can be mined from text and web documents  
 CO2: Use available open source classification and clustering tools on some standard text data sets  
 CO3: Modify existing classification/clustering algorithms in terms of functionality or features used  
 CO4: Design a system that uses text mining to improve the functions of an existing open source search engine  
 CO5: Implement a text mining system that can be used for an application of your choice

**TEXT BOOKS:**

T1 - .Sholom Weiss, Nitin Indurkha, Tong Zhang, Fred Damerau “The Text Mining Handbook:Advanced Approaches in Analyzing Unstructured Data”, Springer, paperback 2010

T2 - Ronen Feldman, James Sanger -“ The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”-Cambridge University press, 2006.

**REFERENCE BOOKS:**

R1 - Manu Konchady “Text Mining Application Programming”, CengageLearning, Fourth Indian Reprint, 2009.

R2 - Thomas W. Miller, Prentice Hall, “Data and Text Mining-A Business Applications Approach”, Second impression, 2011.

R3 - Charu C. Aggarwal ,ChengXiangZhai, Mining Text Data, Springer; 2012



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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7308	SOFT COMPUTING	3	0	0	3

- Course Objective**
1. Study an overview of Artificial Neural Networks
  2. Learn about Fuzzy systems.
  3. Understand the Special networks.
  4. Learn about Genetic algorithms
  5. Understand the applications of soft computing.

UNIT	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
I	<b>ARTIFICIAL NEURAL NETWORKS</b> Fundamental Concept - Basic Model of ANN - Terminologies of ANN - Supervised Learning Neural Networks: Perception Networks - Adaptive Linear Neuron - Multiple Adaptive Linear Neurons – Back Propagation Network - Unsupervised Learning Neural Networks: Kohonen self-organizing Feature Maps- Learning vector Quantization	10
II	<b>FUZZY SYSTEMS</b> Classical sets - Fuzzy sets - Classical relation - Fuzzy relations - Defuzzification - Fuzzy rule base and approximate reasoning: Fuzzy reasoning - Fuzzy Inference Systems - Fuzzy decision making – Fuzzy logic control systems.	10
III	<b>SPECIAL NETWORKS</b> Counter propagation Networks - Adaptive Resonance Theory Network - Simulated Annealing Network - Boltzmann Machine - Gaussian Machine - Cauchy Machine - Probabilistic Neural Net – Cascade Correlation Network.	9
IV	<b>GENETIC ALGORITHMS</b> Introduction - Basic operators and terminologies in GA - Traditional vs Genetic Algorithm - Simple GA -General Genetic Algorithm - Classification of Genetic Algorithm - Holland classifier systems – Genetic Programming.	8
V	<b>APPLICATIONS OF SOFT COMPUTING</b> Image Fusion - Neural network classification - Traveling salesman problem using Genetic algorithm -Genetic algorithm based Internet searching technique - Soft Computing Based Hybrid Fuzzy Controllers - Soft Computing Based Rocket Engine Control.	8
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- course outcome**
- Demonstrate different types of artificial neural networks.
  - Explain the concept of fuzzy systems.
  - Summarize the various special networks.
  - Develop the solutions using genetic algorithms.
  - Develop application using soft computing techniques.

**REFERENCE BOOKS:**

- R1. S.N.Sivanandam and S.N.Deepa, Principles of Soft Computing, Wiley India Ltd,2011  
R2. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 2000  
R3. Davis E.Goldberg, Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley, N.Y., 2001.  
R4.Jang.J.S.R.Sun.C.T.and Mizutami.E, Neuro fuzzy and Soft computing, Prentice Hall, New Jersey-2010

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7309	HUMAN INTERFACE SYSTEM DESIGN	3	0	0	3

**Course Objective**

1. To learn the basic fundamentals of the HISD.
2. To learn the various aspects of managing the human interface design.
3. To understand the various aspects involved in virtual environment and manipulation.
4. To be familiar with various interfaces available.
5. To design the web page and communicate other resource

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Goals of System Engineering - Goals of User Interface Design - Motivations of Human factors in Design - High Level Theories - Object - Action Interface Design - Three Principles - Guidelines for Data Display and Data Entry.	9
	<b>MANAGING DESIGN PROCESS</b>	
II	Introduction - Examples of Direct Manipulation Systems - Explanation of Direct Manipulation - Visual Thinking and Icons - Direct manipulation Programming - Home Automation - Remote Direct Manipulation - Virtual Environments - Task - Related Organization - Item Presentation Sequence - Response Time and Display Rate - Fast Movement Through Menus - Menu Layouts - Form Fillin - Dialog Box - Functionality to Support User's Tasks - Command Organization Strategies - Benefits of Structure - Naming and Abbreviations - Command Menus - Natural Language in Computing.	9
	<b>MANIPULATION AND VIRTUAL ENVIRONMENTS</b>	
III	Introduction - Examples of Direct Manipulation Systems - Explanation of Direct Manipulation - Visual Thinking and Icons - Direct Manipulation Programming - Home Automation - Remote Direct Manipulation - Virtual Environments - Task -Related Organization - Item Presentation Sequence - Response Time and Display Rate - Fast Movement Through Menus - Menu Layouts - Form Fillin - Dialog Box - Functionality to Support User's Tasks - Command Organization Strategies - Benefits of Structure - Naming and Abbreviations - Command Menus - Natural Language in Computing.	9
	<b>INTERACTION DEVICES</b>	
IV	Introduction: Keyboards and Functions – Pointing Devices - Speech recognition, Digitization and Generation – Image and Video Displays – Printers –Theoretical Foundations –Expectations and Attitudes – User Productivity – Variability – Error messages – Nonanthropomorphic Design –Display Design – color - Reading from Paper versus from Displays - Preparation of Printed Manuals - Preparation of Online Facilities.	9
	<b>WINDOWS STRATEGIES AND INFORMATION SEARCH</b>	
V	Introduction - Individual Widow Design - Multiple Window Design - Coordination by Tightly - Coupled Widow - Image Browsing - Personal Role Management and Elastic Windows - Goals of Cooperation - Asynchronous Interaction - Synchronous Distributed - Face to Face - Applying Computer Supported Cooperative Work to Education - Database query and phrase search in Textual documents - Multimedia Documents Searches - Information Visualization - Advance Filtering Hypertext and Hypermedia - World Wide Web - Genres and Goals and Designers - Users and their tasks - Object Action Interface Model for Website Design.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Describe the basic fundamentals of the HISD.
  - CO2: Examine the various aspects of managing human interface design.
  - CO3: Describe the various aspects involved in virtual environment and manipulation.
  - CO4: Identify various interfaces available.
  - CO5: Describe the web page and communicate other resource

**TEXT BOOKS:**

- T1 - Ben Shneiderman J., "Designing the User Interface", 3rd Edition, Addison "Wesley, 2001.
- T2 - Robert D.Braun, Introduction to Instrumental Analysis, PharmaMed Press/BSP books, Second edition, 2012

**REFERENCE BOOKS:**

- R1 - Wilbert O. Galiz, "The Essential guide to User Interface Design", Wiley Dreamtech, 2002.
- R2 - Jacob Nielsen, "Usability Engineering", Academic Press, 1993.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7310	ARTIFICIAL INTELLIGENCE	3	0	0	3

- Course Objective**
1. Understand the problem solving intelligent agents
  2. Understand about searching techniques.
  3. Impart domain knowledge in propositional and first-order logic.
  4. Learn about Planning.
  5. Formulate and solve optimization challenges as planning problems.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Intelligent Agents -Agents and environments-Good behavior-The nature of environments - Structure of agents -Problem Solving-Problem solving agents-Uniformed search strategies-heuristic function.	9
	<b>SEARCHING TECHNIQUES</b>	
II	Local search algorithms and optimization problems -Local search in continuous spaces-Online search agents and unknown environments-optimal Decisions in games-Constraint satisfaction problems(CSP)	9
	<b>KNOWLEDGE REPRESENTATION</b>	
III	First order logic : Representation revisited -Syntax and semantics for first order logic-Using first order logic-Knowledge engineering in first order logic-Inference in First order logic: Propositional versus first order logic-Unification and lifting-Forward chaining -Backward chaining.	9
	<b>PLANNING</b>	
IV	Classical planning: Definition of Classical Planning -Algorithms for Planning as State -Space Search-Planning Graphs-Other Classical Planning Approaches-Analysis of Planning Approaches-Time, Schedules, and Resources-Hierarchical Planning-Planning and Acting in Nondeterministic Domains-Multiagent Planning	9
	<b>LEARNING</b>	
V	Learning from examples: Forms of learning -supervised learning-Learning decision trees-Ensemble learning-A Logical formulation of learning-Knowledge in learning-Explanation based learning-Learning using relevant information.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Apply the characteristics of AI that make it useful to real -world problems.  
CO2: Apply the different searching techniques  
CO3: Understand the domain knowledge representation in propositional and first-order logic  
CO4: Understand the planning process of various state-space search algorithms, and choose the appropriate algorithm for a problem.  
CO5: Apply the different techniques for learning and reasoning under uncertainty

**REFERENCE BOOKS**

- R1. Russell, Peter Norvig, Artificial Intelligence A Modern Approach, 3rd Edition, Prentice Hall of India, 2010  
R2. Nils J. Nilsson, Artificial Intelligence: A new Synthesis, Harcourt Asia Pvt. Ltd., 2000  
R3. Elaine Rich and Kevin Knight, Artificial Intelligence, 3rd Edition, Tata McGraw-Hill, 2011  
R4. George F. Luger, Artificial Intelligence-Structures And Strategies For Complex Problem Solving, Pearson Education / PHI, 2002

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7311	HIGH SPEED NETWORKS	3	0	0	3

- Course Objective**
- To learn the basis of ATM and Frame relay concepts and explain the various types of LAN's and to know about their applications.
  - To know techniques involved to support real-time traffic and congestion control in ATM
  - To learn the basis of ISA and explain the various types of queuing discipline.
  - To understand the protocols for quality of service (Qos) to different applications.
  - To study wireless network operations and functions

UNIT	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
<b>HIGH SPEED NETWORKS</b>		
I	Introduction-frame relay networks –ATM protocol architecture-ATM logical connection –ATM cells-ATM service categories -AAL- High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs	9
<b>CONGESTION AND TRAFFIC MANAGEMENT</b>		
II	Congestion control in data networks and internets-link level flow and error control-TCP traffic -congestion control in ATM networks-Internet Routing: Interior routing protocols.	9
<b>INTEGRATED AND DIFFERENTIATED SERVICES</b>		
III	Integrated Services (IntServ), Queuing Discipline- FQ, PS, BRFQ, GPS, WFQ, Random Early Detection, Differentiated Services (DiffServ)	9
<b>PROTOCOLS FOR QOS SUPPORT</b>		
IV	Resource Reservation Protocol (RSVP), Multiprotocol Label Switching (MPLS), Real-Time Transport Protocol (RTP), RTCP, IP version six.	9
<b>LOCAL BROAD BAND AND AD HOC NETWORKS</b>		
V	Introduction to wireless LANS-IEEE 802.11 WLAN-Wireless ATM-HIPERLAN-Ad hoc networking and WPAN.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Understand various concepts of high-speed networks.  
CO2: Understand different types of congestion control mechanisms and traffic management.  
CO3: Understand the concepts of integrated and differentiated services.  
CO4: Understand various protocols for QOS support  
CO5: Understand the concepts of wireless network operations and functions

**TEXT BOOKS:**

- T1 - Williams Stallings, "High Speed networks And Internet Performance And Quality Of Service", Pearson Second Edition, 2002.  
T2 -KavenPahlavanAnd Prashant Krishnamoorthy, "Principles Of Wireless Network", Prentice Hall Of India, 2010.

