GOVERNMENT COLLEGE OF ENGINEERING - BARGUR
KRISHNAGIRI- 635 104, TAMILNADU
(An Autonomous Institution Affiliated to Anna University – Chennai)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
B.E. – CSE – CURRICULUM AND SYLLABUS
AUTONOMOUS –

Students admitted during 2018-19

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR
Regulations-2018 (AUTONOMOUS) ADMITTED IN 2018-19
Curriculum for B.E. COMPUTER SCIENCE AND ENGINEERING [FULL TIME]
I TO VIII SEMESTER CURRICULUM

INDUCTION PROGRAM:

Induction Program(Mandatory)	3 Weeks Duration
Induction program for students to be Offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch &Innovations

SEMESTER I

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.	**18SLS101**	Engineering Chemistry	**BSC**	**4**	3	1	0	4
2.	**18ZBS102**	Engineering Mathematics - I	**BSC**	**4**	3	1	0	4
3.	**18ZES103**	Basic Electrical Engineering	**ESC**	**3**	2	1	0	3
4.	**18ZES104**	Engineering Graphics and Design	**ESC**	**5**	1	0	4	3
5,	**18ZMC105**	Induction Program	**MC**	-	-	-	-	0
PRACTICALS								
5.	**18SLS106**	Chemistry Laboratory	**BSC**	**3**	0	0	3	1.5
6.	**18ZES107**	Basic Electrical Engineering Laboratory	**ESC**	**4**	0	0	4	2
			TOTAL	23	9	3	11	17.5

SEMESTER II

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.	**18SLS201**	Engineering Physics	**BSC**	**4**	3	1	0	4
2.	**18ZBS202**	Engineering Mathematics-II	**BSC**	**4**	3	1	0	4
3.	**18ZES203**	Programming in C	**ESC**	**3**	3	0	0	3
4.	**18ZHS204**	Technical English	**HSMC**	**2**	2	0	0	2
5.	**18ZMC205**	Constitution of India	**MC**	**1**	1	0	0	0
PRACTICALS								
6.	**18SLS206**	Physics Laboratory	**BSC**	**3**	0	0	3	1.5
7.	**18ZES207**	Programming in C Laboratory	**ESC**	**4**	0	0	4	2
8.	**18ZES208**	Workshop Practices	**ESC**	**5**	1	0	4	3
9.	**18ZHS209**	Communication English Laboratory	**HSMC**	**2**	0	0	2	1
			TOTAL	28	13	2	13	20.5

SEMESTER III

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.	**18ZBS301**	Transforms and Partial Differential Equations	**BSC**	**4**	3	1	0	4
2.	**18SES302**	Digital Principles and Systems Design	**ESC**	**3**	3	0	0	3
3.	**18SPC303**	Object Oriented Programming Using C++ and Java	**PCC**	**4**	3	1	0	4
4.	**18SPC304**	Fundamentals of Data Structures	**PCC**	**3**	3	0	0	3
5.	**18ZMC305**	Environmental Science and Engineering	**MC**	**1**	1	0	0	0
6.	**18SHS306**	Professional Ethics and Human Values	**HSMC**	**3**	3	0	0	2
PRACTICALS								
7.	**18SES307**	Digital Principles and Systems Design Laboratory	**ESC**	**3**	0	0	3	1.5
8.	**18SPC308**	Object Oriented Programming using C++ and Java Laboratory	**PCC**	**4**	0	0	4	2
9.	**18SPC309**	Data Structures Laboratory	**PCC**	**4**	0	0	4	2
			TOTAL	29	16	2	11	21.5

SEMESTER IV

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.	**18SBS401**	Probability and Queuing Theory	**BSC**	**4**	3	1	0	4
2.	**18SPC402**	Computer Organization and Architecture	**PCC**	**3**	3	0	0	3
3.	**18SPC403**	Operating Systems	**PCC**	**3**	3	0	0	3
4.	**18SPC404**	Design and Analysis of Algorithms	**PCC**	**3**	3	0	0	3
5.	**18SPC405**	Database Management Systems	**PCC**	**3**	3	0	0	3
PRACTICALS								
6.	**18SPC406**	Operating Systems Laboratory	**PCC**	**3**	0	0	3	1.5
7.	**18SPC407**	Database Management Systems Laboratory	**PCC**	**4**	0	0	4	2
			TOTAL	23	15	1	7	19.5

