



**Bharath**  
**INSTITUTE OF HIGHER EDUCATION AND RESEARCH**  
(Declared as Deemed-to-be University under section 3 of UGC Act, 1956)  
(Vide Notification No. F.9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4<sup>th</sup> July 2002)

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**REGULATIONS 2018**  
**&**  
**CURRICULUM & SYLLABUS**

**CHOICE BASED CREDIT SYSTEM**  
**(Applicable to the batches admitted from July 2018)**

**B. Tech – COMPUTER SCIENCE AND ENGINEERING**  
**(FULL TIME)**

**I-VIII SEMESTERS**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY**  
**CHENNAI -600 073, TAMIL NADU**

**CURRICULUM AND SYLLABUS(R2018)**  
**CHOICE BASED CREDIT SYSTEM**  
 (Applicable to the batches admitted from July 2018)  
**B.Tech – COMPUTER SCIENCE & ENGINEERING**  
**(FULL TIME)**

**I – VIII SEMESTERS**

<b>SEMESTER I</b>								
<b>Sl. No.</b>	<b>Course Code</b>	<b>Category</b>	<b>Course Title</b>	<b>Contact Period</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>								
1	U18HSEN101	HS	Communicative English	4	2	0	2	3
2	U18BSMA101	BS	Engineering Mathematic- I	4	4	0	0	4
3	U18BSPH101	BS	Waves and Optics	3	3	0	0	3
4	U18BSCH101	BS	Engineering Chemistry	3	3	0	0	3
5	U18ESEE101	ES	Basic Electrical and Electronics Engineering	3	0	0	3	3
6	U18BSBT101	BS	Biology for Engineers	2	2	0	0	2
<b>PRACTICAL</b>								
7	*U18BSPH2L2	BS	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	0
	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	0
8	U18ESME1L2	ES	Workshop/Manufacturing Practices Laboratory	5	1	0	4	3
9	U18ESEE1L3	ES	Basic Electrical and Electronics Engineering Practices Laboratory	3	0	0	3	1.5
<b>ACTIVITY BASED COURSES</b>								
10	U18MCAB101	MC	Physical health – Sports & Games	2	0	0	2	0
11	U18MCAB102	MC	Gardening & Tree Plantation -	2	0	0	2	0
Total				31	14	0	17	22.5

**\*Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry. The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER II								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18HSEN201	HS	Technical English	3	2	1	0	3
2	U18BSMA201	BS	Engineering Mathematics- II	4	4	0	0	4
3	U18BSPH202	BS	Semi Conductor Physics	3	3	0	0	3
4	U18BSCH201	BS	Environmental Sciences	3	3	0	0	3
5	U18ESCS101	ES	Problem Solving and Python Programming	3	3	0	0	3
6	U18ESME101	ES	Engineering Graphics & Design	5	1	0	4	3
<b>PRACTICAL</b>								
7	*U18BSPH2L2	BS	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	1.5
8	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	1.5
9	U18ESCS1L1	ES	Problem Solving and Python Programming Lab	3	0	0	3	1.5
<b>ACTIVITY BASED COURSES</b>								
10	U18MCAB203	MC	Yoga	2	0	0	2	0
11	U18MCAB204	MC	Physical health – NCC	2	0	0	2	0
Total				34	16	1	12	23.5

**\*Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry.**

**The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER III								
Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18BSMA303	BS	Probability and Statistics	4	3	1	0	4
2	U18PCCS301	PC	Data Structures & Algorithm	3	3	0	0	3
3	U18PCCS302	PC	Object Oriented Programming	3	3	0	0	3
4	U18PCCS303	PC	Computer Organization & Architecture	3	3	0	0	3
5	U18ESEC303	ES	Digital Electronics	3	3	0	0	3
<b>PRACTICAL</b>								
6	U18PCCS3L1	PC	Data Structures and Algorithm Laboratory	3	0	0	3	1.5
7	U18PCCS3L2	PC	Object Oriented Programming Lab	3	0	0	3	1.5
8	U18ESEC3L3	ES	Digital Electronics Laboratory	3	0	0	3	1.5
<b>ACTIVITY BASED COURSES</b>								
9	U18MCAB305	MC	Culture- Learning an art form	2	0	0	2	0
10	U18MCAB306	MC	Culture – Intangible Cultural, heritage(festivals, Food ways, Local games)	2	0	0	2	0
Total				29	15	1	13	20.5

SEMESTER IV								
SLN o.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18BSMA401	BS	Discrete Mathematics	4	3	1	0	4
2	U18PCCS401	PC	Cloud Computing	3	3	0	0	3
3	U18PCCS402	PC	Design and Analysis of Algorithm	3	3	0	0	3
4	U18PCCS403	PC	Data Base Management System	3	3	0	0	3
5	U18PCCS404	PC	Operating Systems	3	3	0	0	3
6	U18PCCS405	PC	Formal Language and Automata Theory	3	3	0	0	3
7	U18MCTH502	MC	Universal Human Values	2	2	0	0	0
<b>PRACTICAL</b>								
7	U18PCCS4L1	PC	Operating System Laboratory	3	0	0	3	1.5
8	U18PCCS4L2	PC	Design and Analysis of Algorithm Laboratory	3	0	0	3	1.5
9	U18PCCS4L3	PC	DBMS Lab	3	0	0	3	1.5
<b>ACTIVITY BASED COURSES</b>								
10	U18MCAB407	MC	Literature & Media –Literature, Cinema & Media	2	0	0	2	0
11	U18MCAB408	MC	Literature & Media – Group Reading of Classics	2	0	0	2	0
Total				32	18	1	13	23.5

SEMESTER V								
SL.N o.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18PCCS501	PC	Artificial Intelligence	3	3	0	0	3
2	U18PCCS502	PC	Software Engineering	3	3	0	0	3
3	U18PCCS503	PC	Functional Programming	3	3	0	0	3
4	U18PCCS504	PC	Computer Networks	3	3	0	0	3
5	U18HSBA501	HS	Organizational Behaviour	3	3	0	0	3
6	U18BSCH401	MC	Constitution of India	2	2	0	0	0
7		PE	Programme Elective-I	3	3	0	0	3
<b>PRACTICAL</b>								
8	U18PCCS5L1	PC	Software Engineering Laboratory	3	0	0	3	1.5
9	U18PCCS5L2	PC	Network Programming Laboratory	3	0	0	3	1.5
10	U18PCCS5L3	PC	Functional Programming Laboratory	3	0	0	3	1.5
11	U18EECS5S1	PR	Comprehension-I	0	0	0	0	1
<b>ACTIVITY BASED COURSES</b>								
11	U18MCAB509	MC	Social Services – Social Awareness	2	0	0	2	0
12	U18MCAB510	MC	Social Services – NSS	2	0	0	2	0
Total				33	20	0	13	23.5

<b>SEMESTER VI</b>								
<b>Sl.No.</b>	<b>Code No.</b>	<b>Category</b>	<b>Course Title</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>								
1	U18PCCS601	PC	Compiler Design	3	3	0	0	3
2	U18PCCS602	PC	Object Oriented Software Engineering	3	3	0	0	3
3		PE	Programme Elective-II	3	3	0	0	3
4		PE	Programme Elective-III	3	3	0	0	3
5		OE	Open Elective-I	3	3	0	0	3
<b>PRACTICAL</b>								
6	U18PCCS6L1	PC	Compiler Design Laboratory	3	0	0	3	1.5
7	U18PCCS6L2	PC	Object Oriented Software Engineering Laboratory	3	0	0	3	1.5
8	U18PRCS6P1	EE	Term Paper	3	0	0	3	1
9	U18EECS6S2	EE	Soft Skill	2	0	0	2	1
<b>ACTIVITY BASED COURSES</b>								
10	U18MCAB611	MC	Self Development – Spiritual, Mindfulness & Meditation	2	0	0	2	0
11	U18MCAB612	MC	Self Development - religion and Inter-faith	2	0	0	2	0
<b>Total</b>				<b>30</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>20</b>

SEMESTER VII								
Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1		PE	Programme Elective-IV	3	3	0	0	3
2		PE	Programme Elective-V	3	3	0	0	3
3		OE	Open Elective-II	3	3	0	0	3
4	U18PCCS701	PC	Big Data Analytics	3	3	0	0	3
5	U18MCTH603	MC	Essence of Indian Knowledge Tradition	2	2	0	0	0
<b>PRACTICAL</b>								
6	U18PRCS7P1	EE	Project-I	6	0	0	6	3
7	U18PCCS7L1	PC	Big Data Analytics Lab	3	0	0	3	1.5
<b>ACTIVITY BASED COURSES</b>								
8	U18MCAB713	MC	Behavioral and interpersonal skills	2	0	0	2	0
9	U18MCAB714	MC	Nature – Nature club	2	0	0	2	0
Total				25	12	0	13	16.5

SEMESTER VIII								
Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1		PE	Programme Elective-VI	3	3	0	0	3
2		OE	Open Elective-III	3	3	0	0	3
3		OE	Open Elective-IV (MOOC)	2	2	0	0	2
<b>PRACTICAL</b>								
4	U18PRCS8P1	EE	Project-II	12	0	0	12	9
<b>ACTIVITY BASED COURSE</b>								
5	U18MCAB815	MC	Innovation – Project based – Sc., Tech, Social, Design & Innovation	2	0	0	2	0
Total				20	8	0	12	17

**OVERALL CREDITS FOR THE PROGRAMME : 167**

PROGRAMME ELECTIVE –I (Semester V)								
Sl. No.	Code No.	Specialization	Course Title	Contact Periods	L	T	P	C
1	U18PECS011	Compiler Design	Theory of Computation	3	3	0	0	3
2	U18PECS012	Operating System	Advanced Operating System	3	3	0	0	3
3	U18PECS013	Artificial Intelligence	Speech and Natural Language Processing	3	3	0	0	3
4	U18PECS014	Soft Computing	Data Mining	3	3	0	0	3
5	U18PECS015	Computer Vision	Image Processing	3	3	0	0	3
6	U18PECS016	Cryptography	Information Security	3	3	0	0	3

PROGRAMME ELECTIVE –II (Semester VI)								
Sl. No.	Code No.	Specialization	Course Title	Contact Periods	L	T	P	C
1	U18PECS021	Compiler Design	Graph Theory	3	3	0	0	3
2	U18PECS022	Operating System	Internet of Things	3	3	0	0	3
3	U18PECS023	Artificial Intelligence	Machine Learning	3	3	0	0	3
4	U18PECS024	Soft Computing	Data Science	3	3	0	0	3
5	U18PECS025	Computer Vision	Virtual Reality	3	3	0	0	3
6	U18PECS026	Cryptography	Database Security	3	3	0	0	3

PROGRAMME ELECTIVE –III (Semester VI)								
Sl. No.	Code No.	Specialization	Course Title	Contact Periods	L	T	P	C
1	U18PECS031	Compiler Design	Advanced Algorithms	3	3	0	0	3
2	U18PECS032	Operating System	Embedded Systems	3	3	0	0	3
3	U18PECS033	Artificial Intelligence	Fuzzy Sets & Fuzzy Logic	3	3	0	0	3
4	U18PECS034	Soft Computing	Web Analytics	3	3	0	0	3
5	U18PECS035	Computer Vision	Event Driven Computing	3	3	0	0	3
6	U18PECS036	Cryptography	Cryptography and Network Security	3	3	0	0	3

PROGRAMME ELECTIVE –IV (Semester VII)								
Sl. No.	Code No.	Specialization	Course Title	Contact Periods	L	T	P	C
1	U18PECS041	Compiler Design	Parallel and Distributed Algorithms	3	3	0	0	3
2	U18PECS042	Operating System	Mobile Communication	3	3	0	0	3
3	U18PECS043	Artificial Intelligence	Neural Networks and Deep Learning	3	3	0	0	3
4	U18PECS044	Soft Computing	Data Visualization	3	3	0	0	3
5	U18PECS045	Computer Vision	Human Computer Interaction	3	3	0	0	3
6	U18PECS046	Cryptography	Software and Application Security	3	3	0	0	3

<b>PROGRAMME ELECTIVE –V (Semester VII)</b>								
<b>Sl. No.</b>	<b>Code No.</b>	<b>Specialization</b>	<b>Course Title</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	U18PECS051	Compiler Design	Quantum Computing	3	3	0	0	3
2	U18PECS052	Operating System	Real Time Systems	3	3	0	0	3
3	U18PECS053	Artificial Intelligence	Soft Computing	3	3	0	0	3
4	U18PECS054	Soft Computing	Business Intelligence	3	3	0	0	3
5	U18PECS055	Computer Vision	Computer Graphics	3	3	0	0	3
6	U18PECS056	Cryptography	Web Security	3	3	0	0	3

<b>PROGRAMME ELECTIVE –VI (Semester VIII)</b>								
<b>Sl. No.</b>	<b>Code No.</b>	<b>Specialization</b>	<b>Course Title</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	U18PECS061	Compiler Design	Information Theory and Coding	3	3	0	0	3
2	U18PECS062	Operating System	Distributed Systems	3	3	0	0	3
3	U18PECS063	Artificial Intelligence	Multi agent Intelligent Systems	3	3	0	0	3
4	U18PECS064	Soft Computing	Social Network Analysis	3	3	0	0	3
5	U18PECS065	Computer Vision	Web and Internet Technology	3	3	0	0	3
6	U18PECS066	Cryptography	Cyber Forensics	3	3	0	0	3

**OPEN ELECIVES FROM CSE**

<b>Sl.No.</b>	<b>Code No.</b>	<b>Course Title</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	U18OECS001	Mobile Application Development	3	3	0	0	3
2	U18OECS002	System Modelling and Simulation	3	3	0	0	3
3	U18OECS003	Web Programming	3	3	0	0	3
4	U18OECS004	Ethical Hacking	3	3	0	0	3
5	U18OECS005	E Commerce	3	3	0	0	3

**HUMANITIES AND SOCIAL STUDIES INCLUDING MANAGEMENT COURSES  
(HS)**

Sl. No.	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18HSEN101	Communicative English	4	2	0	2	3
2	U18HSEN201	Technical English	3	2	1	0	3
<b>Total Credits</b>							<b>6</b>

**ENGINEERING SCIENCE COURSES (ES)**

Sl. No.	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18ESEE101	Basic Electrical & Electronics Engineering	3	3	0	0	3
2	U18ESME101	Engineering Graphics & Design	5	1	0	4	3
3	U18ESCS101	Problem Solving and Python Programming	3	3	0	0	3
4	U18ESEC303	Digital Electronics	3	3	0	0	3
5	U18ESME1L2	Workshop/Manufacturing Practices Laboratory	5	1	0	4	3
6	U18ESEE1L3	Basic Electrical & Electronics Engineering Laboratory	3	0	0	3	1.5
7	U18ESCS1L1	Problem Solving and Python Programming Laboratory	3	0	0	3	1.5
8	U18ESEC3L1	Digital Electronics Laboratory	3	0	0	3	1.5
<b>Total credits</b>							<b>19.5</b>

**PROFESSIONAL CORE COURSES (PC)**

Sl.No.	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18PCCS301	Data Structures & Algorithm	3	3	0	0	3
2	U18PCCS302	Object Oriented Programming	3	3	0	0	3
3	U18PCCS303	Computer Organization & Architecture	3	3	0	0	3

4	U18PCCS401	Cloud Computing	3	3	0	0	3
5	U18PCCS402	Design and Analysis of Algorithm	3	3	0	0	3
6	U18PCCS403	Database Systems	3	3	0	0	3
7	U18PCCS404	Operating Systems	3	3	0	0	3
8	U18PCCS405	Formal Language and Automata Theory	3	3	0	0	3
9	U18PCCS501	Artificial Intelligence	3	3	0	0	3
10	U18PCCS502	Software Engineering	3	3	0	0	3
11	U18PCCS503	Functional Programming	3	3	0	0	3
12	U18PCCS504	Computer Networks	3	3	0	0	3
13	U18PCCS601	Compiler Design	3	3	0	0	3
14	U18PCCS602	Object Oriented Software Engineering	3	3	0	0	3
15	U18PCCS701	Big Data Analytics	3	3	0	0	3
16	U18PCCS3L1	Data Structures and Algorithm Laboratory	3	0	0	3	1.5
17	U18PCCS3L2	Object Oriented Programming Lab	3	0	0	3	1.5
18	U18PCCS4L1	Operating System Laboratory	3	0	0	3	1.5
19	U18PCCS4L2	Design and Analysis of Algorithm Laboratory	3	0	0	3	1.5
20	U18PCCS4L3	Database Systems Lab	3	0	0	3	1.5
21	U18PCCS5L1	Software Engineering Laboratory	3	0	0	3	1.5
22	U18PCCS5L2	Network Programming Laboratory	3	0	0	3	1.5
23	U18PCCS5L3	Functional Programming Laboratory	3	0	0	3	1.5

24	U18PCCS6L1	Compiler Design Laboratory	3	0	0	3	1.5
25	U18PCCS6L2	Object Oriented Software Engineering Laboratory	3	0	0	3	1.5
26	U18PCCS7L1	Big Data Analytics Lab	3	0	0	3	1.5
<b>Total Credits</b>							<b>61.5</b>

### MANDATORY COURSES (MC)

Sl.No.	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18BSCH401	Constitution of India	3	3	0	0	3
2	U18MCTH502	Universal Human Values	2	2	0	0	0
3	U18MCTH603	Essence of Indian Knowledge Tradition	2	2	0	0	0
1	U18MCAB101	Physical health – Sports & Games	2	0	0	2	0
2	U18MCAB102	Gardening & Tree Plantation -	2	0	0	2	0
3	U18MCAB203	Yoga	2	0	0	2	0
4	U18MCAB204	Physical health – NCC	2	0	0	2	0
5	U18MCAB305	Culture- Learning an art form	2	0	0	2	0
6	U18MCAB306	Culture – Intangible Cultural, heritage(festivals, Food ways, Local games)	2	0	0	2	0
7	U18MCAB407	Literature & Media – Literature, Cinema & Media	2	0	0	2	0
8	U18MCAB408	Literature & Media – Group Reading of Classics	2	0	0	2	0
9	U18MCAB509	Social Services – Social Awareness	2	0	0	2	0
10	U18MCAB510	Social Services – NSS	2	0	0	2	0
11	U18MCAB611	Self Development – Spiritual, Mindfulness & Meditation	2	0	0	2	0
12	U18MCAB612	Self Development - religion and Inter-faith	2	0	0	2	0
13	U18MCAB713	Behavioral and interpersonal skills	2	0	0	2	0
14	U18MCAB714	Nature – Nature club	2	0	0	2	0
15	U18MCAB815	Innovation – Project based – Sc., Tech, Social, Design & Innovation	2	0	0	2	0
<b>Total Contact hours</b>			<b>37</b>				

**SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT  
HOUR DISTRIBUTION**

S.No	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences including Management Courses (HS)	3	3			3				9	5.39%
2	Maths&Basic Sciences (BS)	12	13	4	4					33	19.76%
3	Engineering Sciences (ES)	7.5	7.5	4.5						19.5	11.68%
4	Professional Core (PC)			12	19.5	16.5	9	4.5		61.5	36.83%
5	Professional Electives (PE)					3	6	6	3	18	10.78%
6	Open Electives (OE)						3	3	3	9	5.39%
7	Massive Open Online Course(MOOC)								2	2	1.20%
8	Employment Enhancement Courses (EEC)					1	2	3	9	15	8.98%
9	Mandatory courses(MC)									0	
	<b>Total Credit</b>	<b>22.5</b>	<b>23.5</b>	<b>20.5</b>	<b>23.5</b>	<b>23.5</b>	<b>20</b>	<b>16.5</b>	<b>17</b>	<b>167</b>	
	<b>Total Contact Hour</b>	<b>31</b>	<b>34</b>	<b>29</b>	<b>32</b>	<b>33</b>	<b>30</b>	<b>25</b>	<b>20</b>		

<b>U18HSEN101</b>	<b>COMMUNICATIVE ENGLISH</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	2	0	2	3
	Prerequisite – School English				
	Course Designed by Department of English				
<b>OBJECTIVES</b>	To gain fundamental knowledge of language and the uses in daily life.				

**UNIT I SPEAKING 6**

Speaking- Pronunciation, Intonation, Stress and Rhythm -Common Everyday Situations: Conversations and Dialogues -Communication at Workplace -Interviews -Formal Presentations - introducing oneself – exchanging personal information- narrating events, - incidents , speaking about one’s friend/pet -Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development– prefixes- suffixes- articles, prepositions.

**UNIT II READING 6**

Reading – comprehension (multiple choice questions, short questions) - short narratives and descriptions from newspapers including dialogues and conversations also used as short reading texts-- and longer passages - understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences vocabulary and structures- Vocabulary Building - The concept of Word Formation

**UNIT III LISTENING 6**

Listening – listening to longer texts and filling in the table- product description- asking about routine actions and expressing opinions. –Listening to telephonic conversations -degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs- Identifying Common Errors in Writing - Subject-verb agreement - Noun-pronoun agreement

**UNIT IV WRITING 6**

Writing- letter writing, formal and personal letters- after listening to dialogues or conversations and completing exercises based on them. Understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences -Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs- Articles - Prepositions.

**UNIT V LANGUAGE DEVELOPMENT 6**

Writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing- listening to talks, conversations to complete the remaining, participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense.– paragraph writing- topic sentence- main ideas short narrative descriptions . Synonyms, antonyms, and standard abbreviations- Basic Writing Skills- Sentence Structures- Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence- Organizing principles of paragraphs in documents- Techniques for writing precisely

**SOFTSKILL LABORATORY**

**LIST OF EXPERIMENTS / EXERCISES**

1. Group discussion
2. Making effective presentations
3. Watching interviews & conversations
4. Reading different genres of texts

5. International English Language Testing System (IELTS)
6. Test of English as a Foreign Language (TOEFL)
7. Mock interviews
8. Time management & stress management
9. Role play
10. Listening to lectures, discussions from TV/ Radio.
11. Articulation of sounds - intonation.
12. Creative and critical thinking.

**TEXT BOOKS:**

1. English A Course book for Under Graduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

**REFERENCES:**

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013
4. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning, USA: 2007
5. Practical English Usage. Michael Swan. OUP. 2005.
6. Remedial English Grammar. F.T. Wood. Macmillan. 2007
7. On Writing Well. William Zinsser. Harper Resource Book. 2001

<b>COURSE OUTCOMES</b>												
CO1	The student will be able to comprehend the text with clarity											
CO2	The capacity to read and listen will improve											
CO3	Writing technical report will be learnt properly											
CO4	Speaking skills will be acquired											
CO5	Overall communication skills will make them employable											
CO6	To create formal letters, presentations and reports for conducting meeting, Interviews and competitive examinations.											
<b>MAPPING BETWEEN COURSE OUTCOMES &amp; PROGRAMME OUTCOMES</b>												
COs\Sos	a	b	c	d	E	f	g	h	i	j	k	l
1								M		H	M	M
2								M		M	M	H
3										H	M	
4								M		H	M	M
5								M		H	M	M
6								M		H	M	M
Category	Humanities and Social Studies (HS)											
Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18BSMA101</b>	<b>Engineering Mathematics – I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 60	3	1	0	4
	Prerequisite – School Level Mathematics				
	Course Designed by Department of Mathematics				
<b>OBJECTIVES</b>	The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate integration analysis and				

	linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
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### **UNIT I THEORY OF EQUATIONS**

**(9+3)**

Fundamental theory of algebra – number of roots of polynomial equations – conjugate pairs theorem ( without proof) – Descartes rules of signs- symmetric functions of the roots – formation of equations – diminish the roots of an equations- Multiple roots – reciprocal equation.

### **UNIT II DIFFERENTIAL CALCULUS – One Variable**

**(9+3)**

Representation of functions – limit of a function – continuity – Derivatives – Differentiation rule – Maxima and minima of functions of one variable – Rolle’s Theorem – Mean Value Theorem – Taylor’s and Maclaurin’s Theorem with remainders

### **UNIT III DIFFERENTIAL CALCULUS - Several Variables**

**(9+3)**

Partial derivatives –Euler’s theorem on Homogeneous functions - directional derivatives – total derivative – Jacobian–Maxima and minima of two variables.

### **UNIT IV INTEGRAL CALCULUS - One Variables**

**(9+3)**

Definite integrals – Substitution rule – Techniques of integration – Integration by parts – Trigonometric integrals – Trigonometric substitutions – Integrations of rational functions by partial fractions – Integrations of irrational functions-Beta, Gamma functions and their properties.

### **UNIT V MATRICES**

**(9+3)**

Characteristic Equations –Eigenvalue and Eigenvectors of the real matrix– Properties– Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of Quadratic form.

### **EXT BOOKS**

1. Grewal B. S, Higher Engineering Mathematics, Khanna Publisher, Delhi – 2014.
2. Kreyszig. E, Advanced Engineering Mathematics, 10<sup>th</sup> edition, John Wiley & Sons, Singapore, 2012.

### **REFERENCE BOOKS**

1. Veerarajan T, Engineering Mathematics, II edition, Tata McGraw Hill Publishers, 2008.
2. Kandasamy P &co., Engineering Mathematics, 9<sup>th</sup> edition, S. Chand & co Pub., 2010.
3. N.P.Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. George B. Thomas ,Jr ,Maurice D.Weir, Joel Hass., Thomas’ Calculus ,Twelfth EditionAddison-Wesley, Pearson.
5. Narayanan S., Manickavachagam Pillai T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I (2<sup>nd</sup> edition), S.Viswanathan Printers and Publishers, 1992.

## COURSE OUTCOMES (COs)

On completion of the course, the students will be able to												
CO1	To apply both the limit definition and rules of differentiation to differentiate functions. Also they will have a basic understanding of Rolle's Theorem that is											
CO2	To apply definite integrals of algebraic and trigonometric functions using formulas and substitution. Also they will have a basic understanding of Beta and Gama functions.											
CO3	To apply differential and integral calculus to notions of curvature. Also apply differentiation to find maxima and minima of functions.											
CO4	To apply multiple integrals to compute area and volume over curves, surface and domain in two dimensional and three dimensional spaces.											
CO5	Identify Eigen value problems from practical areas using transformations; Diagonalising the matrix would render the Eigen values.											
CO6	To choose and solve the problems in double and triple integrals.											
<b>CO/SO Mapping:: H-High, M-Medium, L-Low</b>												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H		H								
CO2	H	H		H								
CO3	H	H		H								
CO4	H	H		H								
CO5	H	H		H								
CO6	H	H		H								
<b>Category</b>	Basic Science (BS)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18BSPH101</b>	<b>WAVES AND OPTICS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Total Contact Hours - 45</b>				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	<b>Prerequisite – Higher Secondary School Physics</b>							
	<b>Course Designed by – Department of Physics</b>							
<b>OBJECTIVES:</b> To develop Physics and Engineering strategies of Waves and Optics and to discuss their functionalities in modern optoelectronics.								