**REFERENCE BOOKS :**

- R1 - Behrouz A. Forouzan, "Data Communication And Computer Networking", 4th, 2011.  
R2 - Larry L. Peterson and Bruce S.Davie, "Computer Networks", Third edition, Elsevier Publications, 2003

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7312	SEMANTIC WEB	3	0	0	3

- Course Objective**
1. To understand the need of semantic web in web services
  2. To know the methods to discover, classify and build ontology for more reasonable results in searching.
  3. To implement the RDF structure and Model
  4. To build and implement a small ontology that is semantically descriptive of chosen problem domain.
  5. To implement applications that can access, use and manipulate the ontology

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Introduction to the Syntactic web and Semantic Web – Evolution of the Web – The visual and syntactic web – Levels of Semantics – Metadata for web information - The semantic web architecture and technologies –Contrasting Semantic with Conventional Technologies –Semantic Modeling - Potential of semantic web solutions and challenges of adoption	9
	<b>ONTOLOGICAL ENGINEERING</b>	
II	Ontologies – Taxonomies –Topic Maps – Classifying Ontologies – Terminological aspects: concepts, terms, relations between them – Complex Objects –Subclasses and Sub-properties definitions –Upper Ontologies – Quality – Uses - Types of terminological resources for ontology building –Methods and methodologies for building ontologies – Multilingual Ontologies - Ontology Development process and Life cycle – Methods for Ontology Learning – Ontology Evolution – Versioning	9
	<b>STRUCTURING AND DESCRIBING WEB RESOURCES</b>	
III	Structured Web Documents - XML – Structuring – Namespaces – Addressing – Querying – Processing - RDF – RDF Data Model – Serialization Formats- RDF Vocabulary –Inferencing - RDFS –basic Idea – Classes – Properties- Utility Properties – RDFS Modeling for Combinations and Patterns-Transitivity	9
	<b>WEB ONTOLOGY LANGUAGE</b>	
IV	OWL – Sub-Languages – Basic Notions -Classes- Defining and Using Properties – Domain and Range – Describing Properties - Data Types – Counting and Sets- Negative Property Assertions – Advanced Class Description – Equivalence – Owl Logic.	9
	<b>SEMANTIC WEB TOOLS AND APPLICATIONS</b>	
V	Development Tools for Semantic Web – Jena Framework – SPARQL –Querying semantic web - Semantic Wikis - Semantic Web Services – Modeling and aggregating social network data - Ontological representation of social relationships, Aggregating and reasoning with social network data.	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>


- Course Outcome**
- CO1: Able to understand semantic web basics, architecture and technologies
- CO2: Able to represent data from a chosen problem in XML with appropriate semantic tags obtained or derived from the ontology
- CO3: Able to understand the semantic relationships among these data elements using Resource Description Framework (RDF)
- CO4: Able to design and implement a web services application that “discovers” the data and/or other web services via the semantic web.
- CO5: Able to discover the capabilities and limitations of semantic web technology for social networks

**TEXT BOOKS:**

- T1 - Williams Stallings, “High Speed networks And Internet Performance And Quality Of Service”, Pearson Second Edition, 2002.
- T2 -KavenPahlavanAnd Prashant Krishnamoorthy, “Principles Of Wireless Network”, Prentice Hall Of India, 2010.

**REFERENCE BOOKS:**

- R1 - John Hebel, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, "Semantic Web Programming", Wiley, First Edition, 2009.
- R2 - Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer", Second Edition (Cooperative Information Systems) (Hardcover), MIT Press, 2008
- R3 - Robert M. Colomb, "Ontology and the Semantic Web", Volume 156 Frontiers in Artificial Intelligence and Applications (Frontier in Artificial Intelligence and Applications), IOS Press, 2007.
- R4 - Dean Allemang and James Hendler, "Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann", Second Edition, 2011.
- R5 - Michael C. Daconta, Leo J. Obrst and Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Wiley, First Edition 2003
- R6 - Karin Breitman, Marco Antonio Casanova and Walt Truszkowski, "Semantic Web: Concepts, Technologies and Applications (NASA Monographs in Systems and Software Engineering)", Springer, Softcover, 2010.
- R7 - Vipul Kashyap, Christoph Bussler and Matthew Moran, "The Semantic Web: Semantics for Data and Services on the Web (Data-Centric Systems and Applications), Springer, 2008.
- R8 - Peter Mika, "Social networks and the Semantic Web", Springer, 1st edition 2007.

  
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**ELECTIVE-V**

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8301	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

- Course Objective**
1. Learn about Project Evaluation and Project Planning
  2. Understand the concepts of Project life cycle and effort estimation
  3. To highlight different techniques for software cost estimation and activity planning
  4. Study about Project Management and Control
  5. Learn about how to manage people

Unit	Description	Instructional Hours
	<b>PROJECT EVALUATION AND PROJECT PLANNING</b>	
I	Importance of Software Project Management–Activities Methodologies–Categorization of Software Projects–Setting objectives–Management Principles–Management Control–Project portfolio Management–Cost-benefit evaluation technology–Risk evaluation–Strategic program Management–Stepwise Project Planning.	9
	<b>PROJECT LIFE CYCLE AND EFFORT ESTIMATION</b>	
II	Software process and Process Models–Choice of Process models-mental delivery–Rapid Application development–Agile methods–Extreme Programming–SCRUM–Managing interactive processes–Basics of Software estimation–Effort and Cost estimation techniques–COSMIC Full function points -COCOMO II A Parametric Productivity Model -Staffing Pattern	9
	<b>ACTIVITY PLANNING AND RISK MANAGEMENT</b>	
III	Objectives of Activity planning–Project schedules–Activities–Sequencing and scheduling –Network Planning models–Forward Pass & Backward Pass techniques–Critical path (CRM) method–Risk identification–Assessment–Monitoring–PERT technique–Monte Carlo simulation –Resource Allocation–Creation of critical patterns–Cost schedules	9
	<b>PROJECT MANAGEMENT AND CONTROL</b>	
IV	Framework for Management and control –Collection of data Project termination–Visualizing progress –Cost monitoring–Earned Value Analysis–Project tracking–Change control–Software Configuration Management–Managing contracts–Contract Management.	9
	<b>STAFFING IN SOFTWARE PROJECTS</b>	
V	Managing people–Organizational behavior–Best methods of staff selection–Motivation–The Oldham-Hackman job characteristic model–Ethical and Programmed concerns–Working in teams–Decision making–Team structures–Virtual teams–Communications genres–Communication plans.	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

**Course Outcome** CO1:Describe project evaluation and planning  
CO2:Explain project life cycle and effort estimation.  
CO3:Discuss activity planning and risk management  
CO4:Analyze project management and control.  
CO5:Able to practice Project Management principles while developing a software

**TEXTBOOK:**

T1.Bob Hughes, Mike Cottare II and Rajib Mall: Software Project Management–Fifth Edition, TataMcGraw Hill, New Delhi, 2012.

**REFERENCE BOOKS**

R1.Robert K. Wysocki “Effective Software Project Management”–Wiley Publication,2011.

R2.Walker Royce: “Software Project Management”-Addison-Wesley,1998.

R3.Gopalswamy Ramesh, “Managing Global Software Projects”–McGraw Hill Education (India),Fourteenth Reprint 2013.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8302	WEB TECHNOLOGY	3	0	0	3

Course Objective	
	1. Understand the scripting languages XHTML, JavaScript and PHP
	2. Familiar with the different server technologies
	3. Gain knowledge in the concepts of web services.
	4. Study about Project Management and Control
	5. Learn about hoew to manage people

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO WEB AND XHTML</b>	
I	Introduction - Blogging - Social Networking - Social media - Tagging - Software development - Introduction to XHTML and Editing XHTML Headings - Linking - Images - Special characters and Horizon rules - Lists - Tables - Forms -Internal Linking- Meta Elements - Cascading Style Sheets	10
	<b>JAVASCRIPT</b>	
II	Introduction to scripting - Control statements I, II - Functions: Definition - Random Number Generation -Global function - Recursion - Arrays: Declaring and allocating arrays Multidimensional arrays - Objects :Math object - String object - Date object - Boolean, Number object - Document object - Window object -Events.	10
	<b>INTERNET APPLICATION SERVER TECHNOLOGIES</b>	
III	Web server (IIS and Apache): Multitier Architecture - Client/ Server side scripting - Accessing web services - Microsoft IIS - Apache HTTP server - Database: Relational database - SQL - PHP: Basics -String and Form Processing - connecting to database - Ruby on Rails - Rail framework - Database driven web application	8
	<b>ASP.NET AND AJAX</b>	
IV	Introduction - creating and running a simple web form - Web controls - session tracking - case study: Connecting to a database in ASP.NET. - Introduction to AJAX- AJAX XML Http request- AJAX Events..	9
	<b>WEB SERVICES</b>	
V	Introduction - Java web services Basics - Creating Publishing, Testing and describing web service -Consuming web service - SOAP - Session Tracking in web services - Consuming a Database driven web service from a web application - Passing an object of a User defined type to a web service	8
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

Course Outcome	
	CO1: Explore the internet related technologies and hierarchy of objects in XHTML, CSS and Social media.
	CO2: Design dynamic and interactive web pages by embedding Java Script code in XHTML.
	CO3: Implement server side programming and build web applications using PHP.
	CO4: Develop the interactive web applications using ASP.NET.
	CO5: Build and consume web services.

#### REFERENCE BOOKS

- R1. P.J. Deitel AND H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education, 2009.
- R2. Deitel, Deitel and Nieto, Internet and World Wide Web How to Program, Pearson Education,2002.
- R3. Uttam K.Roy, Web Technologies, Oxford University Press, 2010.
- R4. Rajkamal, Web Technology, Tata McGraw-Hill, 2009.
- R5. www.w3schools.com/ajax.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8303	PERVASIVE COMPUTING	3	0	0	3

- Course Objective**
1. To provide the student with knowledge and skills about a new trend in computing.
  2. To study about creating a ubiquitous environment.
  3. To learn about connectivity of devices and web applications
  4. To learn WAP and voice technology.
  5. To study about architecture of PDA

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	<b>Pervasive Computing:</b> Past, Present and Future - Pervasive computing Market – m-Business – Application examples: Retail, Airline check-in and booking – Healthcare – Car information system – E-mail access via WAP and voice.	9
	<b>DEVICE TECHNOLOGY</b>	
II	Hardware – Human Machine Interfaces – Biometrics – Operating Systems – Java for Pervasive devices.	9
	<b>DEVICE CONNECTIVITY &amp; WEB APPLICATION CONCEPTS</b>	
III	Protocols – Security – Device Management - Web Application Concepts: WWW architecture – Protocols – Transcoding - Client Authentication via Internet.	9
	<b>WAP &amp; VOICE TECHNOLOGY</b>	
IV	<b>WAP and B.E.yond:</b> Components of the WAP architecture – WAP infrastructure – WAP security issues – WML – WAP push – Products – i-Mode – Voice Technology: Basics of Speech recognition- Voice Standards – Speech applications – Speech and Pervasive Computing.	9
	<b>PDA &amp; PERVASIVE WEB APPLICATION ARCHITECTURE</b>	
V	Device Categories – PDA operation Systems – Device Characteristics – Software Components - Standards – Mobile Applications - PDA Browsers - Pervasive Web Application architecture: Background – Development of Pervasive Computing web applications - Pervasive application architecture.	9
	<b>Total Instructional Hours</b>	<b>45</b>


- Course Outcome**
- CO1: Learn the basics of pervasive computing and recent developments  
CO2: Knowledge about various Human Computer interaction devices  
CO3: Exposure on various connectivity models  
CO4: Get idea on WAP technology and the working mechanism  
CO5: Study of different architecture of PDA devices

#### TEXT BOOK

T1 - Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff, "Pervasive Computing, Technology and Architecture of Mobile Internet Applications", Pearson Education, 2012.