SEMESTER V

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.	**18SBS501**	Discrete Mathematics	**BSC**	**4**	3	1	0	4
2.	**18SPC502**	Computer Networks	**PCC**	**3**	3	0	0	3
3.	**18SPC503**	Object Oriented Software Engineering	**PCC**	**3**	3	0	0	3
4.	**18SPC504**	Theory of Computation	**PCC**	**3**	3	0	0	3
5.		**Professional Elective I**	**PEC**	**3**	3	0	0	3
PRACTICALS								
6.	**18SPC505**	Computer Networks Laboratory	**PCC**	**3**	0	0	3	1.5
7.	**18HSC506**	Soft Skills and Personality Development Laboratory	**HSMC**	**3**	0	0	3	1.5
8.	**18SPR507**	**Project I**	**PROJ**	**3**	0	0	3	1.5
			TOTAL	25	15	1	9	20.5

SEMESTER VI

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.	**18SPC601**	Compiler Design	**PCC**	**3**	3	0	0	3
2.	**18SES602**	Wireless Communication and Networks	**ESC**	**3**	3	0	0	3
3.	**18SPC603**	Embedded Computing Systems	**PCC**	**3**	3	0	0	3
4.		**Professional Elective II**	**PEC**	**3**	3	0	0	3
5.		**Open Electives I**	**OEC**	**3**	3	0	0	3
6.		**Open Electives II**	**OEC**	**3**	3	0	0	3
PRACTICALS								
7.	**18SPC604**	Compiler Laboratory	**PCC**	**4**	0	0	4	2
8.	**18SPC605**	Mobile Application development Laboratory	**PCC**	**4**	0	0	4	2
9.	**18SPC606**	Embedded Computing Systems Laboratory	**PCC**	**4**	0	0	4	2
			TOTAL	**30**	18	0	12	24

SEMESTER VII

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.	**18SHS701**	Management and Entrepreneurship	**HSMC**	**3**	3	0	0	3
2..	**18SPC702**	Cloud Computing	**PCC**	**3**	3	0	0	3
3.	**18SPC703**	Cryptography and Network Security	**PCC**	**3**	3	0	0	3
4.		**Professional Elective III**	**PEC**	**3**	3	0	0	3
5.		**Professional Elective IV**	**PEC**	**3**	3	0	0	3
6.		**Open Elective III**	**OEC**	3	3	0	0	3
PRACTICALS								
7.	**18SPC704**	Cloud Computing Laboratory	**PCC**	**4**	0	0	4	2
8.	**18SPC705**	Network Security Laboratory	**PCC**	**3**	0	0	3	1.5
9.	**18SPR706**	Project II	**PROJ**	**6**	0	0	6	3
			TOTAL	**31**	18	0	13	24.5

SEMESTER VIII

Sl.No	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIOD	L	T	P	C
THEORY								
1.		**Professional Elective V**	**PEC**	**3**	3	0	0	3
2.		**Professional Elective VI**	**PEC**	**3**	3	0	0	3
3.		**Open Elective IV**	**OEC**	**3**	3	0	0	3
PRACTICALS								
4.	**18SPR801**	Project III	**PROJ**	**12**	0	0	12	6
			TOTAL	**21**	9	0	12	15