### UNIT 1 NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES IN ONE DIMENSION 9

Introduction - Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, standing waves, longitudinal waves and the wave equation for them, acoustics waves and speed of sound. Waves with dispersion, superposition of waves, wave groups and group velocity.

### UNIT 2 ULTRASONIC WAVES 9

Production of ultrasonic by magnetostriction and piezoelectric methods - acoustic grating – Detection - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Industrial and Medical applications – Sonogram.

### UNIT 3 THE PROPAGATION OF LIGHT AND GEOMETRIC OPTICS 9

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations,

reflectance and transmittance, Brewster’s angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them.

#### UNIT 4 WAVE OPTICS

9

Huygens’ principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young’s double slit experiment, Newton’s rings, Michelson interferometer. Fraunhofer diffraction from a single slit and a circular aperture, Diffraction gratings and their resolving power.

#### UNIT 5 LASERS

9

Einstein’s theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO<sub>2</sub>), solid-state lasers(Neodymium), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers in science, engineering and medicine.

#### TEXT BOOKS

- 1) M.N. Avadhanulu and P.G. Kshirsagar, “A Textbook of Engineering Physics” S.Chand Publishers, 2016 (for Units 1,3,4 & 5)
- 2) G.Senthil Kumar, “Engineering Physics”, VRB publishers, Chennai, 2015 (for Unit 2)

#### REFERENCE BOOKS

- 1) BrijLal and Subramanian, “Waves and Oscillation”, VikasPublishsing House, 2011
- 2) R.Murugesan,“Optics and Spectroscopy”, S.Chand Publishers, 2015
- 3) BrijLal and Subramanian,“Optics”, S.Chand Publishers 2006
- 4) Ian G. Main, “Vibration and waves in physics”, Cambridge University Press, 1978
- 5) H.J. Pain, “The physics of vibrations and waves”, 6th edition, Wiley 2006
- 6) AjoyGhatak, “Optics”, Tata McGraw-Hill publishing company, New Delhi, 2009
- 7) O. Svelto, “Principles of Lasers”, Springer, 2010
- 8) Online reference Wikipedia.org

Course Outcomes (COs)													
CO1	Understand the basic concept of waves and lights.												
CO2	Understand the importance of Ultrasonic waves and Non-Destructive Testing.												
CO3	Understand the propagation of light and geometrical optics.												
CO4	Understand the optical phenomenon like interference, diffraction and superposition of waves.												
CO5	Understand the concept of laser and its applications.												
CO6	To evaluate the Laser advantages over other materials.												
Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) <b>H-High, M-Medium, L-Low</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M										
	CO2	H	M										
	CO3	H	M										
	CO4	H	M										
	CO5	H	M										
	CO6	H	M										
3	Category	Basic Sciences (BS)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18BSCH101</b>	<b>ENGINEERING CHEMISTRY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – School Level Chemistry				
	Course Designed by – Department of Chemistry				
<b>OBJECTIVES:</b> To gain fundamental knowledge of Engineering Chemistry and its applications					

## **UNIT I WATER TECHNOLOGY**

**9**

Introduction - Characteristics: Hardness of Water – Types - Temporary and Permanent Hardness - Estimation by EDTA method. Alkalinity – Types of Alkalinity - Phenolphthalein and Methyl Orange Alkalinity - Determination – Domestic Water Treatment – Disinfection methods (Chlorination, Ozonation, and UV Treatment). Boiler feed water – Requirements – Disadvantages of using hard water in boilers (Caustic embrittlement, Boiler corrosion, Priming and foaming) – Prevention of scale formation – softening of hard water - Internal treatment (Calgon treatment method) – External treatment – Demineralization process – Desalination and Reverse osmosis.

## **UNIT II PHASE RULE AND ALLOYS**

**9**

Introduction: Statement of Phase Rule and Explanation of terms involved – One component system – Water system – Construction of phase diagram by thermal analysis - Condensed phase rule - Two Component System : Simple eutectic systems (lead-silver system) – eutectic temperature – eutectic composition – Pattinson’s Process of desilverisation of Lead.

Alloys: Importance, ferrous alloys – nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing –hardening – tempering - normalizing – carburizing - nitriding. Non- ferrous alloys: Brass and Bronze.

## **UNIT III NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES**

**9**

Introduction: Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation – breeder reactor. Solar energy conversion – solar cells – wind energy. Fuel cells – hydrogen – oxygen fuel cell. Batteries: Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries: Lead–acid storage battery –working –uses. Nickel–cadmium battery -working –uses. Solid – state battery: Lithium battery.

## **UNIT IV FUELS**

**9**

Introduction: Calorific value – types of Calorific value - gross calorific value – net calorific value. Analysis of Coal – Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke –manufacture by Otto-Hoffmann method. Petroleum processing and fractions– cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number. Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG. Flue gas analysis – importance - Orsat apparatus.

## **UNIT V NANOCHEMISTRY**

**9**

Introduction: Nanochemistry: Definition - Classification based on dimensions - Size dependent properties. Types of nanomaterials: Nanoparticles: Synthesis by Bottom-up and top-down approaches - Nanoporous materials: Synthesis by sol-gel method. Nanowires: Synthesis by VLS mechanism. Carbon Nanotubes (CNTs): Single walled and Multi walled nanotubes - Mechanical and electrical properties of CNTs - Applications of CNTs - Synthesis of CNTs by Electric arc discharge method and Laser ablation method. Nanochemistry in biology and

medicines – nanocatalysis. Nanocomposites – sensors and electronic devices.

**TEXT BOOKS:**

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara “A text book of Engineering Chemistry” S.Chand&Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).
4. S. Vairam, P. Kalyani and Suba Ramesh, —Engineering Chemistry, Wiley India PVT, LTD, New Delhi, 2013.
5. G. B. Sergeev, Nano chemistry, Elsevier Science, New York, 2006.

**REFERENCES:**

1. B.K.Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

<b>COURSE OUTCOMES (COs)</b>												
CO1	To impart knowledge to the Students about the principles, water characterization, conversant with boiler feed water requirements and water treatment techniques.											
CO2	To make them understand the industrial importance of Phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys											
CO3	To make the students to be well versed with the principles of Conventional and non-conventional energy sources and energy storage devices.											
CO4	To make the students to have a deep knowledge of the Chemistry of Fuels and calorific value, manufacture of solid, liquid and gaseous fuels.											
CO5	To make them understand the Nano chemistry, Types of nano materials: Nano particles, Nano chemistry in biology and medicines.											
CO6	To design and develop the Conventional and non-conventional energy sources and energy storage device.											
<b>CO/SO Mapping: H – High, M – Medium, L-Low</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	H	M										
<b>CO2</b>	H	M										
<b>CO3</b>	H	M										
<b>CO4</b>	H	M										
<b>CO5</b>	H	M										
<b>CO6</b>	H	M										
<b>Category</b>	Basic Science (BS)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18ESEE101</b>	<b>BASIC ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite – School Level Physics				
	Course Designed by – Department of Electrical & Electronics Engineering				
<b>OBJECTIVES</b>	To gain fundamental knowledge of Electrical and Electronics Engineering and its applications				

**UNIT 1 DC CIRCUITS**

**12**

Electrical circuit elements, voltage and current sources, Fundamentals Relationship of VI for RLC circuit, Ohms Law, Source Transformation, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Basics of Superposition, Thevenin and Norton Theorems, Maximum Power Transformations Theorem.

**UNIT 2 AC CIRCUITS****9**

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

**UNIT 3 ELECTRICAL MACHINES & TRANSFORMERS****9**

Principles of operation and characteristics of; DC machines, Synchronous machines, three phase and single phase induction motors. Transformers (single and three phase) regulation and efficiency, all day efficiency and auto-transformer.

**UNIT 4 SEMICONDUCTOR DEVICES AND APPLICATIONS****9**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier and its applications, Introduction to OP-AMP.

**UNIT 5 DIGITAL ELECTRONICS****6**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – Fundamentals of A/D and D/A Conversion.

**TEXT BOOKS:**

1. John Bird, Electrical Circuit Theory & Technology, Taylor & Francis Ltd, 6<sup>th</sup>, edition. 2017.
2. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, Second Edition, PHI Learning, 2007.
3. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
4. E. Hughes, “Electrical and Electronics Technology”, Pearson, 10th Edition, 2011.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Pearson, 2nd Edition, 2015.
6. Millman and Halkias, “Integrated Electronics”, McGraw Higher Ed, 2nd Edition, 2011.
7. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 2nd Edition, 2015.
8. K.A.Krishnamurthy and M.R.Raghuveer, `Electrical and Electronics Engineering for Scientists', New Age International Pvt Ltd Publishers, 2011.

**REFERENCES:**

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, Third Reprint, 2016.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Higher Ed, 1st Edition, 2011.
3. Jacob Millman and Christos C-Halkias, “Electronic Devices and Circuits”, McGraw Higher Ed, 4th Edition, 2015.

<b>COURSE OUTCOMES (COs)</b>													
CO1	To gain knowledge regarding the various laws and principles associated with DC Circuits.												
CO2	To gain knowledge regarding fundamentals of AC circuits.												
CO3	To gain knowledge regarding electrical machines and transformers.												
CO4	To gain knowledge regarding various types of semiconductor devices and small signal amplifiers.												
CO5	To gain knowledge on principles of digital electronics systems.												
CO6	To design different kinds of circuits and Switches.												
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M-Medium, L-Low</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H						M			

	CO2	H	M	H						M			
	CO3	H	M	H						M			
	CO4	H	M	H						M			
	CO5	H	M	H						M			
	CO6	H	M	H						M			
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18BSBT101</b>	<b>BIOLOGY FOR ENGINEERS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30				2	0	0	2
	Prerequisite – Higher Secondary level biology, basic concepts in cell signaling							
	Course Designed by – Dept of Industrial Biotechnology							
<b>OBJECTIVES:</b> To provide a basic understanding of the biological systems and its applications in the industrial sector.								

### **UNIT I INTRODUCTION TO LIFE 6**

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell- Introduction to biomolecules - general classification and important functions of carbohydrates-lipids-proteins-nucleic acids – vitamins.

### **UNIT II BIODIVERSITY 6**

Plant System: basic concepts of plant growth-nutrition-photosynthesis-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions. Microbial System - types of microbes-economic importance and control of microbes.

### **UNIT III GENETICS AND IMMUNE SYSTEM 6**

Evolution: theories of evolution- evidence of laws of inheritance-variation and speciation-nucleic acids as a genetic material-central dogma - immunity-antigens-antibody-immune response.

### **UNIT IV HUMAN DISEASES 6**

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, AIDS and Hepatitis.

### **UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6**

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-bioremediation-biofertilizer-biocontrol- biosensors-biopolymers-bioenergy-biomaterials-biochips.

#### **TEXT BOOKS:**

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

#### **REFERENCE BOOKS**

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

<b>COURSE OUTCOMES (COs)</b>													
CO1	To understand the basic concepts of the cell and its structure.												
CO2	To understand about biodiversity and its conservation.												
CO3	To know the fundamentals of genetics and the immune system.												
CO4	To create an awareness about human diseases.												
CO5	To give a basic knowledge of the applications of transgenics.												
CO6	To know the applications of bio systems in environment, medical and agricultural sectors.												
Mapping of Course Outcomes with Programme Outcomes(POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M									
	CO2	H	M	M									
	CO3	H	M	M									
	CO4	H	M	M									
	CO5	H	M	M									
	CO6	H	M	M									
3	Category	Basic Sciences (BS)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18BSPH2L2</b>	<b>WAVE OPTICS AND SEMI CONDUCTOR PHYSICS LABORATORY (Common to B.Tech-EEE, ECE, EIE, BME, CSE &amp; IT)</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	<b>Total Contact Hours - 45</b>							<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>		
	<b>Prerequisite – Higher Secondary School Physics</b>												
	<b>Course designed by – Department of Physics</b>												
<b>OBJECTIVES:</b> To impart knowledge of practical Physics to the students.													
<b>Course Outcome (CO's)</b>													
CO1	Understand the fundamental concept of optics.												
CO2	Understand the concept of production of ultrasonic waves.												
CO3	Understand the functions of semiconductor.												
CO4	Understand the optical phenomenon like interference, diffraction and superposition of waves.												
CO5	Understand the concept of laser and its applications.												
CO6	To evaluate the Laser advantages over other materials.												
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M-Medium, L-Low</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M										
	CO2	H	M										
	CO3	H	M										
	CO4	H	M										
	CO5	H	M										
	CO6	H	M										
3	Category	Basic Sciences (BS)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

## Physics Lab experiments for Semester I & II

List of Experiments for Waves and Optics – Common for all branches

- 1) Ultrasonic Interferometer
- 2) Air-wedge Experiment
- 3) Particle size determination
- 4) Determination of acceptance angle
- 5) Determination of Laser Wavelength
- 6) Spectrometer – Determination of wavelength using grating

List of Experiments for Semiconductor Physics – Circuit branches

- 1) Determination of Band Gap
- 2) Zener diode characteristics
- 3) p-n junction diode Characteristics
- 3) Transistor Characteristics
- 5) V-I characteristics using LDR circuit
- 6) Carey Foster's Bridge

<b>U18BSCH2L4</b>	<b>CHEMISTRY LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – Engineering Chemistry				
	Course Designed by – Department of Chemistry				
<b>OBJECTIVES:</b> To enhance the practical knowledge on Chemistry through Volumetric and circuit experiments.					

### LIST OF EXPERIMENTS

1. Determination of Total Hardness, Temporary Hardness and Permanent hardness of Water by EDTA method
2. Estimation of Alkalinity - Titrimetry
3. Estimation of Dissolved Oxygen
4. Estimation of Chlorides in Water by Argentometric Method (MOHR'S Method)
5. Estimation of Copper by EDTA method
6. Estimation of Iron in Water by Spectrophotometry
7. Conductometric Titration of Strong Acid with Strong Base
8. Determination of Molecular weight of a polymer by Viscosity Average Method
9. pH measurements for Acid - alkali Titrations
10. Determination of rate of corrosion by weight loss method.
11. Conductometric Precipitation titration
12. Determination of Water Crystallization

### REFERENCES

1. R. Jeyalakshmi, "Practical Chemistry", Devi Publications 2014.
2. S.S. Dara, A text book on experiments and calculation Engg.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Students will able to analyze - hardness, Alkalinity, Dissolved oxygen, Chlorides in Water by Argentometric Method, Determination of Water of Crystallization an well as estimation of Copper by EDTA method using volumetric analysis.
CO2	Students will understand basic principle of spectrophotometric method
CO3	Students will learn Conductometric Titration of Strong Acid with Strong Base and Conductometric Precipitation titration.
CO4	Student will be able to analyze Determination of Molecular weight of a polymer by Viscosity Average Method

CO5	Student will understand about pH measurements for Acid - alkali Titrations and rate of corrosion by weight loss method											
CO6	To create molecular weight and degree of polymerization using Viscometer.											
<b>MAPPING OF COURSE OUTCOMES (COs) WITH PROGRAMME OUTCOMES(POs)</b> <b>H – High, M – Medium, L-Low</b>												
COs	PROGRAMME OUTCOMES(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M										
CO2	H	M										
CO3	H	M										
CO4	H	M										
CO5	H	M										
CO6	H	M										
Category			Basic Sciences (BS)									
Approval			47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018									

<b>U18ESME1L2</b>	<b>Workshop/Manufacturing Practices Lab (Theory &amp; Lab.)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 75	1	0	4	3
	Prerequisite – NIL				
	Course Designed by – Department of Mechanical Engineering				
<b>OBJECTIVES</b>	To educate the students on common manufacturing processes employed in Industries.				

## SYLLABUS

**Lectures & videos:** (15 hours)

### Detailed contents

- Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lecture)
- CNC machining, Additive manufacturing (2 lecture)
- Fitting operations & power tools (2 lecture)
- Carpentry (2 lecture)
- Plastic moulding, glass cutting (2 lecture)
- Metal casting (2 lecture)
- Welding (arc welding & gas welding), brazing (2 lecture)

### WORKSHOP PRACTICE:

1. Machine shop (6 hours)
  - a) Facing
  - b) Turning
  - c) Drilling Practice
2. Fitting shop (6 hours)
  - a) Fitting Exercises–Preparation of square fitting
  - b) Vee–fitting models.
3. Carpentry (9 hours)
  - a) Preparation Lap joints.
  - b) Mortise and Tenon joints.
  - c) Cross Half.
  - d) Dove Tail.

4. Welding shop (Arc welding 6 hrs + gas welding 3 hrs) (9 hours)  
Preparation of butt joints, lap joints and tee joints
5. Sheet Metal working (9 hours)
  - a) Forming & Bending:
  - b) Model making—Trays, funnels, etc.
  - c) Different type of joints
6. Demonstration (6 Hours)  
Smithy operations, upsetting, swaging, setting down and bending. Example—Exercise—  
Production of hexagonal headed bolt.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

**SUGGESTED TEXT/REFERENCE BOOKS:**

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers Private Limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4<sup>th</sup> edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4<sup>th</sup> edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

<b>COURSE OUTCOMES (COs)</b>												
CO1	Students will gain knowledge of the different manufacturing processes.											
CO2	Students will be able to fabricate components with their own hands.											
CO3	Students will gain practical knowledge of the dimensional accuracies and dimensional tolerances.											
CO4	Students will be able to produce small devices of their interest.											
CO5	To compare the Laws of Coloumb friction, refrigeration systems, Velocity and acceleration.											
CO6	To develop manufacturing methods encountered in engineering practice.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M-Medium, L-Low</b>												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k
2	CO1	3	2	2								
	CO2	3	2	2								
	CO3	3	2	2								
	CO4	3	2	2								
	CO5	3	2	2								
	CO6	3	2	2								
3	Category	Engg Sciences (ES)										
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018										

<b>U18ESEE1L3</b>	<b>BASIC ELECTRICAL AND ELECTRONIC ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – School Level Physics & Basic Electrical and Electronic Engineering				

**OBJECTIVES:** To enhance the practical knowledge on basics of electrical and electronics components and circuits.

### LIST OF EXPERIMENTS FOR BASIC ELECTRICAL ENGINEERING LAB

1. Verification of Ohms and Kirchoff's Voltage and Current Laws
2. Measurement of the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Fluorescent lamp wiring
4. Staircase wiring
5. Measurement of energy using single phase energy meter
6. Observation of the no-load current waveform on an oscilloscope and Measurement of Primary and secondary voltages and currents of a Transformer
7. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
8. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

### LIST OF EXPERIMENTS FOR BASIC ELECTRONICS ENGINEERING LAB

1. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
2. Characteristics – Half wave and Full wave Rectifiers
3. Characteristics – Common Base transistor configuration
4. Verification of truth tables of OR, AND, NOT, NAND, NOR gates and Flip-flops - JK and RS
5. Applications of Operational Amplifier

COURSE OUTCOMES (COs)													
CO1	To handle basic electrical equipment and verify current and voltage law.												
CO2	To understand the steady-state and transient time-response of R-L, R-C, and R-L-C circuits .												
CO3	To understand domestic wiring procedures practically.												
CO4	To analyze ac signal parameters using cathode ray oscilloscope and function generator.												
CO5	To understand all the fundamental concepts semiconductor Diode and Transistor.												
CO6	To understand all the fundamental concepts of logic Gates and Flip-Flops.												
Mapping of Course Outcomes (COs) with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H						M			
	CO2	H	M	H						M			
	CO3	H	M	H						M			
	CO4	H	M	H						M			
	CO5	H	M	H						M			
	CO6	H	M	H						M			
3	Category	Engg. Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18HSEN201</b>	<b>TECHNICAL ENGLISH</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	2	0	0	2
	Prerequisite – I Semester English				
	Course Designed by – Department of English				
<b>OBJECTIVES</b>	To gain fundamental knowledge of English language and its usage in day to day life.				

**UNIT I LISTENING 9**

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- extended definitions –listening to daily issue- -Vocabulary Development- technical vocabulary - Language Development –subject verb agreement – compound words.

**UNIT II READING 9**

Reading – reading longer technical texts- identifying the various transitions in a text- interpreting charts, graphs after reading the, practice in speed reading- vocabulary Development- vocabulary used in formal letters/emails and reports -Language Development personal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING 9**

Writing after listening to classroom lectures- talk should be on engineering /technology– introduction to technical presentations- longer texts both general and technical, Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words.

**UNIT IV FORMAL WRITING 9**

Writing- email etiquette- job application – cover letter –Resume preparation (via email and hard copy)- analytical essays and issue based essays–Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- clauses- dependant, independent, if conditionals.

**UNIT V LANGUAGE DEVELOPMENT 9**

Speaking –participating in a group discussion – role play, Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- transitive, intransitive verbs, Language Development- reported speech.

**TEXT BOOKS:**

1. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

**REFERENCES**

1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges Cengage Learning, USA: 2007

**COURSE OUTCOMES (COs)**

On completion of the course, the students will be able to	
CO1	The student will acquire basic proficiency in English
CO2	Reading and listening ability will improve.
CO3	Comprehension techniques will develop.

CO4	writing and speaking skills will be acquired
CO5	Overall communication skills will make them employable.
CO6	To develop a reasonably good level of competency in public speaking
<b>Mapping of Course Outcomes (COs) with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low	
<b>COs\POs</b>	a      b      c      d      e      f      g      h      i      j      k      l
1	
2	
3	
4	
5	
6	
<b>Category</b>	Humanities and Social Studies (HS)
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018

	<b>ENGINEERING MATHEMATICS -II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods - 60	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
	Prerequisite – School Level Mathematics				
	Course Designed by Department of Mathematics				
<b>OBJECTIVE</b>	The objective of this course is to equip the students of Engineering and Technology with techniques in ordinary equations, vector calculus, complex variables and Laplace transform with advanced level of mathematics and applications that would be essential to formulate problems in engineering environment.				

### **UNIT I      ORDINARY DIFFERENTIAL EQUATIONS      (9+3)**

Higher order linear differential equations with constant coefficients – linear differential equations with variable coefficients– Euler’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients- Method of variation of parameters.

### **UNIT II      VECTOR CALCULUS      (9+3)**

Scalar and vector point function - Gradient, Divergence and curl – Directional derivatives – Angle between two surfaces - Irrotational and Solenoidal vector fields – Line Integral - Green’s theorem – Gauss divergence theorem and Stokes’ theorem – Simple applications involving cubes and rectangular parallelepipeds.

### **UNIT III      ANALYTIC FUNCTIONS      (9+3)**

Functions of complex variable - Analytic functions – Necessary and sufficient conditions (without proof), Cauchy Riemann Equations in Cartesian and polar form – Harmonic functions – properties of analytic functions – Construction of analytic functions using Milne Thomson method – Conformal mapping : and Bilinear Transformation.

### **UNIT IV      COMPLEX INTEGRATION      (9+3)**

Cauchy integral theorem – Cauchy’s integral formula – problems – Taylor’s and Laurent’s Series – classification of Singularities – Poles and Residues – method of finding residues - Cauchy’s residue theorem and its applications to evaluate real integrals – contour integration.

### **UNIT V      LAPLACE TRANSFORMS      (9+3)**

Transforms of elementary functions – Basic properties – Shifting theorem- Transforms of derivatives and integrals – Initial and final value theorem – Laplace transform of Periodic Functions – Inverse Laplace transform – Convolution theorem – Periodic Functions – Applications of Laplace transform for solving linear ordinary differential equations up to second order with constant coefficient.

**TEXT BOOKS**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Willie & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35<sup>th</sup> Edition, 2000.

**REFERENCE BOOKS**

1. Venkataraman. M. K, Engineering Mathematics, National Publishing Company, 2000.
2. Bali .N.P and Manish Goyal, A Text book of Engineering Mathematics, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
3. Veerarajan T, Engineering Mathematics, II edition, Tata McGraw Hill Publishers, 2008.
4. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass., Thomas' Calculus, 12<sup>th</sup> Edition, Addison-Wesley, Pearson.

<b>COURSE OUTCOMES (COs)</b>												
CO1	The mathematical tools for solution of differential equation that model physical process.											
CO2	To evaluate the line, surface and volume integrals using Green's, Stoke's and Gauss Theorems and their verification.											
CO3	To understand the analytic functions, conformal mapping and complex integration and their applications.											
CO4	To evaluate real and complex integrals using the Cauchy's integral formula and Residue theorem.											
CO5	To apply the concept of Laplace Transformation in analysis and solve differential equations.											
CO6	To formulate mathematical models for solving real world problems.											
<b>CO/PO Mapping: S – Strong, M – Medium, W – Weak</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	H	H		H								
<b>CO2</b>	H	H		H								
<b>CO3</b>	H	H		H								
<b>CO4</b>	H	H		H								
<b>CO5</b>	H	H		H								
<b>CO6</b>	H	H		H								
<b>Cate</b>	Basic Science (BS)											
<b>App</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18BSPH202</b>	<b>SEMICONDUCTOR PHYSICS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Total Contact Hours - 45</b>				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	<b>Prerequisite – Higher Secondary School Physics</b>							
	<b>Course designed by – Department of Physics</b>							
<b>OBJECTIVES</b>								
<ul style="list-style-type: none"> <li>To develop physics and engineering strategies of semiconductor materials and to discuss their functionalities in modern electronic and optoelectronic devices</li> </ul>								

**UNIT1 INTRODUCTION AND ELECTRONIC STATES OF SEMICONDUCTORS 9**

Introduction to solid state materials - crystal structure - Reciprocal lattice - Brillouin zone and rules for band (k - space) representation. Dynamics of electrons in periodic potential:Kronig - penny and nearly free electron models - Real methods for band structure calculations; Band gaps in semiconductors - Holes and effective mass concept - Properties of conduction and valance bands.

**UNIT2 CARRIERS AND DOPING****9**

Fermi distribution and energy - Density of states - Valance and conduction band density of states - intrinsic carrier concentration – intrinsic Fermi level. Extrinsic semiconductors: n and p type doping - Densities of carriers in extrinsic semiconductors and their temperature dependence - extrinsic semiconductor Fermi energy level - Degenerate and non - degenerate semiconductors - Band gap engineering

**UNIT 3 ELECTRICAL TRANSPORT****9**

Scattering Mechanism: electron - electron and electron – phonon scattering. Macroscopic transport: Carrier transport by Diffusion - Carrier transport by Drift: Low field, High field and very high field.