#### REFERENCES

- R1- Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw Hill edition, 2006.  
R2 - Uwe Hansmann, L. Merk, Nicklous M., Stober T., Hansmann U., "Pervasive Computing (Springer Professional Computing)", 2003, Springer Verlag, ISBN:3540002189.  
R3 - <http://www.cs.iit.edu/courses/cs553.html>  
R4 - [http://www.luc.ac/courses/bsc\\_computer-science-is.shtml](http://www.luc.ac/courses/bsc_computer-science-is.shtml)  
R5 - <http://www.cs.cf.ac.uk/teaching/modules/CM0256.pdf>

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8304	DATABASE SECURITY AND PRIVACY	3	0	0	3
<b>Course Objective</b>		1. To understand the fundamentals of security, and how it relates to information systems 2. To identify risks and vulnerabilities in operating systems from a database perspective 3. To learn good password policies, and techniques to secure passwords in an organization 4. To get exposure about various auditing activities done in servers 5. To learn on different security measures available for securing the database				

Unit	Description	Instructional Hours
	<b>SECURITY ARCHITECTURE &amp; OPERATING SYSTEM SECURITY FUNDAMENTALS</b>	
I	<b>Security Architecture:</b> Introduction-Information Systems- Database Management Systems-Information Security Architecture- Database Security- Asset Types and value-Security Methods <b>Operating System Security Fundamentals:</b> Introduction-Operating System Overview-Security Environment – Components- Authentication Methods-User Administration-Password Policies-Vulnerabilities-E-mail Security <b>ADMINISTRATION OF USERS &amp; PROFILES,PASSWORD POLICIES, PRIVILEGES AND ROLES</b>	7
II	<b>Administration of Users:</b> Introduction-Authentication-Creating Users, SQL Server User-Removing, Modifying Users-Default, Remote Users-Database Links-Linked Servers-Remote Servers-Practices for Administrators and Managers-Best Practices <b>Profiles, Password Policies, Privileges and Roles:</b> Introduction-Defining and Using Profiles-Designing and Implementing Password Policies-Granting and Revoking User Privileges-Creating, Assigning and Revoking User Roles-Best Practices	11
III	<b>DATABASE APPLICATION SECURITY MODELS &amp; VIRTUAL PRIVATE DATABASES</b> <b>Database Application Security Models:</b> Introduction-Types of Users-Security Models- Application Types-Application Security Models-Data Encryption <b>Virtual Private Databases:</b> Introduction-Overview of VPD-Implementation of VPD using Views, Application Context in Oracle-Implementing Oracle VPD-Viewing VPD Policies and Application contexts using Data Dictionary, Policy Manager- Implementing Row and Column level Security with SQL Server	9
IV	<b>AUDITING DATABASE ACTIVITIES</b> <b>Auditing Database Activities:</b> Using Oracle Database Activities-Creating DLL Triggers with Oracle-Auditing Database Activities with Oracle-Auditing Server Activity with SQL Server 2000-Security and Auditing Project Case Study	7
V	<b>PRIVACY PRESERVING DATA MINING TECHNIQUES</b> <b>Privacy Preserving Data Mining Techniques:</b> Introduction- Privacy Preserving Data Mining Algorithms-General Survey-Randomization Methods-Group Based Anonymization-Distributed Privacy Preserving Data Mining-Curse of Dimensionality-Application of Privacy Preserving Data Mining	11
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

<b>Course Outcome</b>	CO1:Knowledge about secure OS and Architecture
	CO2:Exposure of security privileges and policies for database
	CO3:Study of virtual database and security model
	CO4:Various auditing and management activities
	CO5:To learn different mining methods involved in securing database

**TEXT BOOKS**

T1 - Hassan A. Afyouni, "Database Security and Auditing", Third Edition, Cengage Learning, 2009.(UNIT 1 to IV)

T2 - Charu C. Aggarwal, Philip S Yu, "Privacy Preserving Data Mining": Models and Algorithms, Kluwer Academic Publishers, 2008.(UNIT V).

**REFERENCES**

R1 - Ron Ben Natan, "Implementing Database Security and Auditing", Elsevier Digital Press, 2005.

R2 - <http://charuaggarwal.net/toc.pdf>

R3 - <http://adrem.ua.ac.be/sites/adrem.ua.ac.be/files/securitybook.pdf>

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8305	R PROGRAMMING	3	0	0	3

- Course Objective**
1. To study the characteristics of the Multimedia data
  2. To understand the Multimedia data Indexing and Retrieval
  3. Understand the basics of R programming.
  4. Gain knowledge about the data analysis and statistical models in R.
  5. Impart knowledge about using graphics in R.

Unit	Description	Instructional Hours
I	<b>GETTING STARTED AND BASICS</b> Introduction to R -R Installation-Basic syntax-R as a calculator-R Libraries-Importing Data-Getting help and loading packages-Data entry and exporting data-Creating and Manipulating objects in R-Vectors-Matrices-Data Frames-Lists	9
II	<b>EXPLORATORY DATA ANALYSIS WITH R</b> Summary statistics-Validating & Exploring Data-Manipulating Data-Summarizing-Sorting-Sub-setting- Merging.	9
III	<b>GRAPHICS</b> Basic plotting -3D plotting-Histograms-Multi-panel plotting-Boxplots-ggplot2-Manipulating the plotting window-Advanced plotting using lattice library-Saving plots.	9
IV	<b>STANDARD STATISTICAL MODELS IN R</b> Univariate Analysis -Multivariate Analysis-Linear & Nonlinear Models-Logistic Regression and Survival Analysis in R	9
V	<b>ADVANCED R</b> Writing R functions-Introduction to Clustering and Classification-k-Means Partitioning-Partitioning around Medoids -Introduction to Unconstrained & Constrained Ordination-Principal Components Analysis (PCA)-Redundancy Analysis (RDA)	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Explain the basic concepts of R.
  - CO2: Illustrate exploratory data analysis with R.
  - CO3: Summarize the use of graphics in R.
  - CO4: Compare the different statistical models in R.
  - CO5: Demonstrate the use of advanced concepts in R.

**REFERENCE BOOKS:**

- R1-Jared P Lander R for Everyone, Kindle Edition, 2014.
- R2-Grolemund and Garrett Hands-On Programming with R, Kindle Edition, 2014.
- R3-Mark Gardener Beginning R: The Statistical Programming Language, 2013.
- R4-Norman Matloff, The Art of R Programming-A Tour of Statistical Software Design, 2011.
- R5-Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures-A Pseudocode Approach with C, Thomson 2009
- R6-John E.Hopcroft, Rajeev Motwani and Jeffrey.D Ullman, Introduction to Automata Theory, Languages and Computations, Pearson Education,3rd Edition, 2009.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8306	DATABASE TUNING	3	0	0	3

- Course Objective**
1. To help you tune your application on your database management system, operating system, and hardware.
  2. To teach you the principles underlying any tuning puzzle
  3. To study real time processing of work load sharing
  4. To apply tuning tools and troubleshoot the various DBMS queries
  5. To tune to data warehouse and CRM applications

Unit	Description	Instructional Hours
I	<b>CONCURRENCY CONTROL AND RECOVERY</b> Review of Relational Databases – Locking and Concurrency Control — Logging and the Recovery Subsystem — Operating Systems Considerations – Hardware Tuning.	9
	<b>INDEX TUNING AND NORMALIZATION</b> Types of Queries – Data Structures – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Hot Tables – Tuning Relational Systems – Normalization – Clustering Two Tables – Aggregate Maintenance – Record Layout- Query Tuning – Triggers	
II	<b>REAL TIME DATABASES</b> Client Server Mechanisms – Objects, Application Tools and Performance – Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases - Real- time databases – transaction chopping – optimal Chopping algorithm – Understanding Access plans case study	9
III	<b>TROUBLESHOOTING</b> Consumption chain approach-Query Plan Explainers – Performance Monitors – Event Monitors – Finding “Suspicious” Queries – Analyzing a Query’s Access Plan – Profiling a Query Execution – DBMS Subsystems - Checking DBMS resources	9
IV	<b>TUNING DATAWAREHOUSE AND E-COMMERCE APPLICATIONS</b> Data Warehouse Tuning– Tuning for CRM Systems – Federated Data Warehouse Tuning -E-commerce architecture- Tuning e-commerce architecture – Capacity planning - Case study .	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

**Course Outcome**

- CO1: Understanding the recovery system and security of Database system
- CO2: Analyze normalization and tuning for various data formats
- CO3: Exposure to real time tuning process
- CO4: Study various querying methods and improvements in tuning
- CO5: Knowledge about application that used for tuning database systems

**TEXT BOOK**

T1 - Dennis Shasha and Philippe Bonnet, “Database Tuning, Principles, Experiments, and Troubleshooting Techniques”, Morgan Kaufmann, An Imprint of Elsevier, 2003.

**REFERENCES**

- R1 - Thomas Connolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2003.
- R2 - Tamer M. Ozsü , Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, Pearson Education, 2003.

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- R3 - Margaret H. Dunham, S. Sridhar "Data Mining Introductory & Advance Topics", PHI, 2002.  
R4 - <http://www.cs.helsinki.fi/u/laine/tikape/k03/material03.html>  
R5 - <http://infolab.stanford.edu/~ullman/dscb.html>  
R6 - <http://cs.nyu.edu/courses/spring06/G22.2433-001/>  
R7 - <http://www.doc.ic.ac.uk/~pjm/adb/index.html>  
R8 - <http://www.cs.manchester.ac.uk/postgraduate/taught/programmes / fulllist/>

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8307	VISUAL PROGRAMMING	3	0	0	3

- Course Objective**
1. To Learn the Basics of Windows Programming
  2. To Design applications using Visual Basic
  3. To Design applications using Visual C++ Programming
  4. To Learn the visual C++ menus and SDI MDI environments
  5. To Study the applications of Visual C++ Programming

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO WINDOWS PROGRAMMING</b> GUI Concepts – Overview of Windows programming – Creating the window – Displaying the window - message Loop – windows procedure-WM_PAINT message - WM_DESTROY message – An Introduction to GDI – device context – basic drawing – Text output Scroll Bars –Keyboard – Mouse – Menus.	9
I	<b>VISUAL BASIC PROGRAMMING</b> IDE – First Visual Basic Program - Introduction to Forms – Control statements – control arrays – Creating and using Controls – Menus and Dialogs- Intrinsic Controls – Objects and instances – Debugging – Responding to mouse events – Drag and Drag drop events- Responding to keyboard events - working with Files - Accessing databases with data control - Classes and Objects – ADO Object Model.	9
II	<b>VISUAL C++ PROGRAMMING</b> Visual C++ components – Introduction to Microsoft foundation classes Library Application Framework – Getting Started with AppWizard – Basic Event handling, Mapping modes, and a Scrolling View - Graphics Device Interface, Colors and fonts – modal and modeless dialog – windows common controls – bitmaps	9
III	<b>THE DOCUMENT AND VIEW ARCHITECTURE</b> Menus – Keyboard Accelerators – Rich Edit Control – Tool bars – Status bars – A reusable Frame Window Base Class - Reading and writing documents - SDI and MDI environments – splitter windows and multiple views.	9
IV	<b>APPLICATIONS OF VISUAL PROGRAMMING</b> Dynamic link library – ActiveX controls Vs. Ordinary Windows Controls – Installing ActiveX controls – Calendar Control – ActiveX control container programming – create ActiveX control at runtime - Component Object Model - Object linking and embedding – Data Base Management with Microsoft ODBC- Threading.	9
V	<b>TOTAL INSTRUCTIONAL HOURS</b>	45
	CO1: To Understand the Basics of Windows Programming	
	CO2: To Develop applications using Visual Basic	
	CO3: To Develop applications using Visual C++ Programming	
	CO4: To Understand the visual C++ menus and SDI MDI environments	
	CO5: To develop the applications of Visual C++ Programming	

**Course Outcome**

**TEXT BOOKS:**

- T1 - Charles Petzold, "Windows Programming", Microsoft press, 1998.  
T2 - Francesco Balena, "Programming Microsoft Visual Basic6.0", Microsoft press, Indian Reprint, 2001.  
T3 - David Kruglirski, J, "Programming Microsoft Visual C++", Fifth Edition, Microsoft press, 1998.

**REFERENCE BOOKS :**

- R1 - Visual C++ 6 From the grounded up , 2nd Edition by John Mueller, McGraw – HILL INTERNATIONAL EDITION, Indian Reprint, 2008.  
R2 - Visual Basic 6.0 Programming, Content Development Group, Tata McGraw-Hill Publishing Company Limited, Indian Reprint, 2008.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8308	SOFTWARE TESTING	3	0	0	3

- Course Objective**
1. Understand the fundamental concepts in software testing, including definition, principles, roles and defects.
  2. Understand the strategies for software testing and understand black box and white box testing methods
  3. Understand various levels of software testing for software project
  4. Identify the issues in testing management and understand test planning.
  5. Understand test measurements and Reviews.

Unit	Description	Instructional Hours
	<b>SOFTWARE TESTING FUNDAMENTALS</b>	
I	Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process- The six essentials of software testing - Basic Definitions: Software Testing Principles - The role of a software tester - Origins of Defects- Defect Classes the Defect Repository	9
	<b>TESTING DESIGN STRATEGIES</b>	
II	Introduction to Testing Design Strategies - The Smarter Tester - Test Case Design Strategies - Black Box testing - Random Testing - Equivalence Class Partitioning - Boundary Value Analysis - Cause and error graphing and state transition testing - Error Guessing - Black-box testing and COTS - White-Box testing - Test Adequacy Criteria - Coverage and Control Flow Graphs.	9
	<b>LEVELS OF TESTING</b>	
III	The Need for Levels of Testing- Unit Test - Unit Test Planning- Designing the Unit Tests. The Class as a Testable Unit - The Test Harness - Running the Unit tests and Recording results- Integration tests- Designing Integration Tests - Integration Test Planning - System Test - Types-of system testing - Regression Testing.	9
	<b>TEST MANAGEMENT</b>	
IV	People and organizational issues in testing - organization structures for testing teams - testing services - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - test management - test process - Reporting Test Results - The role of three groups in Test Planning and Policy Development - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group.	9
	<b>TEST MEASUREMENTS AND REVIEWS</b>	
V	Defining Terms - Measurements and Milestones for Controlling and Monitoring- Status Meetings- Reports and Control Issues - Criteria for Test Completion- SCM - Types of reviews - developing a review program - Components of Review Plans- Reporting review results. Testing Tools-Case Selenium, Autoit	9

**TOTAL INSTRUCTIONAL HOURS 45**

- Course Outcome**
- CO1: Understand the fundamental concepts in software testing, including definition, principles, roles and defects.
- CO2: Understand the strategies for software testing and understand black box and white box testing methods
- CO3: Apply various levels of software testing for software project.
- CO4: Understand the issues in testing management and understand test planning
- CO5: Apply the test measurements and Reviews for software testing

**TEXT BOOKS:**

T1 - 1.John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.

**REFERENCE BOOKS :**

R1 - 1.Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.

R2 - Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology ", Wiley Interscience, 2<sup>nd</sup> Edition, 2006.

R3 - William R. Sherman, Alan B. Craig, " Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann, 2008.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8309	HIGH PERFORMANCE COMPUTING	3	0	0	3

- Course Objective**
1. To learn about Modern Processors and concepts
  2. To understand the concepts of Optimizations
  3. To learn about Parallel Computers and Programming
  4. To study about Memory Parallel Programming using Open MP and MPI
  5. To understand the point-to-point communication

Unit	Description	Instructional Hours
I	<b>MODERN PROCESSORS</b> Stored Program Computer Architecture- General purpose cache-based microprocessor-Performance based metrics and benchmarks-Moore's Law- Pipelining-Superscalarity-SIMDMemory Hierarchies Cache- mapping-prefetch- Multicore processors-Mutithreaded processors- Vector Processors-Design Principles-Maximum performance estimates- Programming for vector architecture.	9
	<b>BASIC OPTIMIZATION TECHNIQUES FOR SERIAL CODE</b> Scalar profiling- Function and line based runtime profiling- Hardware performance counters-Common sense optimizations-Simple measures, large impact- Elimination of common subexpressions- Avoiding branches- Using SIMD instruction sets- The role of compilers-General optimization options-Inlining- Aliasing- Computational Accuracy- Register optimizations- Using compiler logs- C++ optimizations-Temporaries-Dynamic memory management- Loop kernels and iterators Data Access Optimization: Balance analysis and lightspeed estimates- Storage order- Case study: Jacobi algorithm and Dense matrix transpose.	9
III	<b>PARALLEL COMPUTERS</b> Taxonomy of parallel computing paradigms- Shared memory computers- Cache coherence- UMA-ccNUMA-Distributed-memory computers- Hierarchical systems-Networks-Basic performance characteristics- Buses- Switched and fattree networks- Mesh networks- Hybrids Basics of parallelization - Why parallelize - Data Parallelism - Function Parallelism-Parallel Scalability- Factors that limit parallel execution- Scalability metrics-Simple scalability laws- parallel efficiency - serial performance Vs Strong scalability- Refined performance models- Choosing the right scaling baseline.Case Study : Can slow processors compute faster- Load balance.	9
IV	<b>SHARED MEMORY PARALLEL PROGRAMMING WITH OPENMP</b> Introduction to OpenMP - Parallel execution - Data scoping- OpenMP work sharing for loops-Synchronization-Reductions-Loop Scheduling - Tasking -Case Study: OpenMP- parallel Jacobi algorithm- Advanced OpenMP wavefront parallelization- Efficient OpenMP rogramming: Profiling OpenMP programs - Performance pitfalls- Case study: Parale Sparse matrix-vector multiply.	9
V	<b>DISTRIBUTED-MEMORY PARALLEL PROGRAMMING WITH MPI</b> Message passing - Introduction to MPI- Example- Messages and point-to-point communication-Collective communication- Nonblocking point-to-point communication- Virtual topologies - MPI parallelization of Jacobi solver-MPI implementation-performance properties Efficient MPI programming: MPI performance tools- communication parameters-Synchronization, serialization, contention- Reducing communication overhead optimal domain decomposition- Aggregating messages - Nonblocking Vs Asynchronous communication- Collective communication- Understanding intra node point-to-point communication.	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

**Course Outcome**

CO1: Identify the Modern Processors and concepts  
CO2: Discuss the various concepts of Optimizations  
CO3: Analyze the parallel computers and programming  
CO4: Analyze about Memory Parallel Programming using Open MP and MPI.  
CO5: Identify the point-to-point communication.

**TEXT BOOKS:**

T1 - Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.

**REFERENCE BOOKS :**

R1 - Charles Severance, Kevin Dowd, "High Performance Computing", O'Reilly Media, 2nd Edition, 1998.  
R2 - Kai Hwang, Faye Alaye Briggs, "Computer Architecture and Parallel Processing", McGraw Hill, 1984.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8310	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3

- Course Objective**
1. Gain knowledge about the major types of information systems used in a business environment.
  2. Impart knowledge on the ethical issues of information systems.
  3. Impart knowledge on the social issues of information systems
  4. Impart knowledge on the security issues of information systems
  5. Understand the processes of developing and implementing information systems.

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO INFORMATION SYSTEMS</b>	
I	Information Systems in Global Business Today: Role of Information Systems in Business Today - Perspectives of Information Systems - Approaches to Information Systems - Global E-Business and Collaboration: Business Process and Information Systems - Types of Information Systems Enterprise Systems	9
	<b>INFORMATION TECHNOLOGY INFRASTRUCTURE</b>	
II	Information Systems, Organizations and Strategy: Organizations and Information Systems - Impact of Information Systems on organizations and Business Firms - Ethical and Social Issues in Information Systems: Understanding Ethical and Social Issues Related to Systems - Ethics in an information society - IT Infrastructure and Emerging Technologies: Infrastructure Components - Hardware Platform Trends - Software Platform Trends	9
	<b>DATABASES AND INFORMATION MANAGEMENT</b>	
III	Organizing Data in Traditional File Environment - Database Approach to Data Management - Using Databases to improve Business Performance and Decision Making - Managing Data Resources	9
	<b>NETWORKS AND SECURITY</b>	
IV	Telecommunications and Networking in today's Business Needs: Networking and Communication Trends - Key Digital Networking Technologies - Securing Information Systems: System Vulnerability - Business Value of Security and Control - Establishing Management Framework for Security and Control - Technologies and Tools for Protecting Information Resources.	9
	<b>NEW IT INITIATIVES</b>	
V	Enterprise Applications: Enterprise Systems - Supply Chain Management Systems - Customer Relationship Management Systems - Electronic Commerce: Types of Electronic Commerce - Mcommerce Services and Applications - The Knowledge Management Landscape: Important Dimensions of Knowledge - The Knowledge Management Value Chain - Types of Knowledge Management Systems.	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

- Course Outcome**
- CO1: Understand the basics of Management Information systems.  
CO2: Formulate solutions social and ethical issues related to information technology infrastructure.  
CO3: Apply the knowledge on database management systems to store hybrid information in a business organization.  
CO4: Recognize the use of security mechanisms to share business information over various types of networks.  
CO5: Explore the new IT initiatives for enhancing knowledge management information systems.

**REFERENCE BOOKS:**

- R1- Kenneth C. Laudon, Jane P. Laudon, Management Information Systems -Managing the digital firm, Pearson Education, 2012.  
R2- Waman S Jawadekar, Management Information Systems-Texts and Cases, the McGraw-Hill Company, 2009.

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- R3- James O' Brien, Management Information Systems-Managing Information Technology in the Ebusiness enterprise, McGraw-Hill Higher Education, 2011.  
R4- Turban, McLean and Wether, Information Technology for Management-Transforming Organisations in the Digital Economy, John Wiley, 2008.  
R5- Raymond McLeod and Jr. George P. Schell, Management Information Systems, Pearson Education, 2008.

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8311	ENGINEERING ECONOMICS	3	0	0	3

- Course Objective**
1. Provide the theoretical foundations in micro and macro analysis in terms of concepts and theories
  2. Learn the functions of demand and supply
  3. Emphasis the systematic evaluation of the costs and benefits associated with projects.
  4. Understand about the market structure
  5. Learn about financial Accounting

Unit	Description	Instructional Hours
<b>I</b>	<b>INTRODUCTION</b> Introduction to Micro and Macro economics-Kinds of Economic Systems-Production Possibility Frontier-Opportunity Cost-Objective of Organizations-Kinds of Organization.	9
<b>II</b>	<b>DEMAND AND SUPPLY</b> Functions of Demand and Supply -Law of diminishing Marginal Utility Law of Demand and Supply -Elasticity of Demand -Demand Forecasting Methods-Indifference curve	9
<b>III</b>	<b>PRODUCTION AND COST</b> Production Function>Returns to Scale-Law of Variable Proportion-Cost and Revenue concepts and Cost Curves-Revenue curves-Economies and Dis-economies of scale-Break Even point	9
<b>IV</b>	<b>MARKET STRUCTURE</b> Market Structure-Perfect Competition-Monopoly-Monopolistic-Oligopoly-Components of Pricing- Methods of Pricing-Capital Budgeting IRR-ARR-NPV-Return on Investment-Payback Period	9
<b>V</b>	<b>INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL ACCOUNTING</b> National Income-Calculation Methods-Problems-Inflation-Deflation-Business Cycle-Taxes-Direct and Indirect Taxes -Fiscal and monetary policies	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Understand the micro economic environment for creating a favorable business environment.
- CO2: Take decision by making use of the major concepts and techniques of engineering economic analysis.
- CO3: Compare the cost of multiple projects by using the methods learned, and make a quantitative decision between alternate facilities and/or systems.
- CO4: Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.
- CO5: Examine and evaluate the issues in macro-economic analysis.