**UNIT 4 OPTICAL TRANSPORT****9**

Electron - hole pair generation and recombination: band to band (direct and indirect band gap transitions) and intra band (impurity related) transitions, free - carrier & phonon transitions. Excitons: Origin, electronic levels and properties. Carrier transport - continuity equations. Optical constants: Kramers - Kronig relations.

**UNIT 5 SEMICONDUCTOR AS DEVICES AND RECENT ADVANCES****9**

Processing of Semiconductor devices (Brief), p - n Semiconductor as device and Semiconductor junctions - Homo and hetero Junctions. Active and passive optoelectronic devices: performance and response enhancement (photo processes).

**TEXT BOOK:**

- 1) M.N. Avadhanulu and P.G. Kshirsagar, "A Textbook of Engineering Physics" S.Chand Publishers, 2014(for units 1 and 2)
- 2) G.Senthil Kumar, "Engineering Physics", VRB publishers, Chennai, 2015 (for Unit 5)

**REFERENCES BOOKS:**

- 1) Kevin F Brennan, "The Physics of Semiconductors", Cambridge Univ.Press 1999.
- 2) Peter Y Yu and Manuel Cardona, "Fundamentals of Semiconductors", Spriger, 1996.
- 3) Charles Kittel, "Introduction to Solid State Physics", 6th edition, Willey, 1991.
- 4) D.A. Neamen, "Semiconductor Physics and Devices", 3 rdEd., Tata McGraw-Hill, 2002.
- 5) Jasprit Singh, "Semiconductor Optoelectronics (Physics and Technology)", McGraw-Hill, 1995.
- 6) Online reference: Wikipedia, NPTEL.

<b>Course Outcome (COs)</b>													
CO1	Understand the difference between metals, semiconductors and insulators												
CO2	Understand the importance of doping to charge carrier density												
CO3	Understand the electrical transport in semiconductors												
CO4	Understand the difference between direct and indirect semiconductors												
CO5	Understand the concept of semiconductor optoelectronic devices.												
CO6	To design novel engineering materials and its characteristics.												
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M									
	CO2	H	M	M									
	CO3	H	M	M									
	CO4	H	M	M									
	CO5	H	M	M									
	CO6	H	M	M									
3	Category	Basic Sciences (BS)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

	<b>ENVIRONMENTAL SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>U18BSCH201</b>	Total Contact Periods – 45	3	1	0	0
	Prerequisite – NIL				
	Course Designed by – Department of Chemistry				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>• To study the interrelationship between living organism and environment.</li> <li>• To study of the nature and concepts of ecosystem.</li> <li>• To learn about the integrated themes and biodiversity of an environment.</li> <li>• To study of pollution control and waste management.</li> <li>• To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.</li> </ul>				

### **UNIT I -NATURAL RESOURCES**

**9**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people –Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems - Food resources: World food problems, changes caused by agriculture and overgrazing, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Equitable use of resources for sustainable lifestyles.

### **UNIT II -ECOSYSTEMS**

**9**

Introduction: concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)- Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and Possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

### **UNIT III -BIODIVERSITY AND ITS CONSERVATION**

**9**

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega diversity nation, Hot-spots of biodiversity - Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

### **UNIT IV-ENVIRONMENTAL SOLLUTION**

**9**

Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - pollution case studies - Disaster Management: floods earthquake, cyclone and landslides.

### **UNIT V- SOCIAL ISSUES AND HUMAN POPULATION**

**9**

Social issues: Environmental Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wildlife protection Act, Forest Conservation Act, Public awareness – Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel – oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature

of ingredients – chemical effects on health due to inhaling fumes.

Human population: population growth, variation among nations, Population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

**TEXT BOOKS:**

1. Gilbert M. Masters, Introduction to Environmental Engineering and Science’, 2nd edition, Pearson Education 2004.
2. Benny Joseph, Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi, 2006.
3. R.K. Trivedi, Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards’, Vol. I and II, Enviro Media.
4. Rajagopalan, R, Environmental Studies-From Crisis to Cure’, Oxford University Press 2005.
5. K.V.B. Raju and R.T. Ravichandran, “Basics of Civil Engineering”.

**REFERENCES:**

1. Cunningham, W.P. Cooper, T.H. Gorhani, Environmental Encyclopedia’, Jaico Publ., House, Mumbai, 2001.
2. Dharmendra S. Sengar, Environmental law’, Prentice hall of India PVT LTD, New Delhi, 2007.

<b>COURSE OUTCOMES</b>												
CO1	Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving											
CO2	Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.											
CO3	Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems											
CO4	Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales											
CO5	Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes											
CO6	Understand Human population: population growth, variation among nations.											
<b>CO/SO Mapping: H-High, M-Medium ,L-Low</b>												
<b>COs</b>	<b>PROGRAMME OUTCOMES(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	H	M	M									
<b>CO2</b>	H	M	M									
<b>CO3</b>	H	M	M									
<b>CO4</b>	H	M	M									
<b>CO5</b>	H	M	M									
<b>CO6</b>	H	M	M									

<b>U18ESCS101</b>	<b>PROBLEM SOLVING AND PYTHON PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite – NIL				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	To gain fundamental knowledge of algorithmic problem solving and python programming				

## **UNIT 1 ALGORITHMIC PROBLEM SOLVING**

9

Introduction to components of a computer system - disks, memory, processor, operating system, compilers – Problems, Solutions, Idea of Algorithm –Representation of Algorithm. 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). Problem Illustrations

## **UNIT 2 DATA, EXPRESSIONS, STATEMENTS**

9

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; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two Points.

## **UNIT 3 CONTROL FLOW, FUNCTIONS**

9

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. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

## **UNIT 4 LISTS, TUPLES, DICTIONARIES**

9

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; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

## **UNIT 5 FILES, PACKAGES**

9

Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, packages: NumPy, SciPy, Matplotlib, Scikit-learn, Scilab Interface.

### **TEXT BOOKS:**

1. Allen B. Downey, 'Think Python: How to Think Like a Computer Scientist', 2<sup>nd</sup> edition, Updated for Python3, Shroff/O'Reilly Publishers, 2016.  
(<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

### **REFERENCES**

1. John V Guttag, —Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

COURSE OUTCOMES (COs)													
CO1	Develop algorithmic solutions to simple computational problems												
CO2	Demonstrate programs using simple Python statements and expressions.												
CO3	To gain knowledge regarding control flow and functions associated with python												
CO4	Use Python data structures – lists, tuples & dictionaries for representing compound data												
CO5	To gain knowledge on files, exception, modules and packages in Python for solving problems												
CO6	To Understand Matplotlib, Scipy and Numpy.												
Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) <b>H-High, M-Medium, L-Low</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M		M				M			
	CO2	M		M	H	M				M			
	CO3	M		M	H	M				M			
	CO4	M		M		M				M			
	CO5	M		M		M				M			
	CO6	M		M	H	M				M			
3	Category	Engg .Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18ESME101</b>	<b>ENGINEERING GRAPHICS &amp; DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 75	1	0	4	3
	Prerequisite – +12 Level Maths and Physical Science				
	Course Designed by – Department of Mechanical Engineering				
<b>OBJECTIVES</b>	To Prepare students to design a system, component, or process to meet desired needs, using the techniques, skills, and modern engineering tools necessary for engineering practice.				

## SYLLABUS

### Detailed contents

#### *Traditional Engineering Graphics:*

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

#### *Computer Graphics:*

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

*(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)*

### MODULE 1: INTRODUCTION TO ENGINEERING DRAWING

(9+2)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales; Draw simple annotation, dimensioning and scale. Construction of Conic sections; Cycloid, Epicycloid, Hypo cycloid and Involute of circle;

**MODULE 2: ORTHOGRAPHIC PROJECTIONS****(10+2)**

Principles of Orthographic Projections; Conventions; Projections of points and Orthographic projection of lines in first quadrant - Parallel to both the planes – Perpendicular to oneplane – Parallel to one plane and inclined to other plane – Inclined to both the planes; Projections of planes inclined to either HP or VP;

**MODULE 3: PROJECTIONS OF REGULAR SOLIDS& ISOMETRIC PROJECTIONS****(10+3)**

Projection of solids in first quadrant – Prism, Pyramid, Cone and Cylinder inclined to one plane; Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions - Isometric Views of Simple Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa;

**MODULE4:SECTIONSOF SOLIDS AND DEVELOPMENT OF SURFACE****(10+3)**

Sectional view of Prism, Cylinder, Pyramid, Cone (simple position in first quadrant) with cutting planes perpendicular to one plane and parallel or inclined to another plane– True shape of sections; Development of lateral surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone;

**MODULE 5: BUILDING DRAWING****(9+2)**

Introduction to building drawing; Types of Projection adopted in Building Drawing; Scales for various types of Drawings, Symbols, Conventions and Abbreviations. Drawing of residential single and two storied buildings with detail of Line plan, Foundation Plan, Ground floor Plan, First floor plan, Elevation and Sections.

**MODULE 6: OVERVIEW OF COMPUTER GRAPHICS****(12+3)**

Introduction to CAD; Basic commands; Coordinate systems; Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Setup a drawing with proper scale –Dimensioning commands, Editing Dimensions and Dimension text; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles; Create basic drawing of objects such as polygon and general multi-line figures; Creating orthographic views of simple solids like prism, pyramid, cylinder, cone. Drawing sectional views of prism, pyramid, cylinder and cone; Preparation of fabrication drawing (Development of surfaces); Drawing front view, top view and side view of objects from the given pictorial view; Creation of 3-D models of simple objects.

**TEXT BOOKS:**

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiyah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

**COURSE OUTCOMES (COs)**

CO1	Students will gain Exposure to engineering communication.
CO2	Students will learn standards of engineering graphics.
CO3	Students will get Exposure to basics of building construction
CO4	Students will get Exposure to computer-aided geometric design
CO5	Student will gain basic knowledge and Exposure to the visual aspects of Engineering Design.

CO6	To apply Computer Graphics and techniques like Drawing sectional views of prism, pyramid, cylinder and cone.												
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M-Medium, L-Low</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M									
	CO2	M		M									
	CO3	M		M									
	CO4	M		M									
	CO5	M		M									
	CO6	M		M									
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18ESCS1L1</b>	<b>PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – NIL				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES:</b> To enhance the practical knowledge on writing programs using Python					

#### LIST OF EXPERIMENTS FOR PROBLEM SOLVING AND PYTHON PROGRAMMING LAB

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (Power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Find the most frequent words in a text read from a file
11. Simulate elliptical orbits in Pygame
12. Simulate bouncing ball using Pygame
13. Simulate matrix operations with Scilab
14. Simulate fitting curve with NumPy and Matplotlib

#### PLATFORM NEEDED

Python 3 interpreter for Windows/Linux and Scilab

<b>COURSE OUTCOMES (COs)</b>	
CO1	Write, test, and debug simple Python programs.
CO2	Implement Python programs with conditionals and loops
CO3	Develop Python programs step-wise by defining functions and calling them
CO4	Use Python lists, tuples, dictionaries for representing compound data
CO5	Read and write data from/to files in Python and to simulate using the packages Scilab, NumPy and Matplotlib
CO6	To Understand about Simulate bouncing ball using Pygame.
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M-Medium, L-Low</b>	

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	M		M		M				M			
	CO2	M		M	H	M				M			
	CO3	M		M	H	M				M			
	CO4	M		M		M				M			
	CO5	M		M		M				M			
	CO6	M		M	H	M				M			
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18BSMA303</b>	<b>PROBABILITY AND STATISTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods - 60	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
	Prerequisite – Basic knowledge in probability and statistics				
	Course Designed by : Department of Mathematics				
<b>OBJECTIVE</b>	This course aims at providing the required skill to apply the statistical tools in engineering problems.				

### **UNIT I PROBABILITY AND RANDOM VARIABLES (9+3)**

Probability concepts, Random Variables, discrete and continuous functions of random variables. Moment generating function of Binomial, Poisson, Geometric, Uniform, Exponential and Normal distribution (Problems)

### **UNIT II TWO DIMENSIONAL RANDOM VARIABLES (9+3)**

Joint distributions - Marginal and Conditional distributions – Expectation and conditional expectations. Transformation of Random Variable, Central limit theorem (for independent and identically distributed random variables)

### **UNIT III BASIC STATISTICS (9+3)**

Measures of central tendency – Measures of dispersion – Moments, Skewness & Kurtosis – Correlation, and Regression and Rank Correlation.

### **UNIT IV TESTING OF HYPOTHESIS (9+3)**

Introduction – Large sample tests based on normal distribution - Test for single mean, difference between means, proportion, difference between proportions, standard deviation, difference between standard deviation. Chi-square test for goodness of fit, independence of attributes.

### **UNIT V ANALYSIS OF VARIANCE (9+3)**

Small sample tests based on T and F distribution - Test for, single mean, difference between means, Paired t-test, test for equality of variances, ANOVA– one –way classification, Two-way classification.

### **TEXT BOOKS**

- (1) S.C.Gupta&V.K.Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, New Delhi,2003. [Units I to III].
- (2) S.C. Gupta and V.K. Kapoor, “Applied Statistics”. Sultan Chand and Sons, New Delhi 2004 [UnitsIV& V].

(3) Douglas C. Montgomery. “Design and Analysis of Experiments, Student Solutions Manual”, 8thEdn: Wiley India Pvt Ltd., New Delhi-2. 2012.

### REFERENCE BOOKS

1. Veerarajan T. “Probability Statistics and Random Processes” Tata McGraw Hill, New Delhi 2003.
2. W.W. Daniel, “Biostatistics-A foundation for Analysis of Health Sciences”, John Wiley and Sons, New Delhi 2000.
3. Douglas C. Montgomery and George C. Runger. “Applied Statistics and Probability for Engineers”, 6thEdn. Wiley India Pvt Ltd., New Delhi-2. 2010.
4. Tirupathi R.Chandraputta. “Quality and Reliability in Engineering”. Book Vistas, New Delhi.

COURSE OUTCOMES (COs)												
CO1	To Understand the importance and the application of Probability in Engineering.											
CO2	To make students understand Discrete and Continuous Random variables, Random Processes and their Applications.											
CO3	To Understand Various tools for testing the parameters based on samples											
CO4	The techniques of sampling, and estimating and testing the parameters.											
CO5	To Design of Experiments are to be analysed.											
CO6	To Evaluate Small sample tests based on T and F distribution.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H		H								
CO2	H	H		H								
CO3	H	H		H								
CO4	H	H		H								
CO5	H	H		H								
<b>Category</b>	Basic Science (BS)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18PCCS301</b>	<b>DATA STRUCTURES&amp; ALGORITHM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisites –Problem Solving & Python Programming				
	Course Designed by – Dept. of Computer Science & Engineering				
<b>OBJECTIVES</b>					
This course demonstrates familiarity with major algorithms and data structures and analyzes performance of algorithms. It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.					

### UNIT- I INTRODUCTION

9

Data objects and structures – Performance analysis- Space complexity – Time complexity-



Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	M									
CO2	H	M	M									
CO3	H	M	M									
CO4	H	M	M									
CO5	H	M	M									
CO6	H	M	M									
Category	Professional Core (PC)											
Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18PCCS302</b>	<b>OBJECT ORIENTED PROGRAMMING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45				3	0	0	3
	Prerequisites –Problem Solving and Python Programming							
	Course Designed by – Dept. of Computer Science & Engineering							
<b>OBJECTIVES</b>								
<ul style="list-style-type: none"> <li>The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, and an appropriate framework for automated unit and integration tests.</li> <li>To develop programming skill and to solve engineering related problems using Object Oriented Programming Concepts.</li> </ul>								

### **UNIT 1 INTRODUCTION TO OOP CONCEPTS 9**

Procedure Oriented Programming - Object-Oriented Paradigm – Benefits - Applications - Features of OOP – C++ Fundamentals - Data Types – Operators and Expressions – Control Structures – Arrays and Strings – Modular Programming with Functions – Storage Classes – Structures and Unions – Pointers and Runtime Binding.

### **UNIT 2 PROGRAMMING IN C++ 9**

Classes and Objects – Constructors and Destructors – Operator Overloading – Inheritance – Virtual Functions and Polymorphism – Data Abstraction – Encapsulation - Templates – Exception Handling - C++ Stream Classes – I/O Operations – File Classes and Operations

### **UNIT 3 C++ ADVANCED FEATURES 9**

Dynamic Memory –Memory Management-New and Delete Operator-Pointer to Objects-Debugging Pointer- C++ Web Programming – Object Modeling and Object Oriented Software Development.

### **UNIT 4 INTRODUCTION TO JAVA 9**

Overview of Java – Features - JDK, JRE, JVM – Data Types – Variables – Arrays – String – Wrapper Classes – Operators – Control Statements – Java Objects and Classes – Inheritance and Aggregation – Polymorphism: Method Overloading, Method Overriding – Constructors: Default, Parameterized, Static and This Keyword – Garbage Collector – Java Regex.

### **UNIT 5 PROGRAMMING IN JAVA 9**

Packages – Abstract Classes – Interfaces and Inner classes – Exception Handling – Memory Management – Multithreading – File Handling – Streams and I/O – Applets – Design Patterns – Iterator Pattern – Model View Controller Pattern – Generic Programming – Java Collections – Java GUI: Abstract Window Toolkit, Swing, Scala.

## TEXT BOOKS

1. Paul Deital, Harvey Deital, “C++ How to Program”, 10th Edition, Pearson, 2016.
2. K R Venugopal, “Mastering C++”, 25th Reprint , Tata McGraw Hill, 2006.
3. Herbert Schildt, “ Java The Complete Reference”, 11th Edition, Tata McGraw Hill Education, 2017.

## REFERENCES

1. Balagurusamy. E, “Object Oriented Programming with C++”, 5<sup>th</sup> Edition, McGraw Hill, 2008.
2. <http://www.cplusplus.com/articles/cpp11>
3. <https://www.tutorialspoint.com/cplusplus/index.htm>
4. Ali Bahrami, "Object Oriented System Development", Tata McGraw-Hill Education, 2008.
5. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001.

COURSE OUTCOMES (COs)												
CO1	Specify simple abstract data types and design implementations, using abstraction functions to document them											
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity											
CO3	Name and apply some common object-oriented design patterns and give examples of their use											
CO4	Design applications with an event-driven graphical user interface											
CO5	Understand basic knowledge about Java Programming											
CO6	Learn various packages in Java.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	M									
CO2	H	H	M									
CO3	H	H	M									
CO4	H	H	M									
CO5	H	H	M									
CO6	H	H	M									
<b>Category</b>	Professional Core (PC)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

U18PCCS303	<b>COMPUTER ORGANIZATION AND ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Fundamentals				
	Course Designed by – Dept. of Computer Science & Engineering				



COURSE OUTCOMES (COs)												
CO1	Explain the organization and working principle of computer hardware components.											
CO2	Explain the hierarchical memory system and data transfer within a digital computer.											
CO3	Outline the operation of arithmetic unit.											
CO4	Summarize the execution sequence of an instruction through the processor											
CO5	Explain the ways of communication between a processor and I/O devices.											
CO6	Explain the concept of Parallel Architecture.											
Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H									
CO2	H	H	H									
CO3	H	H	H									
CO4	H	H	H									
CO5	H	H	H									
CO6	H	H	H									
<b>Category</b>	Professional Core (PC)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18ESEC303</b>	<b>DIGITAL ELECTRONICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Basic Computer and Electronics Knowledge				
	Course Designed by – Dept. of Computer Science & Engineering				
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To get a basic understanding of how circuits and systems are designed with digital electronic circuit elements.</li> <li>To be able to analyze and design circuits and systems made from digital electronic circuit elements such as gates and flip-flops.</li> <li>To master basic design and programming of simple computers.</li> </ul>					

**UNIT-I NUMBER SYSTEMS AND CODES 9**

Review of binary, octal and Hexa decimal representations of numbers and their conversion, Binary arithmetic; conversion algorithms. Weighted binary codes. Non weighted binary codes error-detecting and error-correcting codes-Alphanumeric codes.

**UNIT-II BOOLEAN ALGEBRA 9**

Introduction to Boolean algebra- The AND, OR and not operations. Laws of Boolean algebra of Boolean expressions. Boolean expressions and logic diagrams. Universal building blocks. Negative logic.

**UNIT-III COMBINATIONAL LOGIC9**

Truth tables and maps. Sum of products and product of sums; Map reduction hybrid functions. Incompletely specified functions. Multiple- Output minimization. Variable- Entered maps. Tabular minimization. analysis of logic schematics. Synthesis of combinational functions.

**UNIT-III LOGIC FUNCTION RELIZATION WITH MSI CIRCUITS 9**

Multiplexers, De-multiplexers, Decoders and code converters. Arithmetic circuits, Adder, Number complements. Subtracting positive binary numbers with adders. Signed number addition and subtraction.

**UNIT-IV SYNCHORONOUS SEQUENTIAL CIRCUITS 9**

Basic latch circuits, De-bouncing switch. Flip-flops, truth table and excitation table. Shift registers. Asynchronous and synchronous counters. Shift counters.

**UNIT-V ASYNCHRONOUS SEQUENTIAL CIRCUITS 9**

Analysis and Design of Asynchronous Sequential Circuits , Reduction of State and Flow Tables ,Race-free State Assignment, Hazards.

**TEXT BOOKS:**

1. T. L Floyd & Jain, “Digital fundamentals”, Pearson Education,3<sup>rd</sup> edition,2011.
2. Morris Mano M., “Digital Logic and Computer Design”, Pearson Education,2010.

**REFERENCE BOOKS:**

1. Heiser Man, “Digital IC applications”, Pearson Education,2007.
2. Raj Kamal, “Digital Systems Principles and Design”, Pearson Education, First Edition, 2007.
- 3.CharlesH.Roth, Jr. and Larry L. Kinney, “Fundamentals of Logic Design”, CL Engineering, 7<sup>th</sup> Edition, 2013.
- 4.WilliamH.Gothmann, “Digital electronics: an introduction to theory and practice”,Prentice-Hall,2006 .
- 5.[http://www.b-u.ac.in/sde\\_book/digi\\_com.pdf](http://www.b-u.ac.in/sde_book/digi_com.pdf)

COURSE OUTCOMES (COs)												
CO1	Perform arithmetic operations in any number system.											
CO2	Understand the hierarchical memory system and data transfer with in a digital computer.											
CO3	Use Boolean simplification techniques to design a combinational hardware circuit.											
CO4	Understand the concept of number system.											
CO5	Learn the various gates like AND, OR, NOT, XOR.											
CO6	Learn the concept of synchronous and asynchronous sequential circuits.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	M	H	M								
CO2	M	M	H	M								
CO3	M	M	H	M								
CO4	M	M	H	M								
CO5	M	M	H	M								
CO6	M	M	H	M								
<b>Category</b>	Professional Core (PC)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18PCCS3L1</b>	<b>DATA STRUCTURES &amp; ALGORITHM LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	0	0	3	1.5
	Prerequisite – Data Structures & Algorithm				
	Lab Manual Prepared by – Dept. of Computer Science & Engineering				
<b>OBJECTIVES</b>					
This course demonstrates familiarity with major algorithms and data structures and analyzes performance of algorithms. It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.					

### **LIST OF EXPERIMENTS:**

1. Control Structures (Biggest Among three Numbers, Sum of Digits, Fibonacci Series, Arithmetic Calculator)
2. Functions( Factorial of a Number, sorting)
3. Aggregate Data Type(Manipulation of Unions, Manipulation of Structures)
4. File Handling(Creating File, Reading file and Merging File)
5. Implementation of Linked List(Singly Linked List)
6. Implementation of Linked List(Doubly Linked List)
7. Implementation of Stack(Using Array, Linked List)
8. Implementation of Queue(Using Array, Linked List)
9. Implementation of Trees
10. Implementation of Searching Algorithms(Binary Search, Linear Search)
11. Implementation of Sorting Algorithms( Quick sort)
12. Implementation of sorting algorithms( Insertion sort, Selection sort)
13. Control Structures (Biggest Among Three Numbers, Sum of Digits, Fibonacci Series, Arithmetic Calculator)
14. Functions ( Factorial of a Number, sorting)
15. Aggregate Data Type (Manipulation of Unions, Manipulation of Structures)
16. File Handling (Creating File, Reading file and Merging File)
17. Implementation of Linked List(Singly Linked List)
18. Implementation of Linked List(Doubly Linked List)
19. Implementation of Stack(Using Array, Linked List)

20.Implementation of Queue(Using Array, Linked List)

21.Implementation of Trees

22. Implementation of Searching algorithms(Binary Search, Linear Search)

23. Implementation of Sorting algorithms (Quick sort)

24. Implementation of Sorting algorithms (Insertion sort, Selection sort)

<b>COURSE OUTCOMES (COs)</b>												
CO1	Implement various basic data structures and its operations.											
CO2	Implement various sorting and searching algorithms.											
CO3	Implement various tree operations.											
CO4	Implement various graphs algorithms.											
CO5	Develop simple applications using various data structures.											
CO6	Develop algorithms using various searching and sorting techniques.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	M									
CO2	H	M	M									
CO3	H	M	M									
CO4	H	M	M									
CO5	H	M	M									
CO6	H	M	M									
<b>Category</b>	Professional Core (PC)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18PCCS3L2</b>	<b>OBJECT ORIENTED PROGRAMMING LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	0	0	3	1.5
	Prerequisites –Object Oriented Programming				
	Course Designed by – Dept. of Computer Science & Engineering				
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, and an appropriate framework for automated unit and integration tests.</li> <li>To develop programming skill and to solve engineering related problems using Object Oriented Programming Concepts.</li> </ul>					

## **LIST OF EXPERIMENTS**

### **PROGRAMMING IN C++**

1. Program using Functions
  - Functions with Default arguments, Friend Function, Inline Function
  - Implementation of Call by Value, Address, Reference
2. Simple classes for understanding objects, member functions, constructors, destructor, copy constructor.
  - Classes with Primitive Data Members
  - Classes with Arrays as Data Members
  - Classes with Pointers as Data Members
  - Classes with Constant Data Members
  - Classes with Static Member Functions
3. Compile Time Polymorphism
  - Operator Overloading
  - Function Overloading
4. Run Time Polymorphism
  - Various Forms of Inheritance
  - Virtual Functions
  - Virtual Base Classes
  - Templates
5. File Handling
  - Sequential Access
  - Random Access
  - Dynamic Memory Allocation

### **PROGRAMMING IN JAVA**

#### Programs Illustrating

1. Various Data Types
2. Manipulating Strings
3. Various forms of Inheritance
4. Polymorphism: Method Overloading, Method Overriding
5. Exception Handling
6. Interfaces
7. Packages
8. Multithreading
9. Draw Various Shapes And Mouse Events Using Java Applets.
10. Window Based Application using Java Swing

<b>COURSE OUTCOMES (COs)</b>	
CO1	Specify simple abstract data types and design implementations, using abstraction functions to document them
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity
CO3	Name and apply some common object-oriented design patterns and give examples of their use

CO4	Design applications with an event-driven graphical user interface											
CO5	To Understand basic knowledge about Java Programming											
CO6	To Learn various packages in Java.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	M									
CO2	H	H	M									
CO3	H	H	M									
CO4	H	H	M									
CO5	H	H	M									
CO6	H	H	M									
<b>Category</b>	Professional Core (PC)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18ESEC3L3</b>	<b>DIGITAL ELECTRONICS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	0	0	3	1.5
	Prerequisite – Basic Electrical and Electronics Engineering Lab				
	Lab Manual Designed by – Department of Electronics & Communication Engineering				
<b>OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To get a basic understanding of how circuits and systems are designed with digital electronic circuit elements.</li> <li>• To be able to analyze and design circuits and systems made from digital electronic circuit elements such as gates and flip-flops.</li> </ul> <p style="margin-left: 40px;">To master basic design and programming of simple computers.</p>					

#### LIST OF EXPERIMENTS:

1. Study of logic gates.
2. Design and implementation of adders and Subtractors using logic gates.
3. Design and implementation of encoder and decoder using logic gates.
4. Design and implementation of multiplexer and Demultiplexer using logic gates .
5. Design and implementation of 2-bit magnitude comparator using logic gates,
6. Design and implementation of 16-bit odd/even parity checker.
7. Design and implementation of Flip-flops using logic gates.
8. Design and implementation of code converters using logic gates.
9. Design and implementation of counters.
10. Design and Implementation of shift registers.

<b>COURSE OUTCOMES (COs)</b>	
CO1	To Learn the basics of gates.
CO2	Construct basic combinational circuits and verify their functionalities.
CO3	To Apply the design procedures to design basic sequential circuits.

CO4	Learn about counters.											
CO5	Learn about Shift registers.											
CO6	To understand the basic digital circuits and to verify their operation.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	M	H	M								
CO2	M	M	H	M								
CO3	M	M	H	M								
CO4	M	M	H	M								
CO5	M	M	H	M								
CO6	M	M	H	M								
<b>Category</b>	Engineering Science (ES)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

<b>U18BSMA401</b>	<b>DISCRETE MATHEMATICS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods - 60				<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
	Prerequisite – School Level Mathematics							
	Course Designed by Department of Mathematics							
<b>OBJECTIVES</b>	Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do use mathematically correct terminology and notation, construct correct direct and indirect proofs, apply logical reasoning to solve a variety of problems and introduce simple concepts in graph theory.							

### UNIT I MATHEMATICAL LOGIC

(9+3)

Propositions and logic operators – Truth table – Equivalence – Implications – Tautologies – Laws of logic – Proofs in Propositional calculus – Inference theory – Predicate calculus.

### UNIT II RELATION AND FUNCTIONS

(9+3)

Different types of relations: Binary Relation – Partial Ordering Relation – Equivalence Relation – Sum and Product of Functions – bijective functions – Inverse and Composite Function.

### UNIT III RECURRENCE RELATIONS

(9+3)

Recurrence relations – solving recurrence relation – Homogeneous and non-homogeneous recurrence relation – Generating Functions – Groups – Properties – cyclic groups and subgroups cosets – Lagrange's theorem.

### UNIT IV GRAPH THEORY

(9+3)

Introduction of Graphs – Graph terminology – Representation of Graphs – Connectivity – Euler and Hamilton path – Euler and Hamilton cycles – the Travelling sales man problem – Graph Isomorphism.

### UNIT V BOOLEAN ALGEBRA

(9+3)

Boolean algebra – Partial order Relations on Boolean algebra – Boolean homomorphism – Disjunctive and conjunctive normal forms – Boolean functions.

**TEXT BOOKS**

1. Tremblay J.P and Manohar. R, “Discrete Mathematical Structures with Application to Computer Science”, McGraw Hill Book Company, International Edition, 1987
2. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, McGraw Hill Book Company 1999.

**REFERENCE BOOKS**

1. Ralph P., Grimaldi, “Discrete and Combinatorial Mathematics”, Pearson Education, Fifth Edition, New Delhi. 2008
2. Venkataraman M.K, Discrete Mathematics”, The National Publishing Company 2000.
3. T. Veerarajan, “Discrete Mathematics”, Mc Graw Hill Publications, 2006.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Understand Proposition and Logic operators, Inference theory and Predicate Calculus
CO2	Use logical notation to define and reason about fundamental Mathematical Concepts such as sets relations, and functions.
CO3	Use logical notations to define and reason about steps in propositional and Predicate logic.
CO4	Expose to the concept of recurrence relations, generating functions, group, and cyclic groups, subgroups.
CO5	Understand the terminologies of graph and develop the given problems as graph networks and solve with techniques of graph theory.
CO6	To understand given graphs are isomorphic and Lattices.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H		H								
CO2	H	H		H								
CO3	H	H		H								
CO4	H	H		H								
CO5	H	H		H								
CO6	H	H		H								
<b>Category</b>	Basic Science (BS)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PCCS401	<b>CLOUD COMPUTING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Computer Organization & Architecture							
	Course Designed by : Dept. of Computer Science and Engineering							
<b>OBJECTIVES</b>								
<ul style="list-style-type: none"> <li>• Identify the technical foundations of cloud systems architectures.</li> <li>• Analyze the problems and solutions to cloud application problems.</li> </ul>								

- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance.

## **UNIT I UNDERSTANDING CLOUD COMPUTING 9**

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services-Web-Based Application.

## **UNIT-II CLOUD ARCHITECTURE AND MODEL 9**

Technologies for Network Based system-System Models for Distributed and Cloud Computing-NIST Cloud Computing Reference Architecture Cloud models: Characteristics-Cloud Models (IaaS, PaaS, SaaS)-Public vs. Private Cloud-Cloud Solutions-Cloud ecosystem-Service Management-Computing on demand.

## **UNIT-III CLOUD INFRASTRUCTURE 9**

Architectural Design of compute and Storage Clouds-Layered Cloud Architecture Development-Design Challenges-Inter Cloud Resource Management-Resource Provisioning and Platform Deployment-Global Exchange of Cloud Resources.

## **UNIT-IV PROGRAMMING MODEL 9**

Parallel and Distributed Programming Paradigms-Map Reduce-Twister and Iterative Map Reduce-Hadoop Library from Apache-Mapping Applications-Programming Support-Google App Engine, Amazon AWS-Cloud Software Environments-Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim.

## **UNIT-V CLOUD SECURITY 9**

Security Overview-Cloud Security Challenges and Risks-Software-as-a-Service-Security Security Governance-Risk Management-Security Monitoring-Security Architecture Design-Data Security-Application Security-Virtual Machine Security-Identity Management and Access Control-Autonomic Security.

### **TEXTBOOK:**

- 1.Kai Hwang, Geoffrey C Fox,Jack G Dongarra “Distributed and Cloud Computing ,From parallel processing to the Internet of Things” Morgan Kaufmann Publishers,2012.

### **REFERENCE BOOKS:**

1. John W.Rittinghouse and James F.Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press, 2010
2. Toby Velte, Anthony Velte, Robert Elsenpeter,”Cloud Computing, A Practical Approach”, TMH, 2009.
3. Kumar Saurabh,”Cloud Computing –Insights into New-Era Infrastructure “, Wiley India, 2011
4. George Reese, “Cloud Applications Architectures: Building Applications and Infrastructure in the Cloud” O’Reilly.
5. <https://eniac2017.files.wordpress.com/2017/03/distributed-and-cloud-computing.pdf>.

<b>COURSE OUTCOMES (COs)</b>	
CO1	To Understand the fundamental principles of distributed computing.
CO2	To Understand how the distributed computing environments known as Grids can be built from lower level services.
CO3	To Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO4	To Analyze the performance of Cloud Computing.
CO5	Learn various Cloud Programming models.
CO6	To Understand the concept of Cloud Security.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Professional Core (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS402</b>	<b>DESIGN AND ANALYSIS OF ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Data Structures & Algorithm				
	Course Designed by – Dept. of Computer Science & Engineering				
<b>OBJECTIVES</b>					
The Course should enable the students to					
<ul style="list-style-type: none"> <li>Analyze various computing problems and design algorithms.</li> <li>Analyze the time and space complexity of algorithms and compute efficiency.</li> <li>Knowledge about different algorithm design techniques for a given problem.</li> <li>Demonstrate a familiarity with major algorithms and data structures.</li> <li>Improve efficiency of existing algorithms using advanced techniques.</li> </ul>					

## **UNIT I FOUNDATIONS**

**9**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Types of problems, Basics of Data Structures, Analysis of non-recursive algorithms, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

## **UNIT II GREEDY METHOD AND DYNAMIC PROGRAMMING**

**9**

Brute Force Approach – Greedy Algorithms: An Activity Selection Problem – Elements of Greedy Strategy – Huffman Codes – Theoretical Foundations of Greedy Method – A task

scheduling problem - Knapsack Problem – Dynamic Programming: Assembly line Scheduling – Matrix Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence – Optimal Binary Search Tree – Knapsack problem – Travelling Salesman Problem.

**UNIT III GRAPH AND TREE ALGORITHMS 9**

Graph and Tree Algorithms: Traversal algorithms – Representation of graphs – Breadth First Search – Depth First Search – Transitive Closure – Topological Sort – Strongly Connected Components – Minimum Spanning Trees – Algorithms – Single Source Shortest Path Algorithms – All Pair Shortest Path Algorithms – Network Flow Algorithms.

**UNIT IV BACKTRACKING AND BRANCH & BOUND TECHNIQUES 9**

Backtracking : n Queens Problem – sum of subsets – graph coloring – Hamiltonian cycle – knapsack problem, Branch and Bound Technique: Knapsack Problem – Travelling Salesman Problem – Heuristics – Characteristics and their applications domains.

**UNIT V ADVANCED TOPICS 9**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook’s theorem, Standard NP-complete problems and Reduction techniques. Approximation algorithms; Randomized algorithms; Class of problems beyond NP – P SPACE.

**TEXT BOOKS**

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

**REFERENCE BOOKS**

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3rd Edition, UdiManber, Addison-Wesley, Reading, MA.
4. <https://mitpress.mit.edu/books/introduction-algorithms>.
5. <https://comsciers.files.wordpress.com/..//horowitz-and-sahani-fundamentals-of-computer>.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
CO2	Analyze the algorithm and solve it by recurrence relations.
CO3	Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
CO4	Describe when an algorithmic design situation calls for it. Derive and solve recurrence relation.
CO5	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
CO6	Apply graph and write the corresponding algorithm to solve the problems.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	M									
CO2	H	M	M									
CO3	H	M	M									
CO4	H	M	M									
CO5	H	M	M									
CO6	H	M	M									
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS403</b>	<b>DATABASE SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Data Structures and Algorithm				
	Course Designed by – Dept. of Computer Science & Engineering				
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>○ To understand the different issues involved in the design and implementation of a database system.</li> <li>○ To study the physical and logical database designs, database modeling, relational, hierarchical, and network models</li> <li>○ To understand and use data manipulation language to query, update, and manage a database</li> <li>○ To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.</li> </ul>					

### **UNIT -I INTRODUCTION**

**9**

Introduction - Database System Applications-Purpose of Database Systems- View of Data-Data Abstraction- Instances and Schemas- Relational Databases - Database Design- Data model- Integrity constraints -The Entity - Relationship Model - Transaction Management - Database Architecture - Data Storage and Querying - Database Users and Administrators.

### **UNIT-II RELATIONAL DATABASES**

**9**

Introduction to Relational model - Structure of Relational Databases - Relational database design - keys - Database Schema and Schema Diagrams - Relational Query Languages - Relational algebra and Relational Operations - Relational calculus -Introduction to SQL - Overview of the SQL Query Language - Basic Structure of SQL Queries - Functional dependency -Normal Forms.

### **UNIT-III DATA STORAGE AND QUERYING**

**9**

Storage and File Structure - File Organization - Indexing and Hashing- Ordered Indices- Static Hashing- Dynamic Hashing- Query Processing- Overview- Measures of Query Cost-Selection-Sorting- Join Operation- Evaluation of Expressions- Query Optimization- Overview- Transformation of Relational Expressions- Estimating Statistics of Expression Results.

### **UNIT-IV TRANSACTIONS**

**9**

Transaction Concept-A Simple Transaction Model-Storage Structure-Transaction Atomicity and Durability-Transaction Isolation- Transaction Isolation Levels- Serializability- Transactions as SQL Statements-Concurrency Control- Lock-Based Protocols- Time Stamp-Based Protocols-Validation Based Protocols- Database recovery - Deadlock Handling.

Database Security-Authentication, Authorization and access control - DAC, MAC and RBAC models –SQL Injection-Object based databases- Object oriented and object relational databases- Persistent Programming Languages-Object-Relational Mapping-Object-Oriented versus Object-Relational Databases – Logical and web databases-Overview of Data warehousing - Data mining techniques.

**TEXT BOOKS:**

1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. “Fundamentals of Database Systems”, 5th Edition by R. Elmasri and S. Navathe, Pearson Education
3. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.

**REFERENCE BOOKS:**

- 1.C. J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Pearson Education, 8thEdition,2006.
2. ArunK.Pujari.,“Data Mining Techniques”, Universities Press,2013.

<b>COURSE OUTCOMES (COs)</b>												
CO1	For a given query write relational algebra expressions for that query and optimize the developed expressions											
CO2	For a given specification of the requirement design the databases using E R method and normalization.											
CO3	For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.											
CO4	For a given query optimize its execution using Query optimization algorithms, For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.											
CO5	Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.											
CO6	Understand about Database security and Object Oriented Databases.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	M	M				M			
CO2	H	H	H	M	M				M			
CO3	H	H	H	M	M				M			
CO4	H	H	H	M	M				M			
CO5	H	H	H	M	M				M			
CO6	H	H	H	M	M				M			
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS404</b>	<b>OPERATING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Organization & Architecture				
	Course Designed by – Dept. of Computer Science & Engineering				
<b>OBJECTIVES</b>					
Every computer professional should have a basic understanding of how an operating system controls the computing resources and provide services to the users. This course provides an introduction to the operating system functions, design and implementation.					

### UNIT – I INTRODUCTION

9

**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

### UNIT – II PROCESSES

9

**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

**Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

**Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

### UNIT – III IPC AND DEADLOCK

9

**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.

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

### UNIT – IV MEMORY MANAGEMENT

9

**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation – Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction, Paging – Principle of operation – Page allocation – Hardware support for paging, Protection and Sharing, Disadvantages of Paging.

**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

### UNIT – V FILE MANAGEMENT

9

**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

**TEXT BOOKS:**

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

**REFERENCES BOOKS:**

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

<b>COURSE OUTCOMES (COs)</b>												
CO1	Illustrate the operating system concepts and its functionalities.											
CO2	To Create processes and threads.											
CO3	To Develop algorithms for process scheduling.											
CO4	To Design and implement file management system.											
CO5	Illustrate various file and disk management strategies.											
CO6	To Understand the concept about Virtual memory.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS405</b>	<b>FORMAL LANGUAGES &amp; AUTOMATA THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Programming for problem solving				
	Course Designed by : Dept. of Mathematics				

**OBJECTIVES**

- To understand various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine.
- To be aware of Decidability and Un-decidability of various problems. Learn types of grammars.

**UNIT I FUNDAMENTALS 9**

Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non-deterministic finite automaton, transition diagrams and Language recognizers.

**UNIT II FINITE AUTOMATA 9**

NFA with  $\epsilon$ -transitions - Significance, acceptance of languages. Conversions and Equivalence : Equivalence between NFA with and without  $\epsilon$  transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output-Moore and Melay machines.

**UNIT III REGULAR LANGUAGES AND GRAMMAR 9**

Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, closure properties of regular sets. Regular grammars-right linear and leftlinear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings.

**UNIT IV CONTEXT FREE GRAMMARS AND PUSH DOWN AUTOMATA 9**

Ambiguity in context free grammars. Minimization of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL. Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA,

**UNIT V TURING MACHINE 9**

Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines. Universal Turing Machine, un-decidability of posts. Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

**TEXTBOOKS:**

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H.E. and Ullman J. D. Pearson Education
2. Introduction to Theory of Computation –Sipser 2nd edition Thomson

**REFERENCES:**

1. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
2. Introduction to languages and the Theory of Computation ,John C Martin, TMH
3. "Elements of Theory of Computation", Lewis H.P. & Papadimition C.H. Pearson /PHI.
- 4 Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekar, 2nd edition, PHI.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Identify the type of random variable and distribution for a given operational conditions.
CO2	Study and design appropriate queuing model for a given problem or system situation.
CO3	To understand and simulate appropriate application and distribution problems.
CO4	Differentiate and infer the merit of sampling tests.
CO5	Formulate and find optimal solution in the real life optimizing, allocation

	assignment problems involving conditions and resource constraints.											
CO6	Understand about Turing machine and NP hard and Complete problems.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS4L1</b>	<b>OPERATING SYSTEM LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	0	0	3	1.5
	Prerequisite –Operating Systems				
	Lab Manual Designed by – Dept. of Computer Science and Engineering				
<b>OBJECTIVES</b> The main objective is students gain knowledge about various Operating System Memory management and Commands using in Operating system.					

### LIST OF EXPERIMENTS

1. Working with basic Unix/ Linux commands.
2. Shell Programming.
3. Programs using the following system calls of Unix / Linux operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
4. Programs using the I/O system calls of UNIX operating system (open, read, write)
5. Simulations of Unix / Linux commands like ls, grep, etc.
6. Simulation of scheduling algorithms (CPU and Disk).
7. Implementation of synchronization problems using Semaphore.
8. Simulation of basic memory management schemes.
9. Simulation of virtual memory management schemes.
10. Simulation of file systems.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Demonstrate Unix / Linux commands.
CO2	Implement various commands using shell programming.
CO3	Implement various CPU scheduling algorithms.
CO4	Implement various disk scheduling algorithms.

CO5	Implement memory management techniques.											
CO6	To Apply concept about File System.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS4L2</b>	<b>DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45	0	0	3	1.5
	Prerequisite: Design and Analysis of Algorithms				
	Course Designed by : Dept. of Computer Science And Engineering				
<b>OBJECTIVE</b>					
The Objective is students should analyze various computing problems and design algorithms henceforth find its complexity and efficiency.					

### LIST OF EXPERIMENTS

1. Implement recursive algorithms using Divide-and-Conquer algorithmic techniques to analyze
  - i) Quick Sort
  - ii) Merge Sort
  - iii) Binary Search.
2. Implement and analyze Greedy method for
  - i) Minimum Spanning Tree problem.
  - ii) Shortest path problem using Dijkstra's algorithm.
3. Implement and analyze Dynamic programming method for Knapsack problem.
4. Implement the graph traversal techniques for Depth First Search and Breadth First Search.
5. Implement and analyze backtracking method for
  - i) Sum of Subsets problem and
  - ii) Graph Coloring problem.
6. Implement the branch and bound technique for Travelling Salesman problem and compare with Dynamic Programming.
7. Implement and analyze randomized algorithm for Hiring problem.

<b>COURSE OUTCOMES (COs)</b>												
CO1	For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms											
CO2	For a given problem analyze the algorithm and solve it by recurrence relations.											
CO3	Describe the greedy paradigm and explain when an algorithmic design situation calls for it.											
CO4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.											
CO5	Describe the backtracking, branch and bound techniques and analyse complexity and efficiency.											
CO6	To Apply concepts like backtracking and Dynamic programming.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	M									
CO2	H	M	M									
CO3	H	M	M									
CO4	H	M	M									
CO5	H	M	M									
CO6	H	M	M									
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS4L3</b>	<b>DATABASE SYSTEMS LAB</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45				0	0	3	1.5
	Prerequisite –Database Management System							
	Lab Manual Designed by – Dept. of Computer Science and Engineering							
<b>OBJECTIVES:</b> The main objective is to make the students to gain knowledge about databases for storing the data and to share the data among different kinds of users for their business operations.								

### LIST OF EXPERIMENTS

1. Data Definition, Manipulation of base tables and views
2. High level programming language extensions.
3. Front end tools.
4. Forms-Triggers-Menu Design.
5. Reports.
6. Database Design and implementation
7. An exercise using Open Source Software like MySQL.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Develop database modeling for a problem.
CO2	Design a database using normalization.

CO3	Implement a data base query language.											
CO4	Develop GUI using front end tool.											
CO5	Develop a connection between frontend and database.											
CO6	To understand Forms ,Triggers and Reports.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	M	M				M			
CO2	H	H	H	M	M				M			
CO3	H	H	H	M	M				M			
CO4	H	H	H	M	M				M			
CO5	H	H	H	M	M				M			
CO6	H	H	H	M	M				M			
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS501</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Analysis of Algorithms, Discrete Mathematics				
	Course Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
The objective of this to learn the concepts of Artificial Intelligence such as enable the computers to perform intellectual tasks, problem solving, perception, understanding human communication.					

### UNIT I PROBLEMS AND SEARCH

9

What is artificial intelligence? - Problems, problem spaces and search – Searching strategies- Uninformed Search- breadth first search, depth first search, uniform cost seart, depth limited search, iterative deepening search, bidirectional search - Informed Search- Best first search, Greedy Best first search , A\* search – Constraint satisfaction problem , Local searching strategies.

### UNIT II REASONING

9

Symbolic Reasoning Under Uncertainty- Statistical Reasoning - Weak Slot-And-Filler-Structure - Semantic nets – Frames- Strong Slot-And-Filler Structure-Conceptual Dependency-Scripts- CYC.

### UNIT III KNOWLEDGE REPRESENTATION

9

Knowledge Representation - Knowledge representation issues - Using predicate logic - Representing Knowledge Using Rules. Syntactic- Semantic of Representation – Logic & slot and filler - Game Playing – Minimal search- Alpha beta cutoffs –Iteratic deepening planning – component of planning system – Goal stack planning.

**UNIT IV NATURAL LANGUAGE PROCESSING****9**

Natural Language Processing –Syntactic processing, semantic analysis-Parallel and Distributed AI-Psychological modeling- parallelism and distributed in reasoning systems – Learning -Connectionist Models – Hopfield networks, neural networks.

**UNIT V EXPERT SYSTEMS 9**

Common Sense –qualitative physics, commonsense Ontologies- memory organization -Expert systems –Expert system shells- explanation – Knowledge acquisition -Perception and Action – Real time search- robot architecture.

**TEXT BOOKS**

1. Elaine Rich, Kevin Knight, “Artificial Intelligence”, 3/e, Tata McGraw Hill, 2009.
2. Russell , “ Artificial intelligence :A modern Approach , Pearson Education ,3<sup>rd</sup> edition,2013

**REFERENCE BOOKS**

- 1.Artificial Intelligence and Expert system by V.Daniel hunt, Springer press,2011.
- 2.Nilsson N.J., ”Principles of Artificial Intelligence”, Morgan Kaufmann.1998.

<b>COURSE OUTCOMES (COs)</b>												
CO1	Describe the modern view of AI as the study of agents that receive percepts from the Environment and perform actions.											
CO2	Demonstrate awareness of informed search and exploration methods.											
CO3	Explain about AI techniques for knowledge representation, planning and uncertainty Management.											
CO4	Develop knowledge of decision making and learning methods.											
CO5	Describe the use of AI to solve English Communication problems											
CO6	To Understand Knowledge acquisition ,Perception and Action											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	H			H			M
CO2	H	H	H	H	H	H			H			M
CO3	H	H	H	H	H	H			H			M
CO4	H	H	H	H	H	H			H			M
CO5	H	H	H	H	H	H			H			M
CO6	H	H	H	H	H	H			H			M
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS502</b>	<b>SOFTWARE ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamentals of Computing and Programming				
	Course Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
This course is intended to provide the students with an overall view over Software Engineering and with insight into the processes of software development.					

**UNIT I INTRODUCTION 9**

Introduction- Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production – necessity of automation. Job responsibilities of Programmers and Software Engineers as Software developers.

**UNIT II PROCESS MODELS AND PROGRAM DESIGN TECHNIQUES 9**

Process Models and Program Design Techniques- Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model. Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modeling Tools – Data flow Diagrams, UML and XML. Jackson System Development.

**UNIT III VERIFICATION AND VALIDATION 9**

Verification and Validation: Testing of Software Products – Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Real-time Software Systems.

**UNIT IV SOFTWARE PROJECT MANAGEMENT 9**

Software Project Management: Management Functions and Processes, Project Planning and Control, Organization and Intra-team Communication, Risk Management. Software Cost Estimation – underlying factors of critical concern. Metrics for estimating costs of software products – Function Points. Techniques for software cost estimation – Expert judgement, Delphi cost estimation, Work break-down structure and Process break-down structure, COCOMO and COCOMO-II.

**UNIT V ADVANCED TOPICS 9**

Advanced Topics: Formal Methods in Software Engineering – Z notation, Hoare’s notation. Formalization of Functional Specifications – SPEC. Support environment for Development of Software Products. Representative Tools for Editors, Linkers, Interpreters, Code Generators, Debuggers. Tools for Decision Support and Synthesis, Configuration control and Engineering Databases, Project Management. Petrinets: Introduction to Design Patterns, Aspect-oriented Programming.

**TEXT BOOKS:**

1. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, “Fundamentals of Software Engineering”, Pearson Education, 2003.
2. Roger Pressman S., “Software Engineering: A Practitioner's Approach”, 7th Edition, McGraw Hill, 2010.

**REFERENCE BOOKS:**

1. I. Sommerville, “Software Engineering”, Eighth Edition, Pearson Education, 2007
2. Pfleeger, “Software Engineering-Theory & Practice”, 3rd Edition, Pearson Education, 2009
3. <http://www.vumultan.com/Books/CS605-SoftwareEngineeringPractitionerEApproachbyRogerPressman.pdf>

COURSE OUTCOMES (COs)												
CO1	Explain the engineering aspects of software production											
CO2	Explain the principles involved in various process models											
CO3	Make use of suitable models through analysis of requirements and arrive at an appropriate software design.											
CO4	Ensure the quality of software through testing											
CO5	Explain software project management and software maintenance practices.											
CO6	To understand various testing concepts.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	H	H	H	M	L	M		M	H	M	H
CO2	M	H	H	H	M	M					M	M
CO3	M	H	H	H	M	M					M	M
CO4	M	H	H	H	M	M					M	M
CO5	M	H	H	H	M	M					M	M
CO6	M	H	H	H	M	M					M	M
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS503</b>	<b>FUNCTIONAL PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Object Oriented Programming				
	Course Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
The Main objective of this course is to learn the basic concepts of functional programming languages like Haskell, Python and Jscript					

### UNIT I INTRODUCTION 9

The standard prelude and the Haskell libraries, Hugs commands , Modules, Hugs Session, Basic types and definitions, Designing and writing programs in Haskell , Recursion , Primitive recursion in practice General forms of recursion , Program testing.