**REFERENCE BOOKS:**

R1-A Ramachandra Aryasri and V V RamanaMurthy, Engineering Economics and Financial Accounting, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.



R2-V L Samuel Paul and G S Gupta, Managerial Economics Concepts and Cases, Tata McGraw Hill Publishing Company Limited, New Delhi, 1981.  
R3.-R Kesavan, C Elanchezhian and T Sunder Selwyn, Engineering Economics and Financial Accounting, Laxmi Publication Ltd, New Delhi, 2005.  
R4-S N Maheswari, Financial and Management Accounting, Sultan Chand  
R5.V L Samuel Paul and G S Gupta, Managerial Economics-Concepts and Cases

  
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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS8312	BIG DATA ANALYTICS	3	0	0	3

- Course Objective**
1. To understand the basics of data analytics.
  2. To Learn the Business Intelligence and its Framework.
  3. To understand the technologies for big data analytics.
  4. To Learn Hadoop and HDFS
  5. To Learn Business implementation for real time data

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO DATA ANALYTICS</b> Data and Relations, Data Visualization, Correlation, Regression, Forecasting, Classification, Clustering. Big Data Technology Landscape: Fundamentals of Big Data Types, Big data Technology Components, Big Data Architecture, Big Data Warehouses, Functional vs. Procedural Programming Models for Big Data.	9
I		
	<b>INTRODUCTION TO BUSINESS INTELLIGENCE</b> Business View of IT Applications, Digital Data, OLTP vs. OLAP, Why, What and How BI? , BI Framework and components, BI Project Life Cycle, Business Intelligence vs. Business Analytics.	9
II		
	<b>BIG DATA ANALYTICS</b> Big Data Analytics, Framework for Big Data Analysis, Approaches for Analysis of Big Data, ETL in Big Data, Introduction to Hadoop Ecosystem, HDFS, Map-Reduce Programming, Understanding Text Analytics and Big Data, Predictive analysis on Big Data, Role of Data analyst.	9
III		
	<b>BUSINESS IMPLEMENTATION OF BIG DATA</b> Big Data Implementation, Big Data workflow, Operational Databases, Graph Databases in a Big Data Environment, Real-Time Data Streams and Complex Event Processing, Applying Big Data in a business scenario, Security and Governance for Big Data.	9
IV		
	<b>BIG DATA ON CLOUD</b> Big Data on Cloud, Best practices in Big Data implementation, Latest trends in Big Data, Latest trends in Big Data, Big Data Computation, More on Big Data Storage, Big Data Computational Limitations. Introduction to most recent advancements in Big Data technology along with their usage and implementation with relevant tools and technologies.	9
V		
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1: Understand the basics of data analytics and big data technology
  - CO2: Understand the business intelligence and its framework.
  - CO3: Understand the implementation of big data analysis using Hadoop
  - CO4: Understand the HDFS concepts
  - CO5: Understand the implementation of Big data and its techniques in a variety of applications.

**TEXT BOOKS:**

- T1 - Michael Minelli, Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley CIO Series (2013), First Edition.

**REFERENCE BOOKS :**

- R1 - T. white, Hadoop: The Definitive Guide, O' Reilly Media (2012), Third Edition.
- R2 - Data-Intensive Text Processing with MapReduce. Jimmy Lin and Chris Dyer. Morgan & Claypool Publishers, 2010.

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*(Signature)*  
**Dean (Academics)  
 HiCET**

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CS7403	FOUNDATION SKILLS IN INFORMATION TECHNOLOGY	3	0	0	3

- Course Objective**
1. To introduce the basics of C programming language
  2. To Learn about the concepts of structure and unions
  3. To be exposed about sorting, searching, hashing algorithms.
  4. To Learn various testing and maintenance measures.
  5. To outline the principles for Software Project Management

Unit	Description	Instructional Hours
I	<b>BASIC PROGRAMMING CONCEPTS IN C LANGUAGE</b> Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays	9
II	<b>FUNCTIONS, POINTERS, STRUCTURES AND UNIONS</b> Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives..	9
III	<b>SORTING, SEARCHING, HASHING TECHNIQUES</b> Sorting algorithms: Insertion sort – Selection sort – Shell sort – Bubble sort – Quick sort – Merge sort – Radix sort – Searching: Linear search – Binary Search Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing	9
IV	<b>SOFTWARE TESTING AND ITS TYPES</b> Software testing fundamentals-Internal and external views of Testing-white box testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing -alpha and beta testing -Acceptance testing – Performance testing– Usability and Accessibility testing –Compatibility testing – Test cases Testing the documentation.	9
V	<b>STAFFING IN SOFTWARE PROJECTS</b> Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership	9
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1 Understand the basics of C programming language
  - CO2 Apply the concepts of structures and unions
  - CO3 Apply the sorting, searching, hashing algorithms.
  - CO4 Understand the various testing and maintenance.
  - CO5 Understand the Project Management principles while developing software.

**TEXT BOOKS:**

- T1: Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988.  
T2: Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.  
R1: Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.  
R2: Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.  
R3: Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.  
R4: Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.  
R5-C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw- Hill Publishing company Ltd., 2006.

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**CSE - HICET**



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**Dean (Academics)**  
**HICET**

**CO'S, PO'S & PSO'S MAPPING – ACADEMIC YEAR (2020-2021)**

**Semester – I**

Course Code & Name: 19HE1101 Technical English

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name: 19MA1101 Calculus

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	2	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name: 19PH1151 Applied Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

**Course Code & Name: 19CY1151 Chemistry for Engineers**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1
Avg	3	2	2	2	2	1	1	-	-	-	-	1	1	1

**Course Code & Name: 19CS1151 Python Programming and Practices**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

**Course Code & Name: 19CS1152 – object oriented programming using python**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

**Course Code & Name: 19EC1154 Basics of Electron Devices and Electric Circuits**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	1	1				1	2	3	3
CO2	3	3	2	2	2	1	1				1	2	3	2
CO3	3	2	3	2	2	1	1				1	2	2	2
CO4	3	3	3	2	2	1	1				1	2	3	2
CO5	3	3	3	2	2	1	1				1	2	3	2
Avg	3	2.8	2.8	2	2	1	1				1	2	2.8	2.2

**Semester – II**

**Course Code & Name: 19HE2101 Business English for Engineers**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

**Course Code & Name: 19MA2104 Differential Equations and Linear Algebra**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	2	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2	-	-	-	-	-	-	2	2	2.2

**Course Code & Name: 19PH2151 Material Science**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

**Course Code & Name: 19CY2151 Environmental Studies**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Avg	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

**Course Code & Name: 19CS2152 Essentials of C and C++ Programming**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-		3	-	-	1	1	-	2	2	3	3
CO2	3	3	2	2	3	-	-	1	1	-	2	2	2	3
CO3	3	3	2	2	3	-	-	1	1	-	2	2	2	3
CO4	3	3	-	2	3	-	-	1	1	-	2	2	2	3
CO5	3	-	2	2	3	-	-	1	1	-	2	2	2	3
Avg	3	2.4	1.2	1.6	3	0	0	1	1	0	2	2	2.2	3

**Course Code & Name: 19CS2153 Java Fundamentals**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

**Course Code & Name: 19ME2154 Engineering Graphics**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	1	1
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	-	3	1	1
CO5	3	3	3	2	2	-	-	-	-	-	-	3	2	2
Avg	3	3	3	2	2	-	-	-	-	-	-	2.8	1.8	1.8

**Course Code & Name: 19ME2001 Engineering Practices Laboratory**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2
CO2														
CO3														
CO4														
CO5														
Avg	3		3		3				1				1	2



### Semester – III

Course Code & Name: 19MA3104 Discrete Mathematics and Graph Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	2	3
CO3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
Avg	2.8	2.8	2.8	2.8	2.8	-	-	-	-	-	-	2.6	2.4	2.6

Course Code & Name: 19CS3201 Data Structures

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2			3	2		3	3	3	2	
CO2	3	2	2	2	2				2					2
CO3	2	2	2	2			2			3	3	3	2	2
CO4	3	3	2		2			2					2	
CO5	3	3	2	2	3					3	3	3		3
Avg	2.8	2.6	2.2	1.6	1.4	0	1	0.8	0.4	1.2	1.8	1.8	1.2	1.4

Course Code & Name: 19CS3202 Database Management Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	3	0	1	3	0	0	3	1	1	2	2	1
CO2	2	2	3	1	1	1	0	0	3	1	1	2	2	2
CO3	3	2	3	2	2	0	0	0	1	1	1	2	2	3

CO4	3	1	3	1	1	2	0	0	1	2	1	2	3	3
CO5	1	2	2	1	3	2	1	0	2	3	3	2	3	1
Avg	2	1.6	2.8	1	1.6	1.6	0.2	0	2	1.6	1.4	2	2.4	2

**Course Code & Name: 19CS3203 Computer Organization and Architecture**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	0	0	0	0	0	0	0	0	1	3	3	2
CO2	2	1	1	0	0	0	0	0	0	0	0	1	2	2
CO3	2	1	2	0	0	0	0	0	0	1	0	2	0	2
CO4	3	3	1	0	0	0	0	0	0	0	1	1	0	2
CO5	3	1	1	0	0	0	0	0	0	1	1	1	1	2
Avg	2	2	1	0	0	0	0	0	0	0	1	2	1	2

**Course Code & Name: 19CS3251 Digital Principles and System Design**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1	0	1	0	1	1	3	0	0
CO2	3	3	2	2	2	2	0	1	0	1	0	1	0	2
CO3	3	3	2	2	2	2	0	1	0	1	0	2	0	1
CO4	3	3	2	2	2	2	0	1	0	1	1	1	0	1
CO5	3	3	2	2	2	2	0	1	0	1	1	1	0	2
Avg	3	3	2	2	2	2	0	1	0	1	1	2	0	1

**Course Code & Name: 19CS3001 Data Structures Laboratory**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	0	0	0	1	0	0	0	0	0	1	1	1	0

CO2	3	2	1	1	1	0	0	0	1	0	0	1	1	0
CO3	3	2	1	1	1	0	0	0	1	1	0	1	0	1
CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Course Code & Name: 19CS3002 Database Management Systems Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	3	0	1	1	0	0	1	1	1	1	2	2
CO2	1	2	3	1	1	1	0	0	1	1	1	1	2	2
CO3	1	2	3	2	2	0	0	0	1	1	1	1	2	2
CO4	1	1	3	1	1	2	0	0	1	2	1	2	2	3
CO5	1	2	2	1	3	2	1	0	2	3	3	2	2	3
Avg	3	2	0	0	1	0	0	0	0	0	1	2	1	0

### Semester – IV

Course Code & Name: 19MA4151 Probability, Statistics and Queuing Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO2	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO4	2	2	3	1	2	-	-	-	-	-	2	2	3	3
CO5	2	3	3	2	2	-	-	-	-	-	3	2	3	3
Avg	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4

Course Code & Name: 19CS4201 Java Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO1	1												2	2
CO2	1	2	2	1									2	2
CO3	1		2	2	2				1	1			2	2
CO4	1		2	2	2								2	2
CO5	1		2	3	2				2	2			2	2
Avg	1	0.2	1.6	1.6	1.2				0.6	0.6			2	2

**Course Code & Name: 19CS4202 Software Engineering**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	-	2	2	-	3	3	-	3	3	3
CO2	2	3	3	2	2	-	2	2	3	3	2	2	3	3
CO3	3	3	3	2			3			2	3	2	2	2
CO4	3	2	2	2	2				2		2	2	2	2
CO5	2	2	2	2			2				2	2	2	2
Avg	2.6	2.6	2.6	2.2	2	2	2.25	2	2.666667	2.666667	2.25	2.2	2.4	2.4

**Course Code & Name: 19CS4203 Operating Systems**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	2	-	-	-	-	-	3	-
CO2	2	3	3	3	-	-	3	-	-	-	3	-	3	2
CO3	3	-	-	-	-	-	2	-	-	-	2	3	3	-
CO4	3	2	3	-	-	-	2	-	3	-	2	-	3	-
CO5	3	-	-	-	-	-	3	-	3	-	2	3	3	-
Avg	2.8	1	1.2	0.6	0	0	2.4	0	1.2	0	1.8	1.2	3	0.4

**Course Code & Name: 19CS4251 Design and Analysis of Algorithm**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO	PSO
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													<b>1</b>	<b>2</b>
<b>CO1</b>	3	3	3			1	1					1	1	
<b>CO2</b>	3	3	3	1	2	1	1				1	1	1	1
<b>CO3</b>	3	2	3	2	1		2		1		2	2	3	2
<b>CO4</b>	3	3	3	1		1	2		1		2	2	2	3
<b>CO5</b>	3	3	3		2		2		1		1	3	3	3
<b>Avg</b>	3.00	2.80	3.00	0.80	1.00	0.60	1.60	-	0.60	-	0.80	1.80	2.00	1.80

**Course Code & Name: 19CS4001 Java Programming Laboratory**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3				2	1	2	2	2	3
<b>CO2</b>	3	3	1	3	3				2	1	2	2	2	3
<b>CO3</b>	3	3	1	3	3				2	1	2	2	2	3
<b>CO4</b>	3	3	1	3	3				2	1	2	2	2	3
<b>CO5</b>	3	3	1	3	3				2	1	2	2	2	3
<b>Avg</b>	3	3	1	3	3	0	0	0	2	1	2	2	2	3

**Course Code & Name: 19CS4002 Operating Systems Laboratory**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	1	0	0	0	0	0	1	1	1	0
<b>CO2</b>	3	2	1	1	1	0	0	0	1	0	0	1	1	0
<b>CO3</b>	3	2	1	1	1	0	0	0	1	1	0	1	0	1
<b>CO4</b>	3	2	1	1	0	0	0	0	1	0	1	1	0	1
<b>CO5</b>	3	0	0	0	0	0	0	0	0	1	1	1	1	0
<b>Avg</b>	3	1	1	1	1	0	0	0	1	0	1	1	1	0

**Semester – V**

**Course Code & Name: 19CS5201 Theory of Computing**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	1	-	-	2	2	-	3	2	1
CO2	3	3	3	3	-	1	-	-	2	2	-	3	2	1
CO3	3	3	3	3	-	1	-	-	2	2	-	3	2	1
CO4	3	3	3	3	-	1	-	-	2	2	-	3	2	1
CO5	3	3	2	2	-	1	-	-	2	2	3	3	2	2
Avg	3	3	2.8	2.8	0.4	1	0	0	2	2	0.6	3	2	1.2

Course Code & Name: 19CS5202 Computer Networks

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19EC5231 Principles of Microprocessors and Microcontrollers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19CS5203 Data Mining

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3			3	1		2	2	2	3
CO2	3	3	3	2	3			3	1		2	2	2	3
CO3	3	2	3	2	3			3	1		2	2	2	3
CO4	3	3	3	2	3			3	1		2	2	2	3
CO5	3	3	3	2	3			3	1		2	2	2	3
Avg	3	2.8	3	2	3	0	0	3	1	0	2	2	2	3

**Course Code & Name: 19CS5252 Object Oriented Analysis And Design**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1					3	3	3							
CO2	2	2			3	3								
CO3	2		2	3	3	3								
CO4	2	1	2	2		3								
CO5	2	2	2	2	3	3	3				2	2		
Avg	2	1.6	2	2.3	3	3	3				2	2		

**Course Code & Name: 19EC5031 Principles of Microprocessors and Microcontrollers Laboratory**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

**Course Code & Name: 19CS5351 Internet and Web Technology**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	2	1		2	3		3	2	
<b>CO2</b>	3	3	3	3	2	2	1			3		3		2
<b>CO3</b>	3	3	3	3	2	1	1		1	3		3	2	2
<b>CO4</b>	3	3	3	3	2	1			1	3		3		3
<b>CO5</b>	3	3	3	3	2	1			1	3		3	2	
<b>Avg</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1.4</b>	<b>0.6</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>1.2</b>	<b>1.4</b>

**Course Code & Name: 19CS5352 Advanced Java Programming**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	3	0	0	0	0	0	2	2	1	2
<b>CO2</b>	3	1	3	0	3	0	0	0	1	0	0	1	1	2
<b>CO3</b>	3	1	2	0	3	0	0	0	0	1	0	3	0	1
<b>CO4</b>	1	1	3	0	0	0	0	0	1	0	1	1	0	1
<b>CO5</b>	3	1	1	0	0	0	0	0	0	1	1	1	1	1
<b>Avg</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 19CS5353 Fundamentals of Open Source Software**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
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CO1	3	2	0	0	3	0	0	0	0	0	2	2	1	2
CO2	3	1	3	0	3	0	0	0	1	0	0	1	1	2
CO3	3	3	2	0	3	0	0	0	0	1	0	3	0	1
CO4	1	1	3	0	0	0	0	0	1	0	1	1	0	1
CO5	3	1	1	0	0	0	0	0	0	1	1	1	1	1
Avg	3	2	2	0	2	0	0	0	0	0	1	2	1	1

Course Code & Name: 19CS5354 R Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	0	0	0	1	0	0	0	0	0	1	1	1	0
CO2	3	2	1	1	1	0	0	0	1	0	0	1	1	0
CO3	3	2	1	1	1	0	0	0	1	1	0	1	0	1
CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Course Code & Name: 19CS5355 Computer Graphics and Multimedia

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3		2	0	0	0	0	2	3	3	3	3
CO2	2	3				0	0	0	0	1	3	1		3
CO3	1		3		2	0	0	0	0	2	0	2	2	
CO4		1		3		0	0	0	0	1	1	1	3	
CO5			3	3	2	0	0	0	0	2	1	1		3
Avg	1.7	2.3	3	3	2	0	0	0	0	2	2	2	2.3	2.8

## Semester – VI

Course Code & Name: 19CS6181 Principles of Management

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1			1			2	2	2	3	3	2		
CO2	2		1	2	1			2	3		3	1	1	
CO3	2		2	2	2	2		3	2	3		1		
CO4	2		3		2	2			3	3	2	1		1
CO5	0				2	2	2		2					
Avg	1.4	0	1.2	1	1.4	1.2	0.8	1.4	2.4	1.8	1.6	1	0.2	0.2

**Course Code & Name: 19CS6201 Artificial Intelligence**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	2	2	1	1	2	2	3	3	2
CO2	3	3	3	2	2	2	2	1	1	2	1	2	3	2
CO3	3	3	3	2	2	2	2	1	1	2	1	2	3	3
CO4	3	3	2	2	2	2	2	1	2	2	1	3	3	2
CO5	3	3	2	2	2	2	2	1	2	2	2	3	3	2
Avg	3	3	2.4	2	2	2	2	1	1.4	2	1.4	2.6	3	2.2

**Course Code & Name: 19CS6202 MOBILE COMPUTING**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	1	-	-	1	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	1	-	-	-	-	-	1	2	-
CO4	1	1	1	1	1	1	-	-	-	-	-	1	2	-
CO5	1	1	1	-	1	1	-	-	-	1		1	2	-
Avg	1	0.6	1	0.2	0.4	0.8				0.2		0.6	1.2	

**Course Code & Name: 19CS6251 COMPILER DESIGN**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	-	-	1	1	-	-	-	-	1	1	-
CO2	3	3	3	1	2	1	1	-	-	-	1	1	1	1
CO3	3	2	3	2	1		2	-	1	-	2	2	3	2
CO4	3	3	3	1		1	2		1	-	-	2	2	3
CO5	3	3	3	-	2	-	2	-	1	-	1	3	3	3
Avg	3.0	2.8	3.0	1.3	1.7	1.0	1.6	-	1.0	-	1.3	1.8	2.0	2.3

**Course Code & Name: 19CS6001 MOBILE APPLICATION DEVELOPMENT LABORATORY**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2		3	-	-	-	-	-	-	-	3	3
CO2	3	2	3	2	3	-	-	-	2	1	-	-	3	2
CO3	3	3	3	2	3	-	-	-	2	2	-	-	3	3
CO4	3	3	3	1	3	-	-	-	2	2	-	-	3	3
CO5	3	3	3	2	2	-	-	-	3	3	2	-	3	3
Avg	3	2.6	2.8	1.4	2.8				1.8	1.6	0.4		3	2.8

**Course Code & Name: 19CS6301 Business Intelligence – Data Warehousing and Analytics**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1

<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 19CS6302 Embedded Systems**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	2	0	0	1	0	1	1	3	1	0
<b>CO2</b>	3	2	2	0	1	0	0	1	0	1	0	1	0	0
<b>CO3</b>	3	2	1	0	3	0	0	1	0	1	0	2	1	0
<b>CO4</b>	3	2	3	0	2	0	0	1	0	1	1	1	1	1
<b>CO5</b>	3	2	3	0	1	0	0	1	0	1	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 19CS6303 Internet of Things**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 19CS6304 Big Data Analytics and Tools**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	0	0	0	2	3	3	2	1
<b>CO2</b>	3	2	1	2	1	0	0	0	0	1	3	1	3	0

<b>CO3</b>	3	2	1	1	1	0	0	0	0	2	0	2	1	0
<b>CO4</b>	3	2	1	0	0	0	0	0	0	1	1	1	2	1
<b>CO5</b>	3	2	1	0	0	0	0	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 19CS6305    Soft Computing**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 19CS6401    Introduction to Java Programming**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	1	3				1		1	2	2	3
<b>CO2</b>	3	3	3	1	3				1		1	2	2	3
<b>CO3</b>	3	2	3	2	3				1		2	2	2	3
<b>CO4</b>	3	3	3	1	3				1		1	2	2	3
<b>CO5</b>	3	3	3	1	3				1		1	2	2	3
<b>Avg</b>	<b>3</b>	<b>2.8</b>	<b>3</b>	<b>1.2</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1.2</b>	<b>2</b>	<b>2</b>	<b>3</b>

## REGULATION - 2016

### Semester – V

Course Code & Name: 16CS5201 Computer Networks

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	2	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	1	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 16CS5202 Free Open Source Software I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0

<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS5203 Computer Architecture**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS5204 Theory Of Computation**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS5001 Network Laboratory**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	1	0	2	0	0	1	0	1	1	3	1	0
<b>CO2</b>	3	1	2	0	1	0	0	1	0	1	0	1	0	0
<b>CO3</b>	3	1	1	0	3	0	0	1	0	1	0	2	1	0

<b>CO4</b>	3	1	3	0	2	0	0	1	0	1	1	1	1	1
<b>CO5</b>	3	1	3	0	1	0	0	1	0	1	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS5002 Open Source Programming Laboratory**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS5301 Advanced Java Programming**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS5302 Visualization Techniques**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	2	0	0	1	0	1	1	3	1	0
<b>CO2</b>	3	2	2	0	1	0	0	1	0	1	0	1	0	0
<b>CO3</b>	3	2	1	0	3	0	0	1	0	1	0	2	1	0