### UNIT II DATATYPES & GENERIC FUNCTIONS 9

Data types: Introducing tuples, lists and strings, Tuple type, Lists in Haskell , List comprehensions , A library database , Generic functions: polymorphism, Lists and list patterns , Primitive recursion over lists, Finding primitive recursive definitions , General recursions over lists, Example: text processing.

### UNIT III FUNCTIONS 9

Functions as values: Function-level definitions , Function composition , Functions as values and results , Partial application, The Program development, Algebraic types : Introducing algebraic types , Recursive algebraic types.

**UNIT IV FUNCTIONAL JAVASCRIPT****9**

Introducing Functional JavaScript, Why Functional Programming Matters, Functions as Units of Abstraction, Encapsulation and Hiding, Functions as Units of Behavior, Data as Abstraction, First Class Functions, JavaScript's Multiple Paradigms.

**UNIT V FUNCTIONAL PYTHON****9**

Introducing Functional Python, Flow Controls: Encapsulation , Comprehensions , Recursion , Eliminating Loops, Callables: Named Functions and Lambdas , Closures and Callable Instances, Lazy Evaluation : The Iterator Protocol Module: Itertools, Higher-Order Functions: Utility Higher-Order Functions , The operator Module :The functools Module , Decorators.

**TEXT BOOKS:**

1. Simon Thompson, Haskell: The Craft of Functional Programming, Addison-Wesley, 2011
2. Michael Fogus, Functional JavaScript, O'Reilly Media, May 2013
3. David Mertz, Functional Programming in Python, O'Reilly Media, May 2015

**REFERENCE BOOKS:**

1. Richard Bird, Thinking Functionally With Haskell, Cambridge University Press, October 2014.
2. Anto Aravinth, Beginning Functional JavaScript, Apress, March 2017
3. Fabrizio Romano, Learning Python, Packt Publishing Limited, Dec 2015
4. <https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf>

<b>COURSE OUTCOMES (COs)</b>												
CO1	Understand the fundamental concepts of Haskell programs											
CO2	Use Haskell to solve simple practical problems											
CO3	Develop programs using mathematical functions, Strings, Dictionary, Sets											
CO4	Develop programs to handle files, identify objects & develop classes											
CO5	Understand the basic concepts of JScrip.											
CO6	To Understand Functional Python, Flow Controls: Encapsulation											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	M		M							
CO2	H	H	M		M							
CO3	H	H	M		M							
CO4	H	H	M		M							
CO5	H	H	M		M							
CO6	H	H	M		M							
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS504</b>	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Internet Concepts				
	Course Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
Computer Networking is the vital part of any organization these days. This course provides a foundation to understand various principles, protocols and design aspects of Computer Networks and also helps to achieve the fundamental purpose of computer networks in the form of providing access to shared resources.					

**UNIT I FUNDAMENTALS AND PHYSICAL LAYER 9**

Computer Network Developments- Network Terms and Components-Network Topology-Standards-ISO/OSI layers-TCP/IP layers-, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

**UNIT II DATA LINK LAYER (LLC & MAC) 9**

Logical Link Control : Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Multiple access protocols : Random Access Protocol, Controlled Access Protocol, Channelization Protocol.

**UNIT III NETWORK LAYER 9**

Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, ICMP, BOOTP and DHCP; Routing algorithm-Link state algorithm, Distance vector routing algorithm, Hierarchical routing algorithm; Routing in the Internet-RIP, OSPF,BGP; Broadcast & Multicast routing- DVMRP, PIM.

**UNIT IV TRANSPORT LAYER 9**

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; QoS Improving Techniques (Traffic Shaping, Admission Control And Resource Reservation).

**UNIT V APPLICATION LAYER 9**

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

**TEXT BOOKS**

1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGraw-Hill,2013.
2. Data and Computer Communication, 10th Edition, William Stallings, Pearson Prentice Hall India,2013.

**REFERENCE BOOKS**

1. Computer Networks, 5th Edition, Andrew S. Tanenbaum, Pearson New International Edition,2010.

2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India, 2013.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America, 2010

COURSE OUTCOMES (COs)												
CO1	Explain data communication system, components and the purpose of layered architecture.											
CO2	Illustrate the functionality of each layer of OSI and TCP/IP reference model.											
CO3	Explain the data link layer and network layer protocols.											
CO4	Outline the functions of transport layer protocols.											
CO5	To Summarize application layer protocols.											
CO6	To Understand various application Protocols.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS5L1</b>	<b>SOFTWARE ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	0	0	3	1.5
	Prerequisite –Software Engineering ,Database Management System				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

### OBJECTIVES

The objective of this Software Engineering Lab is to understand the software engineering methodologies for project development, to gain knowledge on various CASE tools for applying it in the software modeling and implementation, to prepare students for performing requirement analysis and design of variety of applications.

Prepare the following documents for each experiment and develop the software using software engineering methodology.

- **Problem Analysis and Project Planning** -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
- **Software Requirement Analysis** - Describe the individual Phases/modules of the project and Identify deliverables.
- **Data Modeling** - Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
- **Software Development and Debugging** – implement the design by coding
- **Software Testing** - Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.

**LIST OF EXPERIMENTS:**

**Academic Domain**

1. Course Registration System
2. Student Marks Analyzing System

**Railway Domain**

3. Online Ticket Reservation System
4. Platform Assignment System for the Trains in a Railway Station

**Medicine Domain**

5. Expert System to prescribe the Medicines for the given Symptoms
6. Remote Computer Monitoring

**Finance Domain**

7. ATM System
8. Stock Maintenance

**Human Resource management**

9. Quiz System
10. E-mail Client system

<b>COURSE OUTCOMES (COs)</b>												
CO1	Perform requirement analysis and design requirements for solving / developing engineering problems.											
CO2	Identify project scope, objectives, and perform data modeling.											
CO3	Identify the deliverables in various phases of SDLC.											
CO4	Implement solutions using modern tools.											
CO5	Explain test plan, perform validation testing, coverage analysis.											
CO6	To Understand various Design Concepts in Software Engineering.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	H	H	H	M	L	M		M	H	M	H
CO2	M	H	H	H	M	M					M	M
CO3	M	H	H	H	M	M					M	M
CO4	M	H	H	H	M	M					M	M
CO5	M	H	H	H	M	M					M	M
CO6	M	H	H	H	M	M					M	M
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS5L2</b>	<b>NETWORK PROGRAMMING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	0	0	3	1.5
	Prerequisite –Computer Networks				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES:</b> This laboratory course is intended to make the students know about Networking Concepts and Protocols.					

**LIST OF EXPERIMENTS:**

1. Create a socket (TCP) between two computers and enable file transfer between them.
2. Write a program to develop a simple Chat TCP application.
3. Write a program to develop a simple Chat UDP application.
4. Write a socket Program for Echo/Ping/Talk commands.
5. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
6. Implementation of DNS, SNMP and File Transfer application using TCP and UDP Sockets.

7. Create a socket for HTTP for web page upload and download.
8. Write a program to display the client's address at the server end.
9. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
  - i. Link State routing
  - ii. Flooding
  - iii. Distance vector

<b>COURSE OUTCOMES (COs)</b>												
CO1	Understand fundamental underlying of Socket Programming											
CO2	Practice packet/file transmission between nodes.											
CO3	Implementation of client-server applications											
CO4	Analyze the performance of network protocols.											
CO5	To Understand various Network Simulator											
CO6	To apply various routing algorithms.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS601</b>	<b>COMPILER DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Data Structures, Discrete Mathematics				
	Course Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
The objective of this to learn the design of compiler Design, the various parsing techniques, how to optimize and effectively generate machine codes					

### **UNIT I OVERVIEW OF COMPILATION AND SYNTAX ANALYSIS 9**

The structure of a compiler and applications of compiler technology; Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, hand-written lexical analyzers, LEX, examples of LEX programs. Introduction to syntax analysis -Role of a parser, use of context-free grammars (CFG) in the specification of the syntax of programming languages, techniques for writing grammars for programming languages (removal left recursion, etc.), non- context-free constructs in programming languages, parse trees and ambiguity, examples of programming language grammars.

Top-down parsing- FIRST & FOLLOW sets, LL(1) conditions, predictive parsing, recursive descent parsing, error recovery. LR-parsing - Handle pruning, shift-reduce parsing, viable prefixes, valid items, LR(0) automaton, LR-parsing algorithm, SLR(1), LR(1), and LALR(1) parsing. YACC, error recovery with YACC and examples of YACC specifications. Syntax-directed definitions (attribute grammars)-Synthesized and inherited attributes, examples of SDDs, evaluation orders for attributes of an SDD, dependency graphs. S-attributed and L-attributed SDDs and their implementation using LR-parsers and recursive-descent parsers respectively.

**UNIT III SEMANTIC ANALYSIS**

9

Semantic analysis- Symbol tables and their data structures. Representation of“scope”. Semantic analysis of expressions, assignment, and control-flow statements, declarations of variables and functions, function calls, etc., using S- and L-attributed SDDs (treatment of arrays and structures included). Semantic error recovery.

**UNIT IV INTERMEDIATE CODE GENERATION**

9

Intermediate code generation - Different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses. Translation of expressions (including array references with subscripts) and assignment statements. Translation of control-flow statements – it- then-else, while-do, and switch. Short-circuit code and control-flow translation of Boolean expressions. Back patching. Examples to illustrate intermediate code generation for all constructs.

**UNIT V RUN-TIME ENVIRONMENTS**

9

Run-time environments:- Stack allocation of space and activation records. Access to non-local data on the stack in the case of procedures with and without nesting of procedures. Introduction to machine code generation and optimization- Simple machine code generation, examples of machine-independent code optimizations.

**TEXT BOOKS:**

1. Compilers: Principles, Techniques, and Tools , by A.V. Aho, Monica Lam, Ravi Sethi, and J.D. Ullman,(2nd ed.), Addison-Wesley, 2007 (main text book, referred to as ALSU in lab assignments).
2. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2011

**REFERENCE BOOKS:**

1. K.C. louden, compiler construction: principles and practice, cengage learning,1997
- 2.D. Brown, J. Levine, and T. Mason, LEX and YACC, O’Reilly Media,1992
- 3.[http://hjemmesider.diku.dk/~torbenm/Basics/basics\\_lulu2.pdf](http://hjemmesider.diku.dk/~torbenm/Basics/basics_lulu2.pdf)
- 4.<http://ecomputernotes.com/compiler-design>.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Explain the phases of a Compiler
CO2	Illustrate the translation of regular expression into parse tree using syntax analyzer.
CO3	Construct the intermediate representation considering the type systems

CO4	Apply the optimization techniques for the generated code											
CO5	Use the different compiler construction tools to develop a simple compiler											
CO6	To create Compiler using Lex and YACC tools.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS602</b>	<b>OBJECT ORIENTED SOFTWARE ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Analysis of Algorithms, Discrete Mathematics				
	Course Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
The objective of this course is to learn the basic of object oriented analysis and design skills, UML design diagrams and various testing techniques.					

**UNIT I OBJECT ORIENTED METHODOLOGIES 9**

Introduction to System Concepts - Managing Complex Software — Properties – Object Oriented Systems Development – Object Basics – Systems Development Life Cycle - Rumbaugh Methodology - Booch Methodology - Jacobson Methodology – Unified Process.

**UNIT II UML 9**

Unified Approach – Unified Modeling Language – Static behavior diagrams – Dynamic behavior diagrams – Object Constraint Language.

**UNIT III DESIGN CONCEPTS 9**

Inception – Evolutionary Requirements – Domain Models – Operation Contracts - Requirements to Design – Design Axioms – Logical Architecture - Designing Objects with Responsibilities – Object Design – Designing for Visibility.

**UNIT IV DESIGN PATTERNS 9**

Patterns – Analysis and Design patterns – GoF Patterns - Mapping designs to code – Test Driven development and refactoring – UML Tools and UML as blueprint.

**UNIT V ARCHITECTURE ANALYSIS 9**

More Patterns – Applying design patterns – Architectural Analysis – Logical Architecture Refinement – Package Design – Persistence framework with patterns.

**TEXT BOOKS**

1. Booch, Grady. Object Oriented Analysis and Design. 2<sup>nd</sup> edition, Pearson Education. 2006.
2. Ali Bahrami, “Object Oriented Systems Development”, Tata McGraw Hill, 2008.

**REFERENCES**

1. Craig Larman. “Applying UML and Patterns – An introduction to Object-Oriented Analysis and Design and Iterative Development”, 3rd ed, Pearson Education, 2005.
2. Fowler, Martin. UML Distilled. 3<sup>rd</sup> edition. Pearson Education. 2004.
3. Michael Blaha and James Rumbaugh, “Object-oriented modeling and design with UML”, Prentice-Hall of India, 2005.
4. <https://www.cs.ucsb.edu/~mikec/cs48/project/ProcessLarman.pdf>

<b>COURSE OUTCOMES (COs)</b>												
CO1	Design and implement projects using OO concepts											
CO2	Use the UML analysis and design diagrams											
CO3	Apply appropriate design patterns.											
CO4	Create code from design.											
CO5	Compare and contrast various testing techniques.											
CO6	To Applying design patterns.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	M	H	H	H	M	M						
<b>CO2</b>	M	H	H	H	M	M						
<b>CO3</b>	M	H	H	H	M	M						
<b>CO4</b>	M	H	H	H	M	M						
<b>CO5</b>	M	H	H	H	M	M						
<b>CO6</b>	M	H	H	H	M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS6L1</b>	<b>COMPILER DESIGN LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	0	0	3	1.5
	Prerequisite – Compiler Design, C Programming				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

### OBJECTIVES

This laboratory course is intended to make the students experiment on the basic techniques of compiler construction and tools that can be used to perform syntax-directed translation of a high-level programming language into an executable code. Students will design and implement language processors in C by using tools to automate parts of the implementation process. This will provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations, dynamic memory allocation, and object orientation.

### List of Experiments:

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2. Write a C program to identify whether a given line is a comment or not.
3. Write a C program to recognize strings under 'a', 'a\*b+', 'abb'.
4. Write a C program to test whether a given identifier is valid or not.
5. Write a C program to simulate lexical analyzer for validating operators.
6. Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools
7. Write a C program for implementing the functionalities of predictive parser for the mini language specified in Note 1.
8. a) Write a C program for constructing of LL (1) parsing.  
b) Write a C program for constructing recursive descent parsing
9. Write a C program to implement LALR parsing
10. a) Write a C program to implement operator precedence parsing.  
b) Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and \* and computes the value
11. Convert the BNF rules into Yacc form and write code to generate abstract syntax tree for the mini language specified in Note 1.
12. Write a C program to generate machine code from abstract syntax tree generated by the parser. The instruction set specified in Note 2 may be considered as the target code.

<b>COURSE OUTCOMES (COs)</b>	
CO1	To Understand the working of lex and yacc compiler for debugging of programs.
CO2	To Understand and define the role of lexical analyzer, use of regular expression and transition diagrams.
CO3	To Understand and use Context free grammar, and parse tree construction.
CO4	To Learn & use the new tools and technologies used for designing a compiler.
CO5	To Develop program for solving parser problems.
CO6	To generate machine code from abstract syntax tree generated by the parser.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	H	H	H		M	M						
<b>CO2</b>	H	H	H		M	M						
<b>CO3</b>	H	H	H		M	M						
<b>CO4</b>	H	H	H		M	M						
<b>CO5</b>	H	H	H		M	M						
<b>CO6</b>	H	H	H		M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS6L2</b>	<b>OBJECT ORIENTED SOFTWARE ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	0	0	3	1.5
	Prerequisite – Software Engineering				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
This laboratory course is intended to make the students know about basic concepts of Object Oriented Analysis and Design.					

#### LIST OF EXPERIMENTS:

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. E-book management system
10. Recruitment system
11. Foreign trading system
12. Conferencemanagement System
13. BPO management System
14. Library management system
15. Student information system

<b>COURSE OUTCOMES (COs)</b>	
CO1	To capture the requirements specification for an intended software system
CO2	To draw the UML diagrams for the given specification
CO3	To Apply the design pattern properly in .
CO4	To test the software system thoroughly for all scenarios.
CO5	To improve the design by applying appropriate design patterns.
CO6	To analyze the concept of patterns for constructing software architectures.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	M	H	H	H	M	M						
<b>CO2</b>	M	H	H	H	M	M						
<b>CO3</b>	M	H	H	H	M	M						
<b>CO4</b>	M	H	H	H	M	M						
<b>CO5</b>	M	H	H	H	M	M						
<b>CO6</b>	M	H	H	H	M	M						
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS701</b>	<b>BIG DATA ANALYTICS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45				3	0	0	3
	Prerequisite –Data Structures, Data Ware Housing and Data Mining							
	Course Designed by – Dept. of Computer Science and Engineering.							
<b>OBJECTIVES</b>								
The basics of Analytics – Concepts, Data preparation – merging, managing missing numbers sampling, Data visualization, Basic statistics.								

### **UNIT- I INTRODUCTION TO BIG DATA**

**9**

Analytics – Nuances of big data – Value – Issues – Case for Big data – Big data options Team challenge – Big data sources – Acquisition – Nuts and Bolts of Big data. Features of Big Data -Security, Compliance, auditing and protection - Evolution of Big data – Best Practices for Big Data Analytics - Big data characteristics - Volume, Veracity, Velocity, Variety – Data Appliance and Integration tools – Greenplum – Informatica.

### **UNIT- II DATA ANALYSIS**

**9**

Evolution of analytic scalability – Convergence – parallel processing systems – Cloud computing –grid computing – map reduce – enterprise analytic sand box – analytic data sets – Analytic Methods –analytic tools – Cognos – Micro strategy - Pentaho. Analysis approaches – Statistical significance –business approaches – Analytic innovation – Traditional approaches – Iterative.

### **UNIT- III STREAM COMPUTING**

**9**

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 IBM Infosphere – Big data at rest – Infosphere streams – Data stage – Statistical analysis– Intelligent scheduler – Infosphere Streams.

### **UNIT- IV PREDICTIVE ANALYTICS AND VISUALIZATION**

**9**

Predictive Analytics – Supervised – Unsupervised learning – Neural networks – Kohonen models –Normal – Deviations from normal patterns – Normal behaviours – Expert options – Variable entry -Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques –Hierarchical – K- Means – Clustering high dimensional data Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications.

**UNIT- V FRAMEWORKS AND APPLICATIONS****9**

IBM for Big Data – Map Reduce Framework - Hadoop – Hive - – Sharding – NoSQL Databases - S3 -Hadoop Distributed file systems – Hbase – Impala – Analyzing big data with twitter – Big data for Ecommerce– Big data for blogs.

**TEXT BOOKS:**

1. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS BusinessSeries, 2012.
2. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”,Elsevier, 2007
3. Michael Berthold, David J. Hand,” Intelligent Data Analysis”, Springer, 2007.

**REFERENCES:**

1. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge UniversityPress, 2012.
2. <http://www.mosaic.geo-strategies.com/wp-content/uploads/2013/10/Big-Data-for-Dummies.pdf>

COURSE OUTCOMES (COs)												
CO1	Be able to understand Data Appliance and Integration tools like Greenplum and Informatica.											
CO2	Have an awareness of the computational theory underlying NN.											
CO3	Have a working knowledge of a typical neural network simulation											
CO4	Experience in programming Predictive analysis and Visualization.											
CO5	Have knowledge of sufficient in Hadoop and Map reduce concepts.											
CO6	To understand Map Reduce Framework and Hadoop.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PCCS7L1</b>	<b>BIG DATA ANALYTICS LAB</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45				0	0	3	1.5
	Prerequisite – Data Structures &Data Mining							
	Lab Manual Designed by – Dept. of Computer Science and Engineering.							
<b>OBJECTIVES</b>								
This laboratory course is intended to make the students know about Big Data Concepts.								

## LIST OF EXPERIMENTS

1. Summary statistics some sense of the data using R tool.
2. Calculate Hypothesis testing for sample dataset using R tool.
3. Visualization of Health care data using Greenplum.
4. Find the K-means clustering for given dataset.
5. Find the missing dataset using hadoop and map reduce.
6. Calculate mean, median, mode for the given dataset using R tool.
7. Classification using Naïve bayes approach.
8. The k-Nearest Neighbor Algorithm Using MapReduce Paradigm.

<b>COURSE OUTCOMES (COs)</b>												
CO1	Identify the need for big data analytics for a domain.											
CO2	To Use Hadoop, Map Reduce Framework.											
CO3	To Apply big data analytics for a give problem.											
CO4	Suggest areas to apply big data to increase business outcome.											
CO5	Contextually integrate and correlate large amounts of information automatically to gain faster insights											
CO6												
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Professional Course (PC)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

## PROGRAMME ELECTIVE-I

<b>U18PECS011</b>	<b>THEORY OF COMPUTATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Data Structures, Discrete Mathematics				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	The purpose of this course is to impart concepts of Automata and its operations.				

### **UNIT I      FINITE AUTOMATA      9**

Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with  $\epsilon$ - moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without  $\epsilon$ -moves – Equivalence of finite Automaton and regular expressions – Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

### **UNIT II      GRAMMARS      9**

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions - Null productions – Greiback Normal form – Chomsky normal form – Problems related to CNF and GNF.

### **UNIT III      PUSHDOWN AUTOMATA      9**

Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFL – problems based on pumping Lemma.

### **UNIT IV      TURING MACHINES      9**

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 about Turing machine- Chomskian hierarchy of languages.

### **UNIT V      UNSOLVABLE PROBLEMS AND COMPUTABLE FUNCTIONS      9**

Unsolvable Problems and Computable Functions – Primitive recursive functions – Recursive and recursively enumerable languages – Universal Turing machine. MEASURING AND CLASSIFYING COMPLEXITY: Tractable and Intractable problems- Tractable and possibly intractable problems - P and NP completeness - Polynomial time reductions.

#### **TEXT BOOKS:**

- Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2008. (UNIT 1,2,3)
- John C Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007. (UNIT 4,5)

#### **REFERENCES:**

- Mishra K L P and Chandrasekaran N, “Theory of Computer Science - Automata, Languages and Computation”, Third Edition, Prentice Hall of India, 2004.
- Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.
- Peter Linz, “An Introduction to Formal Language and Automata”, Third Edition, Narosa Publishers, New Delhi, 2002.

<b>COURSE OUTCOMES (COs)</b>	
CO1	To Learn Finite automata and Operations.
CO2	To Understand Grammar and its Types.
CO3	To Understand Pushdown automata.
CO4	To Learn Turing machines and Models
CO5	To Understand Polynominal Functions.
CO6	To Apply Primitive recursive functions and Recursive and recursively enumerable languages.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS012</b>	<b>ADVANCED OPERATING SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Operating Systems				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	Every computer professional should have a basic understanding of how an operating system controls the computing resources and provide services to the users. This course provides an introduction to the operating system functions, design and implementation.				

## **UNIT-I FUNDAMENTALS OF OPERATING SYSTEMS**

**9**

Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

## **UNIT II DISTRIBUTED OPERATING SYSTEMS**

**9**

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport’s Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

**UNIT IV REAL TIME SYSTEM**

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management- File system.

**UNIT V CASE STUDIES**

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System - Inter process Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

**TEXTBOOKS:**

1. Mukesh Singhal and Niranjana G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.

**REFERENCES:**

1. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly, 2005.
2. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, 2006.
3. Neil Smyth, “iPhone iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Illustrate the operating system concepts and its functionalities.
CO2	Understand Distributed Operating Systems.
CO3	Learn Distributed Resource Management.
CO4	Identify the issues in deadlock and memory management.
CO5	Illustrate various Distributed resource management.
CO6	To Understand operations in various operating systems like Linux.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						

<b>Category</b>	Programme Elective (PE)
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018

<b>U18PECS013</b>	<b>SPEECH AND NATURAL LANGUAGE PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Principles of Compiler Design				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	This course is designed to introduce some of the problems and solutions of NLP, and their relation to linguistics and statistics.				

### **UNIT I INTRODUCTION 9**

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues - Applications- The role of machine learning - Probability Basics –Information theory – Collocations -N-gram Language Models - Estimating parameters and smoothing - Evaluating language models.

### **UNIT II MORPHOLOGY AND PART OF SPEECH TAGGING 9**

Linguistic essentials - Lexical syntax- Morphology and Finite State Transducers - Part of speech Tagging - Rule-Based Part of Speech Tagging - Markov Models - Hidden Markov Models – Transformation based Models - Maximum Entropy Models. Conditional Random Fields.

### **UNIT III SYNTAX PARSING 9**

Syntax Parsing - Grammar formalisms and tree banks - Parsing with Context Free Grammars- Features and Unification -Statistical parsing and probabilistic CFGs (PCFGs)-Lexicalized PCFGs.

### **UNIT IV SEMANTIC ANALYSIS 9**

Representing Meaning – Semantic Analysis - Lexical semantics –Word-sense disambiguation - Supervised – Dictionary based and Unsupervised Approaches - Compositional semantics- Semantic Role Labeling and Semantic Parsing – Discourse Analysis.

### **UNIT V APPLICATIONS 9**

Named entity recognition and relation extraction- IE using sequence labeling-Machine Translation (MT) - Basic issues in MT-Statistical translation-word alignment- phrase-based translation – Question Answering.

#### **TEXT BOOKS:**

1. Daniel Jurafsky and James H. Martin Speech and Language Processing (2nd Edition), Prentice Hall; 2 edition, 2008.
2. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schuetze, MIT Press, 1999.
3. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media; 1 edition, 2009.
4. Roland R. Hausser, Foundations of Computational Linguistics: Human-Computer Communication in Natural Language, Paperback, MIT Press, 2011.

#### **REFERENCES:**

1. Pierre M. Nugues, An Introduction to Language Processing with Perl and Prolog: An Outline of Theories, Implementation, and Application with Special Consideration of English, French, and German (Cognitive Technologies) Soft cover reprint, 2010.

2. James Allen, Natural Language Understanding, Addison Wesley; 2<sup>nd</sup> edition
3. NLTK – Natural Language Tool Kit - <http://www.nltk.org>

<b>COURSE OUTCOMES (COs)</b>	
CO1	To understand Natural Language Processing tasks in syntax semantics and pragmatics.
CO2	To understand Morphology and Part of Speech Tagging.
CO3	To understand how syntax parsing techniques can be used.
CO4	Explain the use of semantic analysis methods.
CO5	To Relate a few applications of NLP.
CO6	To Understand Linguistic essentials and Lexical syntax.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PECS014	<b>DATA MINING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45				3	0	0	3
	Prerequisite – Database Management System							
	Course Designed by – Department of Computer Science & Engineering							
<b>OBJECTIVES</b>	Dramatic advances in data capture, processing power, data transmission, and Storage capabilities are enabling organizations to integrate their various databases into data warehouses.							