<b>CO4</b>	3	2	3	0	2	0	0	1	0	1	1	1	1	1
<b>CO5</b>	3	2	3	0	1	0	0	1	0	1	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS5303 Service Oriented Architecture**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	3	0	0	0	0	0	2	2	1	2
<b>CO2</b>	3	1	3	0	3	0	0	0	1	0	0	1	1	2
<b>CO3</b>	3	1	2	0	3	0	0	0	0	1	0	3	0	1
<b>CO4</b>	1	1	3	0	0	0	0	0	1	0	1	1	0	1
<b>CO5</b>	3	1	1	0	0	0	0	0	0	1	1	1	1	1
<b>Avg</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS5304 Information Storage Management**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	3	0	0	0	0	0	2	2	1	2
<b>CO2</b>	3	1	3	0	3	0	0	0	1	0	0	1	1	2
<b>CO3</b>	3	3	2	0	3	0	0	0	0	1	0	3	0	1
<b>CO4</b>	1	1	3	0	0	0	0	0	1	0	1	1	0	1
<b>CO5</b>	3	1	1	0	0	0	0	0	0	1	1	1	1	1
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS5305 TCP/IP Principles and Architecture**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	1	0	0	0	0	0	1	1	1	0
<b>CO2</b>	3	2	1	1	1	0	0	0	1	0	0	1	1	0
<b>CO3</b>	3	2	1	1	1	0	0	0	1	1	0	1	0	1

CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Course Code & Name: 16CS5306 System Software

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	0	0	0	0	0	0	2	3	3	2	1
CO2	3	2	1	2	1	0	0	0	0	1	3	1	3	0
CO3	3	2	1	1	1	0	0	0	0	2	0	2	1	0
CO4	3	2	1	0	0	0	0	0	0	1	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	2	1	1	1	0
Avg	3	2	1	1	0	0	0	0	0	2	2	2	2	0

Semester – VI

Course Code & Name: 16CS6201 Free Open Source Software II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	0	2	0	0	1	0	1	1	3	1	0
CO2	3	1	1	0	1	0	0	1	0	1	0	1	0	0
CO3	3	1	1	0	3	0	0	1	0	1	0	2	1	0
CO4	3	1	1	0	2	0	0	1	0	1	1	1	1	1
CO5	3	1	1	0	1	0	0	1	0	1	1	1	1	0
Avg	3	1	1	0	2	0	0	1	0	1	1	2	1	0

Course Code & Name: 16CS6202 Compiler Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0

<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS6203 Internet of Things**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	0	0	0	2	3	3	2	1
<b>CO2</b>	3	2	1	2	1	0	0	0	0	1	3	1	3	0
<b>CO3</b>	3	2	1	1	1	0	0	0	0	2	0	2	1	0
<b>CO4</b>	3	2	1	0	0	0	0	0	0	1	1	1	2	1
<b>CO5</b>	3	2	1	0	0	0	0	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 16CS6204 Software Quality Assurance**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	2	0	0	1	0	1	1	3	1	0
<b>CO2</b>	3	2	1	0	1	0	0	1	0	1	0	1	0	0
<b>CO3</b>	3	2	1	0	3	0	0	1	0	1	0	2	1	0
<b>CO4</b>	3	2	1	0	2	0	0	1	0	1	1	1	1	1
<b>CO5</b>	3	2	1	0	1	0	0	1	0	1	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS6001 Open Source Programming Laboratory II**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0

<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS6002 Compiler Design Laboratory**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	0	0	0	2	3	3	2	1
<b>CO2</b>	3	3	1	2	1	0	0	0	0	1	3	1	3	0
<b>CO3</b>	3	3	1	1	1	0	0	0	0	2	0	2	1	0
<b>CO4</b>	3	3	1	0	0	0	0	0	0	1	1	1	2	1
<b>CO5</b>	3	3	1	0	0	0	0	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 16CS6301 Enterprise Computing**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS6302 Social Network Analysis**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	2	0	0	1	0	1	1	3	1	0
<b>CO2</b>	3	2	2	0	1	0	0	1	0	1	0	1	0	0
<b>CO3</b>	3	2	1	0	3	0	0	1	0	1	0	2	1	0

<b>CO4</b>	3	2	3	0	2	0	0	1	0	1	1	1	1	1
<b>CO5</b>	3	2	3	0	1	0	0	1	0	1	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS6303 Embedded Systems**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS6304 Total Quality Management**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	0	0	0	2	3	3	2	1
<b>CO2</b>	3	2	1	2	1	0	0	0	0	1	3	1	3	0
<b>CO3</b>	3	2	1	1	1	0	0	0	0	2	0	2	1	0
<b>CO4</b>	3	2	1	0	0	0	0	0	0	1	1	1	2	1
<b>CO5</b>	3	2	1	0	0	0	0	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 16CS6305 Network and Routing Protocols**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0

CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 16CS6306 Signals and Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 16CS6402 Introduction to java programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	0	0	0	0	0	0	0	2	3	3	2	1
CO2	3	1	0	2	1	0	0	0	0	1	3	1	3	0
CO3	3	1	0	1	1	0	0	0	0	2	0	2	1	0
CO4	3	1	0	0	0	0	0	0	0	1	1	1	2	1
CO5	3	1	0	0	0	0	0	0	0	2	1	1	1	0
Avg	3	1	0	1	0	0	0	0	0	2	2	2	2	0

### Semester – VII

Course Code & Name: 16CS7201 Cryptography and Network Security

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0

<b>CO2</b>	3	3	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	3	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	2	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS7202 Cloud Computing**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	1	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS7203 Mobile Computing**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS7001 Cryptography and Network Security Laboratory**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	1	2	0	0	0	0	0	0	1	1	0
<b>CO2</b>	3	2	1	1	2	0	0	1	0	0	0	2	1	1

<b>CO3</b>	3	3	1	1	2	0	0	1	0	0	0	1	1	1
<b>CO4</b>	3	2	1	1	0	0	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	1	2	0	0	0	0	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS7002 Cloud Computing Laboratory**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	0	0	0	0	2	3	3	2	1
<b>CO2</b>	3	2	0	2	1	0	0	0	0	1	3	1	3	0
<b>CO3</b>	3	2	0	1	1	0	0	0	0	2	0	2	1	0
<b>CO4</b>	3	2	0	0	0	0	0	0	0	1	1	1	2	1
<b>CO5</b>	3	2	0	0	0	0	0	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 16CS7301 C# and .NET Programming**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	2	0	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	0	2	0	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	0	2	0	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	0	0	0	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	0	2	0	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS7302 Biometrics**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
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<b>CO1</b>	3	2	1	0	0	0	0	0	0	2	3	3	2	1
<b>CO2</b>	3	2	1	2	1	0	0	0	0	1	3	1	3	0
<b>CO3</b>	3	2	1	1	1	0	0	0	0	2	0	2	1	0
<b>CO4</b>	3	2	1	0	0	0	0	0	0	1	1	1	2	1
<b>CO5</b>	3	2	1	0	0	0	0	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 16CS7303 E-Commerce**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	1	0	0	0	0	1	3	0	1	1
<b>CO2</b>	2	2	1	0	1	1	0	1	0	0	3	1	3	0
<b>CO3</b>	3	3	1	0	1	1	0	1	0	0	0	2	1	1
<b>CO4</b>	1	2	1	0	0	1	0	1	0	0	1	1	2	1
<b>CO5</b>	3	2	1	0	0	0	0	0	0	0	1	1	1	0
<b>Avg</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>

**Course Code & Name: 16CS7304 Wireless Sensor Networks**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS7305 Data Mining and Warehousing**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
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CO1	3	2	1	0	0	0	0	0	0	2	3	3	2	1
CO2	3	2	1	2	1	0	0	0	0	1	3	1	3	0
CO3	3	2	1	1	1	0	0	0	0	2	0	2	1	0
CO4	3	2	1	0	0	0	0	0	0	1	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	2	1	1	1	0
Avg	3	2	1	1	0	0	0	0	0	2	2	2	2	0

**Course Code & Name: 16CS7306 Digital Signal Processing**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	0	1	0	0	0	0	1	3	0	1	1
CO2	2	2	1	0	1	1	0	1	0	0	3	1	3	0
CO3	3	3	1	0	1	1	0	1	0	0	0	2	1	1
CO4	1	2	1	0	0	1	0	1	0	0	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	0	1	1	1	0
Avg	2	2	1	0	1	1	0	1	0	0	2	1	2	1

**Course Code & Name: 16CS7307 Text Mining**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	3	3	2	2	1	1	-	1	-	2	2	1	1

**Course Code & Name: 16CS7308 Soft Computing**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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<b>CO1</b>	3	2	0	0	0	0	1	0	0	2	3	3	2	1
<b>CO2</b>	3	2	0	0	1	0	1	0	0	1	3	1	3	0
<b>CO3</b>	3	2	0	0	1	0	1	0	0	2	0	2	1	0
<b>CO4</b>	3	2	0	0	0	0	1	0	0	1	1	1	2	1
<b>CO5</b>	3	2	0	0	0	0	1	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 16CS7309 Human Interface System Design**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	0	0	0	0	0	0	2	3	3	2	1
<b>CO2</b>	3	2	1	2	1	0	0	0	0	1	3	1	3	0
<b>CO3</b>	3	2	1	1	1	0	0	0	0	2	0	2	1	0
<b>CO4</b>	3	2	1	0	0	0	0	0	0	1	1	1	2	1
<b>CO5</b>	3	2	1	0	0	0	0	0	0	2	1	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>

**Course Code & Name: 16CS7310 Artificial Intelligence**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS7311 High speed Networks**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
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CO1	3	3	1	0	2	0	0	0	2	0	0	1	1	0
CO2	3	2	1	0	2	0	0	1	2	0	0	2	1	1
CO3	3	3	1	0	2	0	0	1	2	0	0	1	1	1
CO4	3	2	1	0	0	0	0	1	0	0	0	2	1	1
CO5	3	1	1	0	2	0	0	0	2	0	0	1	1	0
Avg	3	2	1	0	2	0	0	1	2	0	0	1	1	1

Course Code & Name: 16CS7312 Semantic Web

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	0	0	0	0	0	0	2	3	3	2	1
CO2	3	2	1	2	1	0	0	0	0	1	3	1	3	0
CO3	3	2	1	1	1	0	0	0	0	2	0	2	1	0
CO4	3	2	1	0	0	0	0	0	0	1	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	2	1	1	1	0
Avg	3	2	1	1	0	0	0	0	0	2	2	2	2	0

Course Code & Name: 16CS7403 Foundation skills in information technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	0	1	0	0	0	0	1	3	0	1	1
CO2	2	2	1	0	1	1	0	1	0	0	3	1	3	0
CO3	3	3	1	0	1	1	0	1	0	0	0	2	1	1
CO4	1	2	1	0	0	1	0	1	0	0	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	0	1	1	1	0
Avg	2	2	1	0	1	1	0	1	0	0	2	1	2	1

Semester – VIII

Course Code & Name: 16CS8301 Software Project Management

PO&	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO		
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PSO										10	11	12	PSO 1	PSO 2
CO1	3	3	0	0	1	0	0	0	0	1	3	0	1	1
CO2	2	2	0	0	1	1	0	1	0	0	3	1	3	0
CO3	3	3	0	0	1	1	0	1	0	0	0	2	1	1
CO4	1	2	0	0	0	1	0	1	0	0	1	1	2	1
CO5	3	2	0	0	0	0	0	0	0	0	1	1	1	0
Avg	2	2	0	0	1	1	0	1	0	0	2	1	2	1

Course Code & Name: 16CS8302 Web Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 16CS8303 Pervasive Computing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	0	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	0	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	0	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	0	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	0	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	0	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 16CS8304 Database Security and Privacy

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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<b>CO1</b>	3	3	1	0	1	0	0	0	0	1	3	0	1	1
<b>CO2</b>	2	2	1	0	1	1	0	1	0	0	3	1	3	0
<b>CO3</b>	3	3	1	0	1	1	0	1	0	0	0	2	1	1
<b>CO4</b>	1	2	1	0	0	1	0	1	0	0	1	1	2	1
<b>CO5</b>	3	2	1	0	0	0	0	0	0	0	1	1	1	0
<b>Avg</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>