### **UNIT - I INTRODUCTION TO DATA MINING**

**9**

Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation, Data Transformation; Measures of Similarity and Dissimilarity- Basics.

### **UNIT - II ASSOCIATION RULES**

**9**

Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIORI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set- Maximal Frequent Item Set, Closed Frequent Item Set.

### **UNIT - III CLASSIFICATION**

**9**

Problem Definition, General Approaches to solving a classification problem ,Evaluation of Classifiers , Classification techniques, Decision Trees-Decision tree Construction , Methods for

Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision tree Induction ; Naive-Bayes Classifier, Bayesian Belief Networks; K- Nearest neighbor classification-Algorithm and Characteristics.

**UNIT - IV CLUSTERING**

**9**

Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering-K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering-Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and Weakness; Outlier Detection.

**UNIT - V WEB AND TEXT MINING**

**9**

Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining –unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

**TEXT BOOKS:**

1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
- 2.Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson Education.
3. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing

**REFERENCE BOOKS:**

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.
3. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University Press.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Provide efficient distribution of information and easy access to data.
CO2	Create user friendly reporting environment.
CO3	Find the unseen pattern in large volume of historical data that helps to manage an organization efficiently.
CO4	To Understand the concepts of various data mining Techniques.
CO5	To Understand Web and Text mining.
CO6	To understand evaluation of Clustering Algorithms.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											



## REFERENCES:

1. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
3. D.E. Dudgeon and R.M. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
5. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

COURSE OUTCOMES (COs)	
CO1	Learn various Image transformation.
CO2	Learn Image Enhancement.
CO3	Learn Image Compression techniques.
CO4	Explain Image restoration.
CO5	To Understand image restoration, image compression, and image analysis.
CO6	To Understand Region growing and Region splitting and merging.

Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M		M		H							M
CO2	M		M		H							M
CO3	M		M		H							M
CO4	M		M		H							M
CO5	M		M		H							M
CO6	M		M		H							M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS016</b>	<b>INFORMATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Computer Networks				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	understand and appreciate computer/information security as it has become an essential aspect of our day life. This course provides students with concepts of computer security, cryptography, digital money, secure protocols, detection and other security techniques.				

**UNIT I INTRODUCTION 9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.

**UNIT II SECURITY INVESTIGATION 9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues – An Overview of Computer Security – Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

**UNIT III SECURITY ANALYSIS 9**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk – Systems: Access Control Mechanisms, Information Flow and Confinement Problem.

**UNIT IV LOGICAL DESIGN 9**

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

**UNIT V PHYSICAL DESIGN 9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.

**TEXT BOOK:**

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Security, Vikas Publishing House, New Delhi, 2003.

**REFERENCES**

Micki Krause, Harold F. Tipton, — Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.

Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposed, Tata McGraw- Hill, 2003

Matt Bishop, — Computer Security Art and Science, Pearson/PHI, 2002.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Should be able to understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information.
CO2	To Understand concepts of computer security, cryptography, digital money, secure protocols, detection and other security techniques.
CO3	Learn Physical design.
CO4	Explain Logical Design.
CO5	To Understand various security analysis.
CO6	To Apply Security Technology, IDS, Scanning and Analysis Tools

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	L	H	H	H	L	M					M	M
<b>CO2</b>	L	H	H	H	L	M					M	M
<b>CO3</b>	L	H	H	H	L	M					M	M
<b>CO4</b>	L	H	H	H	L	M					M	M
<b>CO5</b>	L	H	H	H	L	M					M	M
<b>CO6</b>	L	H	H	H	L	M					M	M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

## PROGRAMME ELECTIVE-II

<b>U18PECS021</b>	<b>GRAPH THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Discrete Mathematics				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	To understand and apply the fundamental concepts in graph theory 2. To apply graph theory based tools in solving practical problems 3. To improve the proof writing skills.				

### **UNIT I INTRODUCTION 9**

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

### **UNIT II TREES 9**

Trees -Properties- Distance and Centres - Types - Rooted Tree-- Tree Enumeration Labeled Tree - Unlabeled Tree - Spanning Tree - Fundamental Circuits- Cut Sets - Properties - Fundamental Circuit and Cut-set- Connectivity- Separability -Related Theorems.

### **UNIT III GRAPHS 9**

Network Flows - Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph - Properties - Euler Digraph.

### **UNIT IV MATRIX REPRESENTATION 9**

Matrix Representation - Adjacency matrix- Incidence matrix- Circuit matrix - Cut-set matrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial - Chromatic Partitioning - Matching - Covering - Related Theorems.

### **UNIT V SPANNING TREES 9**

Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

#### **TEXT BOOKS:**

1. Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds , "Graph Theory Applications", Springer ,2016.

#### **REFERENCES**

1. Bondy, J. A. and Murty, U.S.R., " Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B., —Introduction to Graph Theory, Pearson Education,2011.
3. John Clark , Derek Allan Holton, —A First Look at Graph Theory, World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer,3rd Edition,2006. 5. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill , 2007. IT8071

<b>COURSE OUTCOMES (COs)</b>	
CO1	To Understand the basic concepts of graphs, and different types of graphs .
CO2	To Understand the properties, theorems and be able to prove theorems.
CO3	To Apply suitable graph model and algorithm for solving applications. .



Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

## UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

**TEXTBOOK:**

1. 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

**REFERENCES:**

1. Arshdeep Bahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 .

<b>COURSE OUTCOMES (COs)</b>	
CO1	Identify and design the new models for market strategic interaction.
CO2	To Understand IoT Protocols.
CO3	Design and Development of Arduino , Embedded Systems.
CO4	Design a middleware for IoT.
CO5	To Analyze and design different models for network dynamics.
CO6	To create CreCisco IoT system and IBM Watson IoT platform.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PECS023	MACHINE LEARNING				L	T	P	C
	Total Contact Periods – 45				3	0	0	3
	Prerequisite – Data structures and Algorithms							
	Course Designed by – Department of Computer Science & Engineering							
OBJECTIVES	<ul style="list-style-type: none"> <li>• To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning</li> <li>• To learn the new approaches in machine learning</li> <li>• To design appropriate machine learning algorithms for problem solving</li> </ul>							

### UNIT I INTRODUCTION 9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

### UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

### UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

### UNIT IV INSTANT BASED LEARNING 9

K- Nearest Neighbor Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

### UNIT V ADVANCED LEARNING 9

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

#### TEXT BOOK:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

#### REFERENCES:

1. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
CO2	To Apply principles of Data Science to the analysis of business problems
CO3	Use data mining software to solve real-world problems.
CO4	Employ cutting edge tools and technologies to analyze Big Data.
CO5	Demonstrate use of team work, leadership skills, decision making and organization theory.
CO6	To Understand Learning Sets of Rules and Sequential Covering Algorithm

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1												
CO2												
CO3												
CO4												
CO5												
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS024</b>	<b>DATA SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Database Management System				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	Develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.				

### **UNIT-I INTRODUCTION TO DATA SCIENCE**

**9**

Data Science - Data Scientist- scope of Data Science: the open data movement, science, business, government, education, and sport-Introduction to the R data analysis environment-Formulating data-centric answers to scientific, business and social questions-Best practices: organizing projects, managing collaborations and expectations.

### **UNIT II DATAMANAGEMENT**

**9**

Database SQL, data cleaning, normalization, feature selection -creation spectral-decompositions and dimensionality reduction. Exploratory Data Analysis- Data scraping-cleaning and summarization-Visualization I: visualizing to explore-Exploration in scale: introduction to map reduce.

### **UNIT-III COMPUTATIONAL AND STATISTICAL DATA ANALYSIS**

**9**

Descriptive-dataquality-Exploratory-statistics-correlation-ANOVA-Inferential-theoryof generalization-sampling-statistical-testing-Predictive-supervised-unsupervised-machine

learning- exploration to inference- quantifying variation and uncertainty- Linear modeling- regression and prediction- visualizing inferences and uncertainty

**UNIT- IV HASHING AND ASSOCIATION RULES 9**

Introduction - Frequent item sets and Association rules - Locality Sensitive Hashing - Theory of Locality Sensitive Hashing - Dimensionality Reduction: SVD and CUR - Web spam and Trust Rank, Random Walks with Restarts - Large-Scale Machine Learning: Support Vector Machines - Large-Scale Machine Learning: Decision.

**UNIT-V GRAPH TEXT MINING AND CLUSTERING 9**

Methods and tools for pre-processing- indexing-querying-retrieval -ranking of text at the document - collection levels- Algorithms for text Foriented application in web and social network- Methods and tools for pre-processing graphs- Community mining methods-graph clustering methods(MinFcut, Spectral, Clustering).

**TEXTBOOKS:**

- 1.1. Introduction to Data Science, with Introduction to R Jeffrey Stanton 2012.
2. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing, CRC Press, 2011.

**REFERENCES:**

1. Wagner, S., Steinmetz, M., Bode, A., Müller, M.M. (Eds.), High Performance Computing in Science and Engineering, Garching/Munich, Springer Verlag, 2010.  
[https://ischool.syr.edu/media/documents/2012/3/DataScienceBook1\\_1.pdf](https://ischool.syr.edu/media/documents/2012/3/DataScienceBook1_1.pdf)

COURSE OUTCOMES (COs)	
CO1	Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
CO2	Apply principles of Data Science to the analysis of business problems
CO3	Use data mining software to solve real-world problems.
CO4	Employ cutting edge tools and technologies to analyze Big Data.
CO5	Demonstrate use of team work, leadership skills, decision making and organization theory.

Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PECS025	VIRTUAL REALITY				
	L	T	P	C	
	Total Contact Periods – 45	2	0	2	3
	Prerequisite – Computer Graphics				
Course Designed by – Department of Computer Science & Engineering					
OBJECTIVES	To provide an overview of the opportunities and the main issues related to designing and developing VR/AR systems architectures, both in local and in distributed (even web-based) contexts, and to the development of VR/AR applications with a multimodal perspective and approach.				

### UNIT-I VIRTUAL REALITY AND ENVIRONMENTS 9

Introduction - Computer graphics - Real-time Computer Graphics -, Flight Simulation - Virtual environments- Requirements- Benefits of virtual reality. The historical development of virtual reality: Scientific landmarks, 3d computer graphics: Virtual world space - Positioning the observer- Perspective projection - Human vision - Stereo perspective Projection - Human Vision -Stereo Perspective Projection - 3D clipping - Color theory - 3D Modeling - Illumination models - Reflection models - Shading Algorithms - Hidden surf ace removal - Stereographic Images.

### UNIT-II GEOMETRIC MODELING 9

Conversion from 2D to 3D-3D Space curves-3D Boundary Representation -modeling strategies. Geometric Transformations ; Frames of references -Modeling Transformations - Instances - Packing - Flying - Scaling the Virtual Environment-Collision detection. Generic Virtual Reality: Virtual Environment - Computer environment - Virtual reality Technology- Models of interaction - Virtual Reality Systems.

### UNIT-III ANIMATING THE VIRTUAL ENVIRONMENT 9

The dynamics of numbers - Animation of objects - shape and Object In betweening - Frame- from deformation - Particle systems Physical Simulation Objects falling in a gravitational field - Rotating Wheels-Elastic collision -Projectiles - simple Pendulums - Springs - Flight dynamics of an aircraft. Human Factors; Eye-Ear- Somatic senses- Equilibrium.

### UNIT-IV VIRTUAL REALITY HARDWARE 9

Sensor Hardware - Head Coupled displays - Acoustic hardware - Integrated Virtual Reality systems. Virtual Reality Software: Modeling virtual worlds -Physical Simulation-Virtual Reality Toolkits.

### UNIT-V VIRTUAL REALITY APPLICATIONS 9

Engineering-Entertainment-Science-Training Future of Virtual Reality: Virtual environments - Models of interactions.

#### REFERENCES:

1. John Vince, “Virtual Reality Systems”, Pearson Education, 2005.
2. Adams, “Visualization of Virtual Reality”, Tata McGraw Hill, 2000.
3. <http://www.cs.tut.fi/kurssit/SGN-5406/lectures/VR1-introduction.pdf>

COURSE OUTCOMES (COs)	
CO1	Demonstrate Computer graphics ,Real-time Computer Graphics and Flight Simulation
CO2	Understand Geometric Principles.
CO3	Learn various animating virtual environment.
CO4	Understand Virtual reality hardware.
CO5	Demonstrate Virtual reality applications.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M		M		H							M
CO2	M		M		H							M
CO3	M		M		H							M
CO4	M		M		H							M
CO5	M		M		H							M
CO6	M		M		H							M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS026</b>	<b>DATABASE SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Database management systems				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>Master the principles of access control and its application to database security.</li> <li>Understand administration of users - Understand the databases security models .</li> </ul>				

### **UNIT I INTRODUCTION 9**

Introduction to Databases Security Problems in Databases Security Controls Conclusions. Security Models - Introduction Access Matrix Model Take-Grant Model Acten Model PN Model Hartson and Hsiao's Model Fernandez's Model Bussolati and Martella's Model for Distributed databases.

### **UNIT II SECURITY MODELS 9**

Security Models -2 Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's Model The Lattice Model for the Flow Control conclusion.

### **UNIT III SECURITY MECHANISM 9**

Security Mechanisms Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria.

### **UNIT IV SECURITY DESIGN 9**

Security Software Design Introduction A Methodological Approach to Security Software Design Secure Operating System Design Secure DBMS Design Security Packages Database Security Design.

### **UNIT V SECURITY THREATS 9**

Statistical Database Protection & Intrusion Detection Systems Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation Criteria for Control Comparison -Introduction IDES System RETISS System ASES System Discovery.

**TEXT BOOKS:**

1. Database Security and Auditing, Hassan A. Afyouni, India Edition, CENGAGE Learning, 2009.
2. Database Security, Castano, Second edition, Pearson Education.

**REFERENCE BOOK:**

1. Database security by alfred basta, melissa zgola, CENGAGE learning.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Define terms related to computer, data and network security.
CO2	Describe the ways in which the security of an information system can be endangered
CO3	Demonstrate competence in detecting potential security vulnerabilities, and demonstrate ways of recovering from the effects of attacks.
CO4	To Analyse the offered system, and point to the potential safety problems.
CO5	Suggest the optimal way to organize information system security.
CO6	To Understand Statistical Database Protection & Intrusion Detection Systems.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	L	H	H	H	L	M					M	M
CO2	L	H	H	H	L	M					M	M
CO3	L	H	H	H	L	M					M	M
CO4	L	H	H	H	L	M					M	M
CO5	L	H	H	H	L	M					M	M
CO6	L	H	H	H	L	M					M	M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

## PROGRAMME ELECTIVE-III

<b>U18PECS031</b>	<b>ADVANCED ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Data Structures & Algorithms				
	Course Designed by : Dept. of Computer Science and Engineering				

**OBJECTIVES**

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.

### **UNIT I INTRODUCTION 9**

Role of algorithms in computing, Analyzing algorithms, Designing Algorithms, Growth of Functions, Divide and Conquer- The maximum-sub array problem, Strassen's algorithms for matrix multiplication, The substitution method for solving recurrences, The recurrence-tree method for solving recurrence, The master method for solving recursions, Probabilistic analysis and random analysis.

### **UNIT II REVIEW OF DATA STRUCTURES 9**

Elementary Data Structures, Hash Tables, Binary Search Trees, Red-Black Trees.

### **UNIT III DYNAMIC PROGRAMMING 9**

Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence, Greedy Algorithms – Elements of the greedy strategy, Huffman codes, Amortized Analysis – Aggregate analysis, The accounting method, The potential method, Dynamic tables.

### **UNIT – IV GRAPH ALGORITHMS 9**

Elementary Graph Algorithms, Minimal spanning trees, Single-Source Shortest Paths, Maximum flow.

### **UNIT V POLYNOMIAL & NP COMPLETE PROBLEM 9**

Complete & Approximate Algorithms-Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-complete & approximation problems – Clique problem, Vertex cover problem, formula satisfiability, 3 CNF Satisfiability, The vertex-cover problem, The traveling salesman problem, The subset-sum problem.

#### **TEXT BOOKS:**

[1] "Introduction to Algorithms", Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Third Edition, PHI Publication.

[2] Data Structures and Algorithms in C++", M.T. Goodrich, R. Tamassia and D. Mount, Wiley India.

**REFERENCES:**

[1] Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Second Edition, Galgotia Publication.

[2] Data structures with C++, J. Hubbard, Schaum's outlines, TMH.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Explain the basic concepts of time and space complexity, divide-and-conquer Strategy, dynamic programming, greedy and approximate algorithms.
CO2	Describe the methodologies of how to analyze an algorithm
CO3	Describe the data structures of graph coloring and back tracking
CO4	Design a better algorithm to solve the problems.
CO5	Know about branch and bound techniques.
CO6	To know the concept Travelling Salesman Problem.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS032</b>	<b>EMBEDDED SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Computer Organization and Architecture				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability				

**UNIT I INTRODUCTION TO EMBEDDED SYSTEMS****9**

Introduction To Embedded Systems – The Build Process For Embedded Systems- Structural Units in Embedded Processor , Selection Of Processor & Memory Devices- DMA – Memory Management Methods- Timer And Counting Devices, Watchdog Timer, Real Time Clock, In Circuit Emulator, Target Hardware Debugging.

**UNIT II EMBEDDED NETWORKING****9**

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus Communication Protocols – RS232 Standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –Need For Device Drivers.

**UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9**

Embedded Product Development Life Cycle- Objectives, Different Phases Of EDLC, Modelling Of EDLC; Issues In Hardware-Software Co-Design, Data Flow Graph, State Machine Model, Sequential Program Model, Concurrent Model, Object Oriented Model.

**UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9**

Introduction To Basic Concepts Of RTOS- Task, Process & Threads, Interrupt Routines In RTOS, Multiprocessing And Multitasking, Preemptive And Non Preemptive Scheduling, Task Communication shared Memory, Message Passing-, Inter Process Communication – Synchronization Between Processes-Semaphores, Mailbox, Pipes, Priority Inversion, Priority Inheritance, Comparison of Real Time Operating Systems: Vx Works, ̢C/OS-II, RT Linux.

**UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT 9**

Case Study Of Washing Machine- Automotive Application- Smart Card System Application.

**TEXT BOOKS:**

- [1] Rajkamal, ‘Embedded System-Architecture, Programming, Design’, Mc Graw Hill, 2013.
- [2] Peckol, “Embedded System Design”, John Wiley & Sons,2010.
- [3] Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013.

**REFERENCES:**

- [1] Shibu. K.V, “Introduction To Embedded Systems”, Tata Mcgraw Hill,2009.
- [2] Elicia White,” Making Embedded Systems”, O’ Reilly Series,SPD,2011.
- [3] Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.
- [4] Han-Way Huang, ”Embedded System Design Using C8051”, Cengage Learning,2009.
- [5] Rajib Mall “Real-Time Systems Theory And Practice” Pearson Education, 2007.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Explain the basic concepts of time and space complexity, divide-and-conquer Strategy, dynamic programming, greedy and approximate algorithms.
CO2	Describe the methodologies of how to analyze an algorithm.
CO3	Describe the data structures of graph coloring and back tracking.
CO4	Design a better algorithm to solve the problems.
CO5	Know about branch and bound techniques.
CO6	To understand embedded system development.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS033</b>	<b>FUZZY SETS &amp; FUZZY LOGIC</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Probability and Statistics				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	Students can understand about Fuzzy logic, Fuzzy set and defuzzification methods.				

**UNIT I CRISP SETS AND FUZZY SETS 9**

Crisp sets: overview – Notion of Fuzzy sets- Basic concepts- Classical Logic Fuzzy Logic – Operations on Fuzzy sets- Fuzzy complement- Fuzzy Union – Fuzzy Intersection- Combinations of operations- General Aggregation operations.

**UNIT II FUZZY RELATIONS 9**

Crisp and Fuzzy relations- Binary relations – Binary relations on a single set – Equivalence and similarity relations- compatibility or tolerance relations – orderings – morphisms – Fuzzy relation equations.

**UNIT III FUZZY MEASURES 9**

Fuzzy measures- Belief and Plausibility measures- Probability measures – Possibility and Necessity measures- Relationship among classes of Fuzzy measures.

**UNIT IV UNCERTAINTY AND INFORMATION 9**

Types of Uncertainty – Measures of Fuzziness – Classical measures of Uncertainty – Measures of Dissonance – Measures of confusion – Measures of Non-specificity – Uncertainty and information – Information and complexity – principles of uncertainty and information.

**UNIT V APPLICATIONS 9**

Applications in Natural, life and social sciences- Engineering – Medicine – Management and Decision making – computer Science- Systems Science – other applications.

**TEXT BOOK:**

1. George J. Klir& Tina Folger A., “Fuzzy sets Uncertainty & Information”, PHI Learning Pvt.Ltd,2010

**REFERENCES:**

- 1 Timothy J.Ross, ”Fuzzy Logic with Engineering applications”,John Wiley and Sons, 2010
2. Jang J.S.R. Sun C.T., Mizutani E.,”Neuro fuzzy and Soft Computing”, PHI Learning Pvt. Ltd., 2012.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Learn the unified and exact mathematical basis as well as the general.
CO2	Principles of various soft computing techniques.
CO3	Provide detailed theoretical and practical aspects of intelligent
CO4	Modeling, optimization and control of non-linear systems.
CO5	Prepare the students for developing intelligent systems through case.
CO6	To understand Applications in Natural, life and social sciences.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PECS034	WEB ANALYTICS			L	T	P	C
	Total Contact Periods – 45			2	0	2	3
	Prerequisite – Data ware housing and Datamining						
	Course Designed by – Department of Computer Science & Engineering						
OBJECTIVES	Dramatic advances in data capture, processing power, data transmission, and storage capabilities are enabling organizations to integrate their various databases.						

### UNIT-I INTRODUCTION

9

Web analytics-Importance of Web Analytics-Web Analytics Process-Google Analytics-Audience Analysis-Acquisition Analysis-Behavior Analysis-Conversion Analysis. Optimizely-Kiss metrics-Key Metrics.

### UNIT-II OLAP, WEB DATA EXPLORATION AND REPORTING

9

Web analytics at e-Business scale-Framework for mapping business needs to web analytics tasks-Data collection architecture - OLAP- Web data exploration and reporting - Splunk-Computational advertisement-Display and search advertising.

### UNIT-III WEB ANALYTICS TOOLS

9

Introduction to Google Ad Words and O2MC-Simulation tool-Knowledge discovery from web data-Major computing paradigms-Typical problem formulations-R, KNIME, MOA, WEKA, Rapid Miner.

### UNIT-IV CLASSIFICATION

9

Predictive modeling. Classification-Generative and discriminative models-Classification vs. regression vs. ranking vs. prediction-Active learning and semi-supervised learning-Dimensionality reduction-Sampling-Discretization.

### UNIT-V CLUSTERING

9

Predictive modeling. Evaluation-Cross-validation vs. prequential evaluation-Cost-sensitive classification-Translate business problem to data mining problem-Partitional clustering (kMeans and DBSCAN)-Hierarchical clustering (AHC)-Evaluation of clustering (statistical vs. utility-based)-Pattern mining-Frequent itemset mining-Frequent sequence mining.

### TEXT BOOKS:

1. Web Analytics 2.0, Avinash Kaushik, Wiley India Private Limited,2012.
2. Web Analytics, Zumstein Darius,Sudwestdeutscher Verlag Fur Hochschulschriften AG, ISBN: 9783838151311, 3838151313,2014.

COURSE OUTCOMES (COs)	
CO1	Provide efficient distribution of information and easy access to data.
CO2	Create user friendly reporting environment.
CO3	Find the unseen pattern in large volume of historical data that helps to manage an organization efficiently.
CO4	Understand the concepts of various data mining Techniques.
CO5	Explain the Architecture of Data warehousing.

CO6	To Understand classification and Clustering Techniques
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<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PECS035	EVENT DRIVEN COMPUTING				L	T	P	C
	Total Contact Periods – 45				2	0	2	3
	Prerequisite – Object Oriented Programming							
	Course Designed by – Department of Computer Science & Engineering							
<b>OBJECTIVES</b>	Students can understand about Visual Basic and IDE.							

### **UNIT I INTRODUCTION TO VISUAL BASIC 9**

Integrated Development Environment (IDE) – Features, Event driven programming, Programming Constructs: Data Types, Variable, Constant, Operator, System defined Function, Dialog Box and Creating User Interface Control flow statement: if-then, select-case, for-next, while wend, do-loop statement. With..End, Type of Event.

### **UNIT II VB CONTROL 9**

Form, Label, Textbox, Frame, Checkbox, Option Button, List Box, Combo Box, Timer, Scrollbar, Picture, Image, File Controls, Artwork control.

### **UNIT III PROCEDURE VISUAL BASIC CONTROL 9**

ActiveX Control: Tab Strip, Status Bar, Slider, Month View, DTPicker, Rich Text Box, Common Dialog Procedure: Types of Procedure, Subroutine, Function, Module

### **UNIT IV MENU, INTERFACE AND ARRAYS 9**

Menu Editor, Creating Menus, Utility features provided by menu editor, modifying menu at run time, pop-up menu, Creating Toolbar using Image List Interface: SDI, MDI, Array: One Dimensional Array, Built-in Array function, For..Each Loop, Arrays Types.

### **UNIT V ACTIVEX DATA OBJECT 9**

Data & ADODC Control, Connecting ADODC to Bound Control, Use of ADO Object, ADO Architecture, ADO Object Methods for Editing, Updating and Searching Data Environment, Data Report, Debugging and Error Handling: Types of Error, Debugging, Handling Run Time Error.

### **TEXTBOOKS:**

- 1) Steve Brown, "Visual Basic 6.0 Complete", Complete Idiot's Books.
- 2) Dr. S.B. Kishor, "Front End Development using Visual Basic", Das Ganu Prakashan,

- 3) Evangelos Petroustos, "Mastering Visual Basic 6", BPB, 2005 ISBN-81-7635-269-1.  
 4) Moel Jerke, "Complete Reference Visual Basic 6", TMH, 2004, ISBN -0-07-463666-9.