**Course Code & Name: 16CS8305 R Programming**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS8306 Database Tuning**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS8307 Visual Programming**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
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<b>CO1</b>	3	3	1	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS8308      Software Testing**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**Course Code & Name: 16CS8309      High Performance Computing**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS8310      Management Information System**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
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<b>CO1</b>	3	3	0	3	2	0	0	0	3	0	3	0	1	2
<b>CO2</b>	3	1	0	2	2	3	0	1	2	0	3	2	1	2
<b>CO3</b>	3	3	0	2	2	3	0	1	2	0	2	2	1	2
<b>CO4</b>	3	1	0	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	0	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS8311    Engineering Economics**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	2	1	0	0	2	0	0	1	1	0
<b>CO2</b>	3	2	1	3	2	3	0	1	2	0	0	2	1	1
<b>CO3</b>	3	3	1	3	2	1	0	1	2	0	0	1	1	1
<b>CO4</b>	3	2	1	3	0	1	0	1	0	0	0	2	1	1
<b>CO5</b>	3	1	1	3	2	2	0	0	2	0	0	1	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Course Code & Name: 16CS8312    Big data Analytics**

<b>PO&amp; PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</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	3	3	2	0	0	0	3	0	3	0	1	0
<b>CO2</b>	3	1	2	2	2	3	0	1	2	0	3	2	1	0
<b>CO3</b>	3	3	2	2	2	3	0	1	2	0	2	2	1	0
<b>CO4</b>	3	1	2	2	0	3	0	1	0	0	2	2	1	0
<b>CO5</b>	3	1	2	1	2	0	0	0	0	0	2	3	1	0
<b>Avg</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**



**REGULATIONS 2019 (AY-20-21)**

**Mapping of Course Outcome and Programme Outcome:**

Year	Sem	Course code & Name	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		
I	I	19HE1101- Technical English	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4		
		19MA1101- Calculus	3	3	3	2.6	2.8	-	-	-	-	-	-	-	2	1.8	2	
		19PH1151 - Applied Physics	3	2.2	2	1.6	2	1.33 3333	-	-	-	-	-	-	1	2.4	2.4	
		19CY1151 -Chemistry for Engineers	3	2	2	2	2	1	1	-	-	-	-	-	1	1	1	
		19CS1151 - Python Programming and Practices	2	3	3	-	2	-	-	-	-	2	-	-	2	2	2	
		19CS1152 -Object oriented programming using python	1	1.4	1	1.2	1	1.4	1.2	1.2	1.2	1.8	3	1	2.2	2.4	2.4	
		19EC1154- Basics of Electron devices And Electric Circuits	3	2.8	2.8	2	2	1	1						1	2	2.8	2.2
		19HE1071 - Language Competency Enhancement Course-I																
		19MC1191 – Induction Program																
	II	19HE2101 - Business English for Engineers	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1		

		19MA2104 – Differential Equations And Linear Algebra	3	3	3	2.6	2	-	-	-	-	-	-	2	2	2.2
		19PH2151 - Material Science	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2
		19CY2151 - Environmental Studies	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-
		19CS2152 - Essentials of C and C++ Programming	3	2.4	1.2	1.6	3	0	0	1	1	0	2	2	2.2	3
		19CS2153 -Java Fundamentals	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1
		19ME2154 – Engineering Graphics	3	3	3	2	2	-	-	-	-	-	-	2.8	1.8	1.8
		19ME2001 - Engineering Practices	3		3		3				1				1	2
		19HE2071 - Language Competency Enhancement Course-II														
II	III	19MA3104 – Discrete Mathematics and Graph Theory	2.8	2.8	2.8	2.8	2.8	-	-	-	-	-	-	2.6	2.4	2.6
		19CS3201 - Data Structures	2.8	2.6	2.2	1.6	1.4	0	1	0.8	0.4	1.2	1.8	1.8	1.2	1.4
		19CS3202 - Database Management Systems	2	1.6	2.8	1	1.6	1.6	0.2	0	2	1.6	1.4	2	2.4	2
		19CS3203 – Computer Architecture	2	2	1	0	0	0	0	0	0	0	1	2	1	2
		19CS3251 – Digital Principles and System Design	3	3	2	2	2	2	0	1	0	1	1	2	0	1
		19CS3001 – Data Structures Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0

		19CS3002 – Database Management Systems Laboratory	3	2	0	0	1	0	0	0	0	0	1	2	1	0
		19MC3191-Indian Constitution														
	IV	19CS4201 – Java Programming	1	0.2	1.6	1.6	1.2				0.6	0.6			2	2
		19CS4202- Software Engineering	2.6	2.6	2.6	2.2	2	2	2.25	2	2.666667	2.666667	2.25	2.2	2.4	2.4
		19CS4203– Operating Systems	2.8	1	1.2	0.6	0	0	2.4	0	1.2	0	1.8	1.2	3	0.4
		19MA4151 - Probability, Statistics and Queuing Theory	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4
		19CS4251 – Design and Analysis of Algorithms	3.00	2.80	3.00	0.80	1.00	0.60	1.60	-	0.60	-	0.80	1.80	2.00	1.80
		19CS4001 – Java Programming Laboratory	3	3	1	3	3	0	0	0	2	1	2	2	2	3
		19CS4002- Operating Systems Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		19MC4191-Essence of Indian tradition knowledge														
III	V	19CS5201 – Theory of Computing	3	3	2.8	2.8	0.4	1	0	0	2	2	0.6	3	2	1.2
		19CS5202 – Computer Networks	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19CS5203 – Data Mining	3	2.8	3	2	3	0	0	3	1	0	2	2	2	3
		19EC5231 –Principles of Microprocessors and	3	2	2	2	2	2	0	1	1	0	2	2	1	0

		Micro Controllers														
		19CS5252 – Object Oriented Analysis and Design	2	1.6	2	2.3	3	3	3				2	2		
		19CS53XX -Professional Elective I														
		19CS5001 – Engineering Clinic														
		19EC5031 - Principles of Microprocessors and Microcontrollers Laboratory	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19HE5071-Soft Skills - I														
		19HE5072-Design Thinking														
	VI	19CS6181 – Principles of Management	1.4	0	1.2	1	1.4	1.2	0.8	1.4	2.4	1.8	1.6	1	0.2	0.2
		19CS6201 – Artificial Intelligence	3	3	2.4	2	2	2	2	1	1.4	2	1.4	2.6	3	2.2
		19CS6202 – Mobile Computing	1	0.6	1	0.2	0.4	0.8				0.2		0.6	1.2	
		19XX6401 - Open Elective– I														
		19CS63XX -Professional Elective– I														
		19CS6251 – Compiler Design	3.0	2.8	3.0	1.3	1.7	1.0	1.6	-	1.0	-	1.3	1.8	2.0	2.3
		19CS6001 – Mobile Application Development Laboratory	3	2.6	2.8	1.4	2.8				1.8	1.6	0.4		3	2.8

		19HE6071-Soft Skills - II														
		19HE6072-Intellectual Property Rights (IPR)														
		19CS6701-Internship/Industrial Training														

**PROFESSIONAL ELECTIVE COURSES**

Elective	Sem	Course code & Name	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	
I	V	19CS5351 – Internet and Web Technology	3	3	3	3	2	1.4	0.6	0	1	3	0	3	1.2	1.4	
		19CS5352 – Advanced Java Programming	3	1	2	0	2	0	0	0	0	0	0	1	2	1	1
		19CS5353 – Fundamentals of Open	3	2	2	0	2	0	0	0	0	0	0	1	2	1	1

		Source Software														
		19CS5354 – R Programming	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		19CS5355 – Computer Graphics and Multimedia	1.7	2.3	3	3	2	0	0	0	0	2	2	2	2.3	2.8
<b>II</b>	<b>VI</b>	19CS6301 – Business Intelligence – Data Warehousing And Analytics	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19CS6302 – Embedded Systems	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		19CS6303 - Internet Of Things	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		19CS6304 – Big Data Analytics and Tools	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		19CS6305 – Soft Computing	3	2	2	2	2	2	0	1	1	0	2	2	1	0

**OPEN ELECTIVE COURSES**

Elective	Sem	Course code & Name	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>I</b>	<b>VI</b>	19CS6401 – Introduction to Java Programming	3	2.8	3	1.2	3	0	0	0	1	0	1.2	2	2	3

**REGULATION - 2016**

**Mapping of Course Outcome and Programme Outcome:**

Year	Sem	Course code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
IV	VII	16CS7201	Cryptography and Network Security	3	3	1	3	2	2	0	1	2	0	0	1	1	1	
		16CS7202	Cloud Computing	3	1	2	2	2	2	0	1	1	0	2	2	1	0	
		16CS7203	Mobile Computing	3	2	1	3	2	2	0	1	2	0	0	1	1	1	
		16CS73XX	Professional Elective – III															
		16CS73XX	Professional Elective – IV															
		16XX74XX	Open Elective – II															
		16CS7001	Cryptography and Network Security Laboratory	3	2	1	1	0	0	0	0	0	0	2	2	2	2	0
		16CS7002	Cloud Computing Laboratory	3	2	0	1	0	0	0	0	0	0	2	2	2	2	0
<b>16CS73XX Professional Elective - III</b>																		
IV	VII	16CS7301	C# and .NET Programming	3	2	1	0	2	0	0	1	2	0	0	1	1	1	
		16CS7302	Biometrics	3	2	1	1	0	0	0	0	0	0	2	2	2	2	0
		16CS7303	E-Commerce	2	2	1	0	1	1	0	1	0	0	0	2	1	2	1

		16CS7304	Wireless Sensor Networks	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16CS7305	Data Mining and Warehousing	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16CS7306	Digital Signal Processing	2	2	1	0	1	1	0	1	0	0	2	1	2	1
<b>16CS83XX Professional Elective - IV</b>																	
IV	VII	16CS7307	Text Mining	3	3	3	2	2	1	1	-	1	-	2	2	1	1
		16CS7308	Soft Computing	3	2	0	0	0	0	1	0	0	2	2	2	2	0
		16CS7309	Human Interface System Design	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16CS7310	Artificial Intelligence	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16CS7311	High speed Networks	3	2	1	0	2	0	0	1	2	0	0	1	1	1
		16CS7312	Semantic Web	3	2	1	1	0	0	0	0	0	2	2	2	2	0
<b>16CSXX74XX Open Elective - II</b>																	
IV	VII	16CS7403	Foundation skills in information technology	2	2	1	0	1	1	0	1	0	0	2	1	2	1
IV	VII I	16CS83XX	Professional Elective V														
		16CS83XX	Professional Elective VI														
		16CS8901	Project Work	2	2	1	0	1	1	0	1	0	0	2	1	2	1
<b>16CS83XX Professional Elective - V</b>																	
IV	VII I	16CS8301	Software Project Management	2	2	0	0	1	1	0	1	0	0	2	1	2	1
		16CS8302	Web Technology	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16CS8303	Pervasive Computing	3	2	0	3	2	2	0	1	2	0	0	1	1	1
		16CS8304	Database Security and Privacy	2	2	1	0	1	1	0	1	0	0	2	1	2	1
		16CS8305	R Programming	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16CS8306	Database Tuning	3	2	2	2	2	2	0	1	1	0	2	2	1	0



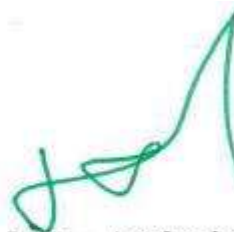
16CS83XX Professional Elective - VI																	
IV	VII I	16CS8307	Visual Programming	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16CS8308	Software Testing	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16CS8309	High Performance Computing	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16CS8310	Management Information System	3	2	0	2	2	2	0	1	1	0	2	2	1	1
		16CS8311	Engineering Economics	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16CS8312	Big data Analytics	3	2	2	2	2	2	0	1	1	0	2	2	1	0

1-Low, 2-Medium, 3-High, - No Correlation



Chairman, Board of Studies

**Chairman - BoS  
CSE - HiCET**



Dean – Academics

**Dean (Academics)  
HiCET**