**REFERENCES:**

- 1) Peter Norton's, "Visual Basic 6.0", SAMS tec-Media, 2006, ISBN-81-7635-150-4  
 2) Michael Halvorson, "Learn Visual Basic 6.0 Now", PHI, ISBN 0-7356-0729-X  
 3) Michael Vine, "Visual Basic Programming – For Absolute Beginner", PHI.  
 4) Paul Sheriff, "Teaches Visual Basic 6", PHI, 978-8120315624.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Learn basic Visual basic IDE and Operations.
CO2	Learn various VB Controls.
CO3	Understand Procedure and Modules.
CO4	Learn Menu, Interfaces and Arrays.
CO5	Learn Activex Data Object and Error Handling.
CO6	To Understand Data & ADODC Control, Connecting ADODC to Bound Control

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M		M		H							M
CO2	M		M		H							M
CO3	M		M		H							M
CO4	M		M		H							M
CO5	M		M		H							M
CO6	M		M		H							M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS036</b>	<b>CRYPTOGRAPHY AND NETWORK SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	2	0	2	3
	Prerequisite – Computer Networks				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>To understand Cryptography Theories, Algorithms and Systems.</li> <li>To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.</li> </ul>				

**UNIT I INTRODUCTION**

**9**

Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, Steganography- Foundations of modern cryptography:

**UNIT II SYMMETRIC KEY CRYPTOGRAPHY**

**9**

**MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY:** Algebraic structures – Modular arithmetic-Euclid’s algorithm- Congruence and matrices – Groups, Rings, Fields-Finite fields- **SYMMETRIC KEY CIPHERS:** SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 – Key distribution.

**UNIT III PUBLIC KEY CRYPTOGRAPHY**

**9**

**MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY:** Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – **ASYMMETRIC KEY CIPHERS:** RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509.

**UNIT V SECURITY PRACTICE AND SYSTEM SECURITY**

**9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**TEXT BOOK:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3<sup>rd</sup> Edition, 2006.

**REFERENCES:**

2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
3. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
4. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019

<b>COURSE OUTCOMES (COs)</b>	
CO1	Should be able to identify network security threats and determine efforts to counter them.
CO2	Should be able to write code for relevant cryptographic algorithms.
CO3	Should be able to write a secure access client for access to a server.
CO4	Should be able to learn Message authentication and integrity.
CO5	Should be able to determine firewall, Web Security.
CO6	To understand system security and security practices.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	L	H	H	H	L	M					M	M
<b>CO2</b>	L	H	H	H	L	M					M	M
<b>CO3</b>	L	H	H	H	L	M					M	M
<b>CO4</b>	L	H	H	H	L	M					M	M
<b>CO5</b>	L	H	H	H	L	M					M	M
<b>CO6</b>	L	H	H	H	L	M					M	M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

## PROGRAMME ELECTIVE-IV

<b>U18PECS041</b>	<b>PARALLEL AND DISTRIBUTED ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Data structures & Algorithms				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"><li>• To realize the need of parallel processing, to cater the applications that requires a system capable of sustaining trillions of operations per second on very large data sets.</li><li>• To understand the need of data integration over data centralization.</li></ul>				

### **UNIT I INTRODUCTION 9**

Introduction- Benefits and Needs- Parallel and Distributed Systems- Programming Environment- Theoretical Foundations- Parallel Algorithms— Introduction- Parallel Models and Algorithms- Sorting- Matrix Multiplication- Convex Hull- Pointer Based Data Structures.

### **UNIT II SYNCHRONIZATION 9**

Synchronization- Process Parallel Languages- Architecture of Parallel and Distributed Systems- Consistency and Replication- Security- Parallel Operating Systems.

### **UNIT III PARALLEL COMPUTING 9**

Management of Resources in Parallel Systems- Tools for Parallel Computing- Parallel Database Systems and Multimedia Object Servers.

### **UNIT IV DISTRIBUTED COMPUTING 9**

Networking Aspects of Distributed and Parallel Computing- Process- Parallel and Distributed Scientific Computing.

### **UNIT V HIGH PERFORMANCE COMPUTING 9**

High-Performance Computing in Molecular Sciences- Communication- Multimedia Applications for Parallel and Distributed Systems- Distributed File Systems.

### **REFERENCES:**

1. Jacek Błażewicz, et al., “Handbook on parallel and distributed processing”, Springer Science & Business Media, 2013.
2. Andrew S. Tanenbaum, and Maarten Van Steen, “Distributed Systems: Principles and Paradigms”. Prentice-Hall, 2007.
3. George F.Coulouris, Jean Dollimore, and Tim Kindberg, “Distributed systems: concepts and design”, Pearson Education, 2005.
4. Gregor Kosec and Roman Trobec, “Parallel Scientific Computing: Theory, Algorithms, and Applications of Mesh Based and Meshless Methods”, Springer, 2015.

<b>COURSE OUTCOMES (COs)</b>												
CO1	Acquire knowledge on the need, issues, design and application of both parallel and distributed databases.											
CO2	Know how to write optimal queries to cater applications of that need these forms of databases.											
CO3	An able to fragment, replicate and localize their data as well as their queries to get their work done faster.											
CO4	Get idea on other similar trends of optimal data processing.											
CO5	Understand about Transaction management and web data management.											
CO6	To understand concepts about high performance computing.											
<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS042</b>	<b>MOBILE COMMUNICATIONS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45				3	0	0	3
	Prerequisite – Computer Networks							
	Course Designed by – Department of Computer Science & Engineering							
<b>OBJECTIVES</b>	Students can understand about Cellular standards and Applications.							

## **UNIT I INTRODUCTION**

**9**

Cellular concepts: Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards-Signal propagation: Propagation mechanism reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing Multiple access schemes: FDMA, TDMA, CDMA and SDMA.

## **UNIT II 3G AND 4G CELLULAR NETWORKS**

**9**

Migration to 3G Networks – IMT 2000 and UMTS – UMTS Architecture – User Equipment – Radio Network Subsystem – UTRAN – Node B – RNC functions – USIM – Protocol Stack – CS and PS Domains – IMS Architecture – Handover – 3.5G and 3.9G a brief discussion – 4G LAN and Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC and MAC – WiMaxIEEE 802.16d/e – WiMax Internetworking with 3GPP.

## **UNIT IIISENSOR AND MESH NETWORKS**

**9**

Sensor Networks – Role in Pervasive Computing – In Network Processing and Data Dissemination –Sensor Databases – Data Management in Wireless Mobile Environments – Wireless Mesh Networks– Architecture – Mesh Routers – Mesh Clients – Routing – Cross

**UNIT IV CONTEXT AWARE COMPUTING**

**9**

Adaptability – Mechanisms for Adaptation - Functionality and Data – Transcoding – Location Aware Computing – Location Representation – Localization Techniques – Triangulation and Scene Analysis– Delaunay Triangulation and Voronoi graphs – Types of Context – Role of Mobile Middleware –Adaptation and Agents – Service Discovery Middleware

**UNIT V APPLICATION DEVELOPMENT**

**9**

Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME –Programming for CLDC – GUI in MIDP – Application Development on Android and iPhone.

**TEXT BOOKS:**

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing: Technology, Applications and Service Creation”, Second Edition, Tata McGraw Hill, 2010.
2. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley, 2010.
3. Pei Zheng and Lionel M Li, “Smart Phone & Next Generation Mobile Computing”, MorganKaufmann Publishers, 2006.

**REFERENCE BOOKS:**

1. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley, 2010.
2. Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and Interactions”, Wiley,2009.
3. Frank Adelstein, “Fundamentals of Mobile and Pervasive Computing”, TMH, 2005.
4. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufmann Publishers,2004.
5. JochenBurthardt et al, “Pervasive Computing: Technology and Architecture of Mobile InternetApplications”, Pearson Education, 2003.
6. Uwe Hansmaan et al, “Principles of Mobile Computing”, Springer, 2003.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Apply knowledge of Cellular concepts: Cell structure.
CO2	Design, implement and maintain Sensor networks.
CO3	Understand Sensor and Mesh networks.
CO4	Understand about Context aware computing.
CO5	Learn about Model View Controller Architecture.
CO6	To Understand Three tier architecture and Model View Controller Architecture

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	H	H	H		M	M						
<b>CO2</b>	H	H	H		M	M						

<b>CO3</b>	H	H	H		M	M						
<b>CO4</b>	H	H	H		M	M						
<b>CO5</b>	H	H	H		M	M						
<b>CO6</b>	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS043</b>	<b>NEURAL NETWORKS AND DEEP LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Data structures and Algorithms				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	Understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.				

### **UNIT 1 AN INTRODUCTION TO NEURAL NETWORKS 9**

Introduction, The Basic Architecture of Neural Networks, Training a Neural Network with Back propagation, Practical Issues in Neural Network Training, The Secrets to the Power of Function Composition, Common Neural Architectures.

### **UNIT II MACHINE LEARNING WITH SHALLOW NEURAL NETWORKS 9**

Introduction, Neural Architectures for Binary Classification Models, Neural Architectures for Multiclass Models ,Matrix Factorization with Auto encoders ,Word2vec: An Application of Simple Neural Architectures.

### **UNIT III RECURRENT NEURAL NETWORKS 9**

Introduction , The Architecture of Recurrent Neural Networks, The Challenges of Training Recurrent Networks, Echo-State Networks, Long Short-Term Memory , Gated Recurrent Units (GRUs), Applications of Recurrent Neural Networks, Convolutional Neural Networks, The Basic Structure of a Convolutional Network , Case Studies of Convolutional Architectures, AlexNet , ZFNet, VGG, GoogLeNet.

### **UNIT IV DEEP REINFORCEMENT LEARNING 9**

Introduction , Stateless Algorithms, Multi-Armed Bandits , Naive , Greedy Algorithm, Upper Bounding Methods , The Basic Framework of Reinforcement Learning , Challenges of Reinforcement Learning , Bootstrapping for Value Function Learning, Policy Gradient Methods

### **UNIT V ADVANCED TOPICS IN DEEP LEARNING 9**

Attention Mechanisms , Recurrent Models of Visual Attention, Application to Image Captioning, Attention Mechanisms for Machine Translation, , Neural Networks with External Memory , Generative Adversarial Networks (GANs), Competitive Learning.

#### **TEXT BOOKS:**

1. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education, 2004.
2. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.

<b>COURSE OUTCOMES (COs)</b>	
CO1	The role of neural networks in engineering, artificial intelligence, and cognitive modeling.
CO2	Feed-forward neural networks of increasing complexity, gradient descent learning and extensions, learning and generalization theory.
CO3	Hopfield model of content-addressable memory, Hopfield-Tank approach to optimization, resistive networks for vision models, complex dynamical learning models.
CO4	Generalization and function approximation
CO5	To have a knowledge of sufficient theoretical background to be able to reason about the behaviour of neural networks.
CO6	To analyze Attention Mechanisms , Recurrent Models of Visual Attention.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PECS044	<b>DATA VISUALIZATION</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45				3	0	0	3
	Prerequisite – Statistics							
	Course Designed by – Department of Computer Science & Engineering							
<b>OBJECTIVES</b>	Understand the concept of presentation of data in graphics and image formats							

### **UNIT I CORE SKILLS FOR VISUAL ANALYSIS 9**

Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views– focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

### **UNIT II TIME-SERIES, RANKING, AND DEVIATION ANALYSIS 9**

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.

### **UNIT III DISTRIBUTION, CORRELATION, MULTIVARIATE ANALYSIS 9**

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations –

correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

**UNIT IV INFORMATION DASHBOARD DESIGN 9**

Information dashboard – categorizing dashboards – typical dashboard data – dashboard design issues and best practices – visual perception – limits of short-term memory – visually encoding data – Gestalt principles – principles of visual perception for dashboard design.

**UNIT V INFORMATION DASHBOARD DESIGN 9**

Characteristics of dashboards – key goals in visual design process – dashboard display media – designing dashboards for usability – meaningful organization – maintaining consistency – aesthetics of dashboards – testing for usability – case studies: sales dashboard, CIO dash board, Tele sales dashboard, marketing analysis dashboard.

**REFERENCES:**

1. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.
2. Stephen Few, "Information dashboard design: The effective visual communication of data", O'Reilly, 2006.
3. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
4. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
5. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
6. Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
7. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Understand about Data Visualization analysis and Tools.
CO2	Learn about Time-series analysis
CO3	Understand Distribution, Correlation, Multivariate Analysis
CO4	Learn Information dashboard ,Categorizing dashboards
CO5	To have a knowledge of Characteristics of dashboards and key goals in visual design process
CO6	To understand information dashboard design concepts

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS045</b>	<b>HUMAN AND COMPUTER INTERACTION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Computer Architecture				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>• Learn the foundations of Human Computer Interaction</li> <li>• Be familiar with the design technologies for individuals and persons with disabilities</li> <li>• Be aware of mobile Human Computer interaction.</li> </ul>				

### **UNIT 1 I/O CHANNELS & MEMORY 9**

I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models– frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

### **UNIT 2 INTERACTIVE DESIGN BASICS 9**

Interactive Design basics – process – scenarios – navigation – screen design –Iteration and prototyping. HCI in software process – software life cycle –usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

### **UNIT 3 COGNITIVE MODELS 9**

Cognitive models –Socio-Organizational issues and stake holder requirements– Communication and collaboration models-Hypertext, Multimedia and WWW.

### **UNIT 4 MOBILE ECOSYSTEM 9**

Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

### **UNIT 5 DESIGNING WEB INTERFACES 9**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. Recent Trends: Speech Recognition and Translation, Multimodal System.

#### **TEXT BOOKS:**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rdEdition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, “Mobile Design and Development”, First Edition , OReilly Media Inc., 2009 (UNIT –IV)
3. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, OReilly, 2009.(UNIT-V)

**REFERENCE:**

1. [https://www.tutorialspoint.com/human\\_computer\\_interface/pdf\\_version.html](https://www.tutorialspoint.com/human_computer_interface/pdf_version.html)

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Understand fundamental design and evaluation methodologies of human computer interaction.
<b>CO2</b>	Design an interactive web interface on the basis of models studied
<b>CO3</b>	Understand the structure of cognitive models
<b>CO4</b>	Learn about Mobile Eco system design and tools.
<b>CO5</b>	Understand about Designing web interface and recent trends.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	H	M	H	M	M	M						
<b>CO2</b>	H	M	H	M	M	M						
<b>CO3</b>	H	M	H	M	M	M						
<b>CO4</b>	H	M	H	M	M	M						
<b>CO5</b>	H	M	H	M	M	M						
<b>CO6</b>	H	M	H	M	M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS046</b>	<b>SOFTWARE AND APPLICATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Computer Networks				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>• Describe today’s increasing network security threats and explain the need to implement a comprehensive security policy to mitigate the threats.</li> <li>• Explain general methods to mitigate common security threats to network devices, hosts, and applications.</li> </ul>				

**UNIT-I INTRODUCTION****9**

Basic concepts-threats, vulnerabilities, controls; risk; confidentiality, integrity-availability; security policies, security mechanisms; assurance; prevention-detection, deterrence.

**UNIT-II CRYPTOGRAPHY AND PROGRAM SECURITY****9**

Basic cryptography - Basic cryptographic terms- Historical background- Symmetric crypto primitives- Modes of operation- Cryptographic hash functions- Asymmetric crypto primitives- Program security.

**UNIT-III MALICIOUS ATTACKS****9**

Malicious code: viruses, Trojan horses, worms- Program flaws: buffer overflows, time-of-check to time-of-use flaws-incomplete mediation- Defenses- Software development controls- Testing techniques.

**UNIT-IV SECURITY IN CONVENTIONAL OPERATING SYSTEMS****9**

Memory, time, file, object protection requirements and techniques- Protection in contemporary operating systems- Identification and authentication- Identification goals- Authentication requirements-Human authentication- Machine authentication.

**TRUSTED OPERATING SYSTEMS**

Assurance; trust- Design principles- Evaluation criteria- Evaluation process- Database management-Systems security - Database integrity- Database secrecy- Inference control- Multilevel databases.

**UNIT-V NETWORK SECURITY****9**

Network threats: eavesdropping, spoofing, modification, denial of service attacks- Introduction to network security techniques: firewalls, virtual private networks-intrusion detection- Management of security- Security policies- Risk analysis- Physical threats and controls- Legal aspects of security- Privacy and ethics.

**TEXT BOOKS:**

- 1.The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities, John McDonald , Mark Down , Justin Schuh,2006.
2. William Stallings, “Cryptography And Network Security Principles and Practices”, Prentice Hall of India, 3<sup>rd</sup> Edition, 2003.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Should be able to identify network security threats and determine efforts to counter them.
CO2	Should be able to write code for relevant cryptographic algorithms.
CO3	Should be able to write a secure access client for access to a server.
CO4	Understand Security in Conventional and Trusted Operating System.
CO5	Should be able to determine firewall requirements, and configure a firewall.
CO6	To Understand Network threats like eavesdropping, spoofing, modification, denial of service attacks.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	L	H	H	H	L	M					M	M
<b>CO2</b>	L	H	H	H	L	M					M	M
<b>CO3</b>	L	H	H	H	L	M					M	M
<b>CO4</b>	L	H	H	H	L	M					M	M
<b>CO5</b>	L	H	H	H	L	M					M	M
<b>CO6</b>	L	H	H	H	L	M					M	M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

**PROGRAMME ELECTIVE-V**

<b>U18PECS051</b>	<b>QUANTUM COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Mathematics				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	Students will be well versed in Quantum computation and algorithms, Basic quantum mechanics, quantum cryptographic protocols, quantum teleportation, polynomial-time factoring, quantum error correction, and a new graphical calculus for reasoning about quantum systems				

**UNIT I FOUNDATION 9**

Overview of traditional computing – Church-Turing thesis – circuit model of computation – reversible computation – quantum physics – quantum physics and computation – Dirac notation and Hilbert Spaces – dual vectors – operators – the spectral theorem – functions of operators – tensor products – Schmidt decomposition theorem.

**UNIT II QUBITS AND QUANTUM MODEL OF COMPUTATION 9**

State of a quantum system – time evolution of a closed system – composite systems – measurement – mixed states and general quantum operations – quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations – quantum circuits.

**UNIT III QUANTUM ALGORITHMS – I 9**

Superdense coding – quantum teleportation – applications of teleportation – probabilistic versus quantum algorithms – phase kick-back – the Deutsch algorithm – the Deutsch-Jozsa algorithm – Simon's algorithm – Quantum phase estimation and quantum Fourier Transform.

**UNIT IV QUANTUM ALGORITHMS – II 9**

Order-finding problem – eigen value estimation approach to order finding – Shor's algorithm for order finding – finding discrete logarithms – hidden subgroups – Grover's quantum search algorithm – amplitude amplification – quantum amplitude estimation – quantum counting – searching without knowing the success probability.

**UNIT V QUANTUM COMPUTATIONAL COMPLEXITY 9**

Computational complexity – black-box model – lower bounds for searching – general black-box lower bounds – polynomial method – block sensitivity – adversary methods – classical error correction – classical three-bit code – fault tolerance – quantum error correction – three- and nine-qubit quantum codes – fault-tolerant quantum computation.

**TEXTBOOK:**

1. P. Kaye, R. Laflamme, and M. Mosca, “An introduction to Quantum Computing”, Oxford University Press, 1999.

**REFERENCE:**

1. V. Sahni, “Quantum Computing”, Tata McGraw-Hill Publishing Company, 2007.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Should be able to translate fluently between the major mathematical representations
CO2	Should be able to ‘implement’ basic quantum algorithms,
CO3	To Understand quantum decoherence in systems for computation,
CO4	To Understand eigen value estimation approach to order finding
CO5	To Learn quantum error correction.
CO6	To understand Computational complexity and black-box model.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS052</b>	<b>REAL TIME SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Database Management System				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	The main objective of this course is to cover the principles and design methods of real-time computer systems. It covers the interfacing techniques and microprocessor system realization. The principles of real-time operating systems and real-time software system				

**UNIT I INTRODUCTION****9**

Issues in Real Time Computing, Structure of a Real Time System. Task Classes, Performance Measures for Real Time Systems, Estimating Program Run times. Task Assignment and Scheduling -Classical Uniprocessor scheduling algorithms, UniProcessor.

scheduling of IRIS Tasks, Task Assignment, Mode Changes, and Fault Tolerant Scheduling.

**UNIT II PROGRAMMING LANGUAGES AND TOOLS 9**

Programming Language and Tools – Desired Language characteristics, Data Typing, Control structures, Facilitating Hierarchical Decomposition, Packages, Runtime (Exception) Error handling, Overloading and Generics, Multitasking, Low Level programming, Task scheduling, Timing Specifications, Programming Environments, Run-time Support.

**UNIT III REAL TIME DATABASES 9**

Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency Control Issues, Disk Scheduling Algorithms, Twophase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time systems.

**UNIT IV COMMUNICATION 9**

Real-Time Communication - Communications Media, Network Topologies Protocols, Fault Tolerant Routing. Fault Tolerance Techniques - Fault Types, Fault Detection. Fault Error containment Redundancy, Data Diversity, Reversal Checks, Integrated Failure handling.

**UNIT V EVALUATION TECHNIQUES 9**

Reliability Evaluation Techniques - Obtaining Parameter Values, Reliability Models for Hardware Redundancy, Software Error models. Clock Synchronization - Clock, A Nonfault-Tolerant Synchronization Algorithm, Impact of Faults, Fault Tolerant Synchronization in Hardware, Fault Tolerant Synchronization in Software

**TEXT BOOK:**

1. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, McGraw-Hill International Editions, 1997.

**REFERENCES:**

1. Stuart Bennett, “Real Time Computer Control-An Introduction”, Second edition Prentice Hall PTR, 1994.
2. Peter D. Lawrence, “Real time Micro Computer System Design – An Introduction”, McGraw Hill, 1988.
3. S.T. Allworth and R.N. Zobel, “Introduction to real time software design”, Macmillan, II Edition, 1987.
4. R.J.A Buhur, D.L. Bailey, “ An Introduction to Real-Time Systems”, Prentice-Hall International, 1999.
5. Philip.A.Laplante “Real Time System Design and Analysis” PHI , III Edition, April 2004.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Understand the basics and importance of real-time systems.
CO2	Generate a high-level analysis document based on requirements specifications

CO3	Understand basic multi-task scheduling algorithms for periodic, a periodic.
CO4	Understand Real-Time Communication and Communications Media.
CO5	Understand Reliability Evaluation Techniques ,Obtaining Parameter Values.
CO6	To understand various Evaluation Techniques.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS053</b>	<b>SOFT COMPUTING</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45					3	0	0	3
	Prerequisite: Artificial Intelligence, Machine Learning								
	Course Designed by : Dept. of Computer Science and Engineering								
<b>OBJECTIVES</b>									
<ul style="list-style-type: none"> <li>To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.</li> <li>To implement soft computing based solutions for real-world problems.</li> <li>To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.</li> <li>To provide student an hand-on experience on MATLAB to implement various strategies</li> </ul>									

### **UNIT 1 UNDERSTANDING ABOUT SOFT COMPUTING 9**

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

### **UNIT 2 FUZZY LOGIC 9**

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

### **UNIT 3 NEURAL NETWORKS 9**

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks,

Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

**UNIT4 GENETIC ALGORITHMS**

**9**

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

**UNIT 5 MATLAB/PYTHON LIB**

**9**

Introduction to MAT Lab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic , Recent Trends' in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

**TEXT BOOKS:**

- 1.Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, Prentice Hall, 1995.

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Identify and describe soft computing techniques and their roles in building intelligent machines.
<b>CO2</b>	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
<b>CO3</b>	Apply genetic algorithms to combinatorial optimization problems.
<b>CO4</b>	Evaluate and compare solutions by various soft computing approaches for a given problem.
<b>CO5</b>	Learn Arrays and array operations, Functions and Files, neural network.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	H	H	H		M	M						
<b>CO2</b>	H	H	H		M	M						
<b>CO3</b>	H	H	H		M	M						
<b>CO4</b>	H	H	H		M	M						
<b>CO5</b>	H	H	H		M	M						
<b>CO6</b>	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS054</b>	<b>BUSINESS INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Database Management System				
	Course Designed by : Dept. of Computer Science and Engineering				
<b>OBJECTIVE</b>					
The objective of this course is to explore business intelligence and data mining, using powerful user friendly tools, with exposure to real world business applications.					

**UNIT I BUSINESS INTELLIGENCE 9**  
 Effective And Timely Decisions – Data, Information And Knowledge – Role Of Mathematical Models – Business Intelligence Architectures: Cycle of A Business Intelligence Analysis – Enabling Factors In Business Intelligence Projects – Development of a Business Intelligence System – Ethics And Business Intelligence.

**UNIT II KNOWLEDGE DELIVERY 9**  
 The Business Intelligence User Types, Standard Reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports And Self-Service Reporting, Dimensional Analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards And Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing The Presentation For The Right Message.

**UNIT III EFFICIENCY 9**  
 Efficiency Measures – The CCR Model: Definition Of Target Objectives- Peer Groups – Identification Of Good Operating Practices; Cross Efficiency Analysis – Virtual Inputs And Outputs – Other Models. Pattern Matching – Cluster Analysis, Outlier Analysis.

**UNIT IV BUSINESS INTELLIGENCE APPLICATIONS 9**

Marketing Models – Logistic And Production Models – Case Studies.

**UNIT V FUTURE OF BUSINESS INTELLIGENCE 9**  
 Future of Business Intelligence – Emerging Technologies, Machine Learning, Predicting The Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future Beyond Technology.

**TEXT BOOK:**

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support And Business Intelligence Systems”, 9<sup>th</sup> Edition, Pearson 2013.

**REFERENCES:**

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle Of Decision Making”, Addison Wesley, 2003.
2. Carlo Vercellis, “Business Intelligence: Data Mining And Optimization For Decision Making”, Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager“S Guide”, Second Edition, 2012.
4. Cindi Howson, “Successful Business Intelligence: Secrets To Making BI A Killer App”, McGraw-Hill, 2007.

5.Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, Wiley Publication Inc.,2007.

<b>COURSE OUTCOMES (COs)</b>	
CO1	To Understand the basics Business Intelligence.
CO2	Learn Standard Reports, Interactive Analysis and Ad Hoc Querying.
CO3	To Understand Efficiency Measures and CCR Model.
CO4	To Understand business Intelligence applications.
CO5	To Understand BI Applications and Machine learning.
CO6	Future of Business Intelligence

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS055</b>	<b>COMPUTER GRAPHICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Computer Architecture				
	Course Designed by : Dept. of Computer Science and Engineering				
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• Be familiar with both the theoretical and practical aspects of computing with images.</li> <li>• Have described the foundation of image formation, measurement, and analysis.</li> <li>• Understand the geometric relationships between 2D images and the 3D world.</li> </ul>					

## **UNIT I INTRODUCTION**

**9**

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

## **UNITII TWO DIMENSIONAL GRAPHICS**

**9**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline,

viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

### **UNIT III THREE DIMENSIONAL GRAPHICS**

**9**

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces.

**TRANSFORMATION AND VIEWING:** Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

### **UNIT IV ILLUMINATION AND COLOUR MODELS**

**9**

Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.

### **UNIT V ANIMATIONS & REALISM ANIMATION GRAPHICS**

**9**

Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening. **COMPUTER GRAPHICS REALISM:** Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

#### **TEXT BOOKS:**

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,”Computer Graphics: Principles and Practice”, , 3rd Edition, Addison- Wesley Professional,2013. (UNIT I, II, III, IV).
2. Donald Hearn and Pauline Baker M, “Computer Graphics”, Prentice Hall, New Delhi, 2007 (UNIT V).

#### **REFERENCES:**

1. Donald Hearn and M. Pauline Baker, Warren Carithers,“Computer Graphics With Open GL”, 4th Edition, Pearson Education, 2010.
2. Jeffrey McConnell, “Computer Graphics: Theory into Practice”, Jones and Bartlett Publishers, 2006.
3. Hill F S Jr., “Computer Graphics”, Maxwell Macmillan” , 1990.
4. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.
5. William M. Newman and Robert F.Sproull, “Principles of Interactive Computer Graphics”, Mc GrawHill 1978.

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Developed the practical skills necessary to build computer vision applications.
<b>CO2</b>	To have gained exposure to object and scene recognition and categorization from images.
<b>CO3</b>	Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.
<b>CO4</b>	Implement motion related techniques.
<b>CO5</b>	To Develop applications using computer vision techniques.
<b>CO6</b>	To Design of Animation sequences and animation function

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	M		M		H							M
<b>CO2</b>	M		M		H							M
<b>CO3</b>	M		M		H							M
<b>CO4</b>	M		M		H							M
<b>CO5</b>	M		M		H							M
<b>CO6</b>	M		M		H							M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS056</b>	<b>WEB SECURITY</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45				3	0	3	3
	Prerequisite – Computer Network							
	Course Designed by – Department of Computer Science & Engineering							
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>Describe today's increasing network security threats and explain the need to implement a comprehensive security policy to mitigate the threats.</li> <li>Explain general methods hosts, and to mitigate common security threats to network devices, applications.</li> <li>Describe the functions of common security appliances and applications.</li> <li>Describe security recommended practices including initial steps to secure network devices.</li> </ul>							

## **UNIT I      BASICS OF CRYPTOGRAPHY      9**

Basic of Cryptography, secret key cryptography, Types of attack, Substitution ciphers, Transposition ciphers, block ciphers and stream ciphers, Confusion and Diffusion, Data encryption standard, round function, modes of operation, cryptanalysis, brute force attack, Security Goals (Confidentiality, Integrity, Availability).

## **UNIT II      CRYPTOGRAPHIC ALGORITHMS      9**

Public key Cryptography, Modulo arithmetic, Greatest common divisor, Euclidean algorithm, RSA algorithm, hash function, attack on collision resistance, Diffie-Hellman key exchange, Digital signature standard, elliptic curve cryptography

One way Authentication, password based, certificate based, Mutual Authentication ,shared secret based, Asymmetric based, Authentication and key agreement, centralized Authentication, eavesdropping, Kerberos, IP security overview:- security association & Encapsulating security payload ,tunnel and transfer modes, internet key exchange protocol, Secure Socket Layer(SSL), Transport Layer Security (TLS).

**UNIT IV SOFTWARE VULNERABILITIES**

Phishing Attacks, buffer overflow vulnerability, Format String attack, Cross Site Scripting, SQL injection Attacks, Email security:- Security services of E-mail ,Establishing keys, Privacy Authentication of the source, Message integrity ,Non-Repudiation, Viruses, Worms, Malware.

**UNIT V WEB ISSUE**

Introduction, Uniform Resource Locator/uniform resource identify, HTTP, Cookies, Web security problem, Penetration Testing, Firewalls:- functionality, Polices and Access Control, Packet filters, Application level gateway, Encrypted tunnel, Security architecture, Introduction to intrusion detection system.

**TEXT BOOKS:**

1. Bernard Menezes, “ Network Security and Cryptography”, CENGAGE Learning.
2. Charlie Kaufman, “ Network Security”, PHI.
3. Forouzan, “Cryptography & Network Security”, TMH

**REFERENCES:**

1. Randy Weaver, “ Network Infrastructure Security”, Cengage Learning.
2. Atual Kahate, “ Cryptography and Network Security”, TMH.
3. William Stallng, “ Cryptography and Network security”, Pearson.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Should be able to identify network security threats and determine efforts to counter them.
CO2	Should be able to write code for relevant cryptographic algorithms.
CO3	Should be able to write a secure access client for access to a server.
CO4	Should be able to send and receive secure mails.
CO5	Should be able to determine firewall requirements, and configure a firewall.
CO6	To understand Penetration Testing, Firewalls and its functionality.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	L	H	H	H	L	M					M	M
CO2	L	H	H	H	L	M					M	M
CO3	L	H	H	H	L	M					M	M
CO4	L	H	H	H	L	M					M	M
CO5	L	H	H	H	L	M					M	M
CO6	L	H	H	H	L	M					M	M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											



**REFERENCES:**

1. Mark Nelson, "Data Compression Book", BPB Publication 1992.
2. Watkinson J, "Compression In Video And Audio", Focal Press, London, 1995.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Understand about Information entropy and Huffman coding.
CO2	Learn Data and Voice Coding.
CO3	Learn about Error Control Coding.
CO4	Understand Compression Techniques.
CO5	Understand Audio and Video coding techniques.
CO6	To understand audio and video coding.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS062</b>	<b>DISTRIBUTED SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	3	3
	Prerequisite – Computer Networks				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>• Understand foundations of Distributed Systems.</li> <li>• Introduce the idea of peer to peer services and file system.</li> <li>• Understand in detail the system level and support required for distributed system.</li> <li>• Understand the issues involved in studying process and resource management.</li> </ul>				

**UNIT I INTRODUCTION****9**

Introduction – Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

## UNIT II COMMUNICATION IN DISTRIBUTED SYSTEM

9

System Model – Inter process Communication - the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction - Request-reply protocols - Remote procedure call - Remote method invocation. Case study: Java RMI - Group communication - Publish-subscribe systems - Message queues - Shared memory approaches - Distributed objects - Case study: Enterprise Java Beans -from objects to components.

## UNIT III PEER TO PEER SERVICES AND FILE SYSTEM 9

Peer-to-peer Systems – Introduction - Napster and its legacy - Peer-to-peer – Middleware - Routing overlays. Overlay case studies: Pastry, Tapestry- Distributed File Systems – Introduction - File service architecture – Andrew File system. File System: Features-File model -File accessing models - File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

## UNIT IV SYNCHRONIZATION AND REPLICATION

9

Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks - Global states – Coordination and Agreement – Introduction - Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control - Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study – Coda.

## UNIT V PROCESS & RESOURCE MANAGEMENT

9

Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms – Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

### TEXT BOOK:

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.

### REFERENCES:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
3. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
4. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.

COURSE OUTCOMES (COs)	
CO1	Discuss trends in Distributed Systems.
CO2	Apply network virtualization.
CO3	Apply remote method invocation and objects.

CO4	Design process and resource management systems.
CO5	Learn Process & Resource Management.
CO6	To analyze resource and process management.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	H	M	M	M						
CO2	H	M	H	M	M	M						
CO3	H	M	H	M	M	M						
CO4	H	M	H	M	M	M						
CO5	H	M	H	M	M	M						
CO6	H	M	H	M	M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS063</b>	<b>MULTI AGENT INTELLIGENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Artificial Intelligence				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	The purpose of this course is to impart concepts of Artificial Intelligence and Different Agents.				

## **UNIT I INTRODUCTION 9**

Definitions - Foundations - History - Intelligent Agents-Problem Solving-Searching - Heuristics -Constraint Satisfaction Problems - Game playing.

## **UNIT II KNOWLEDGE REPRESENTATION AND REASONING 9**

Logical Agents-First order logic-First Order Inference-Unification-Chaining- Resolution Strategies Knowledge Representation-Objects-Actions-Events.

## **UNIT III PLANNING AGENTS 9**

Planning Problem-State Space Search-Partial Order Planning-Graphs-Nondeterministic Domains Conditional Planning-Continuous Planning-Multi Agent Planning.

## **UNIT IV AGENTS AND UNCERTAINTY 9**

Acting under uncertainty – Probability Notation-Bayes Rule and use - Bayesian Networks- Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory - Decision Network – Complex Decisions.

## **UNIT V HIGHER LEVEL AGENTS 9**

Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning Communication-Formal Grammar-Augmented Grammars- Future of AI.

**TEXTBOOKS:**

1. Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2nd Edition, Prentice Hall, 2002.
2. Michael Wooldridge, “An Introduction to Multi Agent System”, John Wiley, 2002.

**REFERENCE BOOKS:**

1. Patrick Henry Winston, Artificial Intelligence, 3<sup>rd</sup> Edition, AW, 1999.
2. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1992.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Describe the modern view of AI as the study of agents that receive percepts from the Environment and perform actions.
CO2	Demonstrate awareness of informed search and exploration Methods.
CO3	Explain about AI techniques for knowledge representation, planning and uncertainty Management.
CO4	Develop knowledge of decision making and learning Methods.
CO5	Describe the use Planning Agents.
CO6	To Understand Knowledge in Learning.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H		M	M						
CO2	H	H	H		M	M						
CO3	H	H	H		M	M						
CO4	H	H	H		M	M						
CO5	H	H	H		M	M						
CO6	H	H	H		M	M						
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS064</b>	<b>SOCIAL NETWORK ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Computer Network				
	Course Designed by – Department of Computer Science & Engineering				
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>• Understand the concept of semantic web and related applications.</li> <li>• Understand human behaviour in social web and related communities</li> <li>• Learn visualization of social networks.</li> </ul>				

**UNIT I INTRODUCTION****9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network

analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

## **UNIT II KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

## **UNIT III WEB COMMUNITY**

**9**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

## **UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

## **UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

### **TEXT BOOKS:**

1. Peter Mika, "Social Networks and the Semantic Web", , First Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

### **REFERENCES:**

1. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Develop semantic web related applications.
CO2	Represent knowledge using ontology.
CO3	Predict human behaviour in social web and related communities.
CO4	Visualize social networks.
CO5	Gaining knowledge about Web Community.
CO6	To analyze issues in social networks.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) <b>H-High, M – Medium, L-Low</b>												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18PECS065</b>	<b>WEB AND INTERNET TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks, Distributed Computing, Internet Programming				
	Course Designed by – Dept. of Computer Science and Engineering.				
<b>OBJECTIVES</b>					
This course discuss about various concepts using to develop web programming.					

## **UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0**

**9**

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

## **UNIT II CLIENT SIDE PROGRAMMING**

**9**

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

**UNIT IV PHP and XML**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

**UNIT V AJAX and WEB SERVICES**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

**TEXT BOOK:**

1. Deitel and Deitel and Nieto, —Internet and World Wide Web – How to Program, Prentice Hall, 5th Edition, 2011.

**REFERENCES:**

1. Stephen Wynkoop and John Burke —Running a Perfect Website, QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, —Web Technologies A Computer Science Perspective, Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., —Web Technology, Prentice Hall of India, 2011.
5. UttamK.Roy, —Web Technologies, Oxford University Press, 2011.
- 6.

<b>COURSE OUTCOMES (COs)</b>	
CO1	Construct a basic website using HTML and Cascading Style Sheets.
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
CO3	Develop server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and to represent data in XML format.
CO5	Use AJAX and web services to develop interactive web applications.
CO6	To understand web services and SOAP.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	H	H	H	M			M			M
CO2	H	H	H	H	H	M			M			M
CO3	H	H	H	H	H	M			M			M
CO4	H	H	H	H	H	M			M			M
CO5	H	H	H	H	H	M			M			M
CO6	H	H	H	H	H	M			M			M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18PECS066	<b>DIGITAL FORENSICS</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
	Total Contact Hours: 45						3	0	0	3
	Prerequisite: Computer Networks, Network Security									
	Course Designed by : Dept. of Computer Science and Engineering									
<b>OBJECTIVES</b>										
<ul style="list-style-type: none"> <li>Learn the security issues network layer and transport layer.</li> <li>Be exposed to security issues of the application layer.</li> <li>Be familiar with forensics tools.</li> <li>Learn to analyze and validate forensics data.</li> </ul>										

**UNIT I IP SECURITY 9**

IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec. Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.

**UNIT II E-MAIL SECURITY & FIREWALLS 9**

PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

**UNIT III INTRODUCTION TO COMPUTER FORENSICS 9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT IV EVIDENCE COLLECTION AND FORENSICS TOOLS 9**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

**TEXT BOOKS:**

1. Man Young Rhee, “Internet Security: Cryptographic Principles”, “Algorithms and Protocols”, Wiley Publications, 2003.
2. Nelson, Phillips, Enfinger, Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2008.

**REFERENCES:**

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
2. Richard E.Smith, “Internet Cryptography”, 3rd Edition Pearson Education, 2008.
3. Marjie T.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3rd Edition, Prentice Hall, 2013.

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Understand relevant legislation and codes of ethics.
<b>CO2</b>	Computer forensics and digital detective and various processes, policies and procedures.
<b>CO3</b>	E-discovery, guidelines and standards, E-evidence, tools and environment.
<b>CO4</b>	Email and web forensics and network forensics.
<b>CO5</b>	Learn about Mobile Forensics and various ACT.
<b>CO6</b>	

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	L	H	H	H	L	M					M	M
<b>CO2</b>	L	H	H	H	L	M					M	M
<b>CO3</b>	L	H	H	H	L	M					M	M
<b>CO4</b>	L	H	H	H	L	M					M	M
<b>CO5</b>	L	H	H	H	L	M					M	M
<b>CO6</b>	L	H	H	H	L	M					M	M
<b>Category</b>	Programme Elective (PE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

## OPEN ELECTIVE

<b>U18OECS001</b>	<b>MOBILE APPLICATION DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Nil				
	Course Designed by : Dept. of Computer Science and Engineering				
<b>OBJECTIVES</b> This course is concerned with the development of applications on mobile and wireless computer platforms. Android will be used as a basis for teaching programming techniques and design patterns related to the development of standalone applications and mobile portals to enterprise and commerce systems. Emphasis is placed on the processes, tools and frameworks required to develop applications for current and emerging mobile computing devices.					

### **UNIT-I INTRODUCTION 9**

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

### **UNIT –II ANDROID APPLICATIONS 9**

Android Application Design Essentials: Anatomy of an Android application, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

### **UNIT-III USER INTERFACE 9**

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

### **UNIT- IV TESTING AND DEPLOYMENT 9**

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

### **UNIT- V ANDROID API 9**

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

#### **TEXT BOOKS:**

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd edition. (2011)

#### **REFERENCES:**

1. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd
2. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd.
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Identify various concepts of mobile programming that make it unique from programming for other platforms.
<b>CO2</b>	Critique mobile applications on their design pros and cons.
<b>CO3</b>	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
<b>CO4</b>	Program mobile applications for the Android operating system that use basic and advanced phone features.
<b>CO5</b>	Deploy applications to the Android marketplace for distribution.
<b>CO6</b>	To apply Managing data using Sqlite and Sharing Data between Applications with Content Providers.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	M		H		M							
<b>CO2</b>	M		H		M							
<b>CO3</b>	M		H		M							
<b>CO4</b>	M		H		M							
<b>CO5</b>	M		H		M							
<b>CO6</b>	M		H		M							
<b>Category</b>	Open Elective (OE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18OECS002</b>	<b>SYSTEM MODELLING AND SIMULATION</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Nil							
	Course Designed by : Dept. of Computer Science and Engineering							

### **OBJECTIVES**

The overall aim of the course is to provide an understanding of Methods, techniques and tools modeling, simulation and performance analysis of complex systems such as communication computer networks.

### **UNIT-I OVERVIEW OF PERFORMANCE EVALUATION 9**

Need for Performance Evaluation in Computer Systems – Overview of Performance Evaluation Methods – Introduction to Queuing – Probability Review – Generating Random Variables for Simulation – Sample Paths, Convergence and Averages – Little’s Law and other Operational Laws – Modification for Closed Systems.

### **UNIT-II MARKOV CHAINS AND SIMPLE QUEUES 9**

Discrete-Time Markov Chains – Ergodicity Theory – Real World Examples – Google, Aloha – Transition to Continuous-Time Markov Chain – M/M/1 and PASTA.

### **UNIT-III MULTI-SERVER AND MULTI-QUEUE SYSTEMS 9**

Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke’s Theorem – Networks of Queues and Jackson Product Form – Classed and Closed Networks of Queues.

### **UNIT-IV REAL-WORLD WORKLOADS 9**

Case Study of Real-world Workloads – Phase-Type Distributions and Matrix-Analytic

**UNIT-V SMART SCHEDULING IN THE M/G/1**

**9**

Performance Metrics – Scheduling Non-Preemptive and Preemptive Non-Size-Based Policies - Scheduling Non-Preemptive and Preemptive Size-Based Policies – Scheduling - SRPT and Fairness.

**TEXT BOOKS**

1. MorHarchol - Balter, “Performance Modeling and Design of Computer Systems – Queueing Theory in Action”, Cambridge University Press, 2013.
2. LievenEeckhout, “Computer Architecture Performance Evaluation Methods”, Morgan and Claypool Publishers, 2010.

**REFERENCES**

1. Paul J. Fortier and Howard E. Michel, “Computer Systems Performance Evaluation and Prediction”, Elsevier, 2003.

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Define basic concepts in modeling and simulation (M&S)
<b>CO2</b>	Classify various simulation models and give practical examples for each category
<b>CO3</b>	Construct a model for a given set of data and motivate its validity
<b>CO4</b>	Generate and test random number varieties and apply them to develop simulation models.
<b>CO5</b>	Analyze output data produced by a model and test validity of the model.
<b>CO6</b>	To apply Performance Metrics and Non-Preemptive and Preemptive Scheduling

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	M		M									
<b>CO2</b>	M		M									
<b>CO3</b>	M		M									
<b>CO4</b>	M		M									
<b>CO5</b>	M		M									
<b>CO6</b>	M		M									
<b>Category</b>	Open Elective (OE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U180ECS003</b>	<b>WEB PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Nil				
	Course Designed by : Dept. of Computer Science and Engineering				

**OBJECTIVES**

The objective of Web Services is Build web based application using sockets.

**UNIT I SCRIPTING**

Web page Designing using HTML, Scripting basics- Client side and server side scripting. Java Script-Object, names, literals, operators and expressions- statements and features- events - windows - documents - frames - data types - built-in functions- Browser object model -

## UNIT II JAVA

Introduction to object oriented programming-Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces –Exception Handling – Multithreaded Programming – Input/Output – Files – Utility Classes – String Handling.

## UNIT III JDBC

JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– InetAddress class – URL class- TCP sockets - UDP sockets, Java Beans –RMI.

## UNIT IV APPLETS

Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

## UNIT V XML AND WEB SERVICES

Xml – Introduction-Form Navigation-XML Documents- XSL – XSLT- Web services-UDDI- WSDL-Java web services – Web resources.

## REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill, 2006.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Fourth Ed., Morgan Kaufmann, 2007.
3. Markus Hoffmann and Leland R. Beaumont, Content Networking: Architecture, Protocols, and Practice, Morgan Kauffman, 2005.
- 4.<http://www.cs.wayne.edu/~hzhang/courses/7290/Lectures/0-0%20-%20Course%20plan.pdf>

COURSE OUTCOMES (COs)	
CO1	To understand the concept of Web Application Development and its Architecture.
CO2	To understand the Essentials of Web Application Development.
CO3	To understand and practice web page designing techniques.
CO4	To understand and practice embedded dynamic scripting on client side Internet Programming.
CO5	To understand the differences between client side & server side technologies to develop Web Application
CO6	To apply XML and Web Services concepts.

Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs	Programme Outcomes(POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M		H		M							
CO2	M		H		M							
CO3	M		H		M							
CO4	M		H		M							
CO5	M		H		M							
CO6	M		H		M							
<b>Category</b>	Open Elective (OE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

U18OECS004	ETHICAL HACKING				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Nil							
	Course Designed by : Dept. of Computer Science and Engineering							
<b>OBJECTIVES</b>								
This course gives to explore the concepts of security testing and the knowledge required to protect against the hacker and attackers.								

### UNIT I INTRODUCTION 9

Introduction to Hacking – Important Terminologies – Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement – Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary – Reports.

### UNIT II INFORMATION GATHERING AND SCANNING 9

Information Gathering Techniques – Active Information Gathering – Passive Information Gathering – Sources of Information Gathering – Tracing the Location – Traceroute – ICMP Traceroute – TCP Traceroute – Usage – UDP Traceroute – Enumerating and Fingerprinting the Webservers – Google Hacking – DNS Enumeration – Enumerating SNMP – SMTP Enumeration – Target Enumeration and Port Scanning Techniques – Advanced Firewall/IDS Evading Techniques.

### UNIT III NETWORK ATTACKS 9

Vulnerability Data Resources – Exploit Databases – Network Sniffing – Types of Sniffing – Promiscuous versus Nonpromiscuous Mode – MITM Attacks – ARP Attacks – Denial of Service Attacks – Hijacking Session with MITM Attack – SSL Strip: Stripping HTTPS Traffic – DNS Spoofing – ARP Spoofing Attack Manipulating the DNS Records – DHCP Spoofing – Remote Exploitation – Attacking Network Remote Services – Overview of Brute Force Attacks – Traditional Brute Force – Attacking SMTP – Attacking SQL Servers, Testing for Weak Authentication.

### UNIT IV EXPLOITATION 9

Introduction to Metasploit – Reconnaissance with Metasploit – Port Scanning with Metasploit – Compromising a Windows Host with Metasploit – Client Side Exploitation Methods – E-Mails with Malicious Attachments – Creating a Custom Executable – Creating a Backdoor with SET – PDF Hacking – Social Engineering Toolkit – Browser Exploitation – Post-Exploitation – Acquiring Situation Awareness – Hashing Algorithms – Windows Hashing Methods – Cracking the Hashes – Brute force Dictionary Attacks – Password Salts – Rainbow

**UNIT V WIRELESS AND WEB HACKING**

**9**

Wireless Hacking – Introducing Aircrack– Cracking the WEP – Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng – Evil Twin Attack – Causing Denial of Service on the Original AP – Web Hacking – Attacking the Authentication – Brute Force and Dictionary Attacks – Types of Authentication – Log-In Protection Mechanisms – Captcha Validation Flaw – Captcha RESET Flaw – Manipulating User-Agents to Bypass Captcha and Other Protection – Authentication Bypass Attacks – Testing for the Vulnerability – Automating It with Burp Suite – Session Attacks – SQL Injection Attacks – XSS (Cross-Site Scripting) – Types of Cross-Site Scripting – Cross-Site Request Forgery (CSRF) – SSRF Attacks.

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Use the various security tools to assess the computing system.
<b>CO2</b>	Predict the vulnerabilities across any computing system using penetration testing.
<b>CO3</b>	Identify prediction mechanism to prevent any kind of attacks.
<b>CO4</b>	Protect the system from malicious software and worms.
<b>CO5</b>	Evaluate the wireless network flaws and able to apply security patches .
<b>CO6</b>	To Understand various Network attacks and Solutions

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	L	H	H	H	L	M					M	M
<b>CO2</b>	L	H	H	H	L	M					M	M
<b>CO3</b>	L	H	H	H	L	M					M	M
<b>CO4</b>	L	H	H	H	L	M					M	M
<b>CO5</b>	L	H	H	H	L	M					M	M
<b>CO6</b>	L	H	H	H	L	M					M	M
<b>Category</b>	Open Elective (OE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

<b>U18OECS005</b>	<b>E COMMERCE</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Nil							
	Course Designed by : Dept. of Computer Science and Engineering							
<b>OBJECTIVES</b>								
This course Discuss the current drivers and inhibitors facing the business world in adopting using Ecommerce.								

**UNIT-I ELECTRONIC COMMERCE**

**9**

Electronic Commerce, Electronic Data Interchange (EDI), E-Commerce Types – PC and networking: Networking, Communication media – Computer Communication Systems: ISO model, Electronic mail, X.400 Message Handling System, E-mail security, Lightweight directory access protocol – Internet: Introduction, Communication protocols, Issues of concern.

**UNIT-II ELECTRONIC DATA INTERCHANGE 9**

EDI: Introduction, Cost and Benefits, Components of EDI System, Implementation Issues – UN/EDIFACT Standard: Introduction, An EDIFACT Message, Interchange Structure, Message Directories - EDI Over Internet, Commerce Over Extranets, Identification and Tracking Tools.

**UNIT-III BUSINESS PROCESS REENGINEERING 9**

Business process reengineering – Approach to BPR, BPR methodology – Change management: Change management in the Government, Implementation plan.

**CONCERNS FOR E-COMMERCE GROWTH**

Legal issues, Risks: Paper document versus electronic document, Technology for authenticating an electronic document, Laws for e-commerce, EDI interchange agreement.

**UNIT-IV CYBER SECURITY 9**

Cyber Attacks, Hacking, Firewalls, IDS, Secure Sockets Layer, Symmetric and asymmetric crypto systems, Guidelines for Cryptography Policy, Developing a Security Policy.

**CYBER CRIMES:** Cybercrimes and the Information Technology Act, 2000, Cyber forensics

**UNIT-V CASE STUDIES 9**

E-Commerce: Case Studies: ITC's e-Choupal - E-Governance: Case Studies: Indian customs EDI System, Indian Railways, Government of Andhra Pradesh – eSeva.

**COMPUTER EMERGENCY RESPONSE TEAM (CERT):** Introduction, CERT-In, CERT-In Activities.

**REFERENCE BOOKS:**

1. Kamlesh K Bajaj, Debjani Nag, "E-Commerce – The Cutting Edge of Business", Tata McGraw Hill, Second Edition, 2006
2. David Whitley, "E-Commerce: Strategy, Technologies and applications", McGraw Hill, 2000.

<b>COURSE OUTCOMES (COs)</b>	
<b>CO1</b>	Create and refine website and application designs based on industry's usability.
<b>CO2</b>	Assess the suitability of various design principles for websites and applications.
<b>CO3</b>	Apply the skills necessary for large-scale project development on the Web.
<b>CO4</b>	Apply the technologies required to design and prototype Web-based information system
<b>CO5</b>	Recognize the business impact and potential of E-Commerce.
<b>CO6</b>	To analyze various case studies in electronic commerce.

<b>Mapping of Course Outcomes with PROGRAMME OUTCOMES(POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
<b>COs</b>	<b>Programme Outcomes(POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>							H	M			M	
<b>CO2</b>							H	M			M	
<b>CO3</b>							H	M			M	
<b>CO4</b>							H	M			M	
<b>CO5</b>							H	M			M	
<b>CO6</b>							H	M			M	
<b>Category</b>	Open Elective (OE)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											