TOTAL NUMBER OF CREDITS: 163

CREDIT SUMMARY

S.No	Subject Area	Credits Per Semester								Credits Total	% of Total Credits	AICTE Suggested Breakup of Credits(Total 159)
		1	2	3	4	5	6	7	8			
1	**HSMC**		3	2		1.5		3		**9.5**	**5.83**	12
2	**BSC**	9.5	9.5	4	4	4				**31**	**19.02**	24
3	**ESC**	8	8	4.5			3			**23.5**	**14.42**	29
4	**PCC**			11	15.5	10.5	12	9.5		**58.5**	**35.89**	49
5	**PEC**					3	3	6	6	**18**	**11.04**	18
6	**OEC**						6	3	3	**12**	**7.36**	12
7	**PROJ**					1.5		3	6	**10.5**	**6.44**	15
8	**MC**	√	√	√						**(non credit)**	**-**	-
	Total	17.5	20.5	21.5	19.5	20.5	24	24.5	15			
	AICTE semwise	**17.5**	**20.5**	**23**	**22**	**21**	**22**	**18**	**15**	**163***	**100**	159*

LIST OF MANDATORY COURSES

S.NO	COURSE CODE	COURSE TITLE	SEMESTER
1.	**18ZMC105**	Induction Program	I
2.	**18ZMC205**	Constitution of India	II
3.	**18SMC305**	Environmental Science and Engineering	III

LIST OF PROFESSIONAL ELECTIVES

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**18SPE001**	Fundamentals of Image Processing	3	0	0	3
2.	**18SPE002**	Software Project Management	3	0	0	3
3.	**18SPE003**	Foundations of IT	3	0	0	3
4.	**18SPE004**	Data Mining	3	0	0	3
5.	**18SPE005**	C # and .NET Framework	3	0	0	3
6.	**18SPE006**	Green Computing	3	0	0	3
7.	**18SPE007**	Agile Software Development	3	0	0	3
8.	**18SPE008**	Software Defined Networks	3	0	0	3
9.	**18SPE009**	Social Networks Analysis	3	0	0	3
10.	**18SPE010**	Pattern Recognition	3	0	0	3
11.	**18SPE011**	Building Enterprise Applications	3	0	0	3
12.	**18SPE012**	Natural Language Processing	3	0	0	3
13.	**18SPE013**	Information Retrieval Techniques	3	0	0	3
14.	**18SPE014**	GPU Architecture and Programming	3	0	0	3
15.	**18SPE015**	Business Intelligence and its Applications	3	0	0	3
16.	**18SPE016**	Game Theory	2	1	0	3
17.	**18SPE017**	Open Source Systems	3	0	0	3
18.	**18SPE018**	Big Data and Analytics	2	2	0	3
19.	**18SPE019**	Machine Learning	2	2	0	3
20.	**18SPE020**	Geographical Information Systems	3	0	0	3
21.	**18SPE021**	Service Oriented Architecture	3	0	0	3
22.	**18SPE022**	Web Technology	3	0	0	3
23.	**18SPE023**	Computer Graphics and Multimedia	3	0	0	3
24.	**18SPE024**	Artificial Intelligence	3	0	0	3
25.	**18SPE025**	Parallel and Distributed Systems	3	0	0	3
26.	**18SPE026**	Essentials of Python Programming	2	2	0	3
27.	**18SPE027**	Graph Theory and its Applications.	2	1	0	3
28.	**18SPE028**	Fundamentals of Signal Processing	3	0	0	3
29.	**18SPE029**	Advances in Data Structures	3	0	0	3
30.	**18SPE030**	Operations Research	2	1	0	3

OPEN ELECTIVES

[Students from other departments can select open electives offered by CSE]

CSE:

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**18SOE001**	Programming in C++	3	0	0	3
2.	**18SOE002**	Java Programming	3	0	0	3
3.	**18SOE003**	Database Concepts	3	0	0	3
4.	**18SOE004**	Web Designing	3	0	0	3
5.	**18SOE005**	Android Application Development	3	0	0	3
6.	**18SOE006**	Computer Architecture	3	0	0	3
7.	**18SOE007**	Fundamentals of Computer Networks	3	0	0	3
8.	**18SOE008**	Linux and RTOS	3	0	0	3
9.	**18SOE009**	Introduction to Python	3	0	0	3
10.	**18SOE010**	Introduction to Data Analytics	3	0	0	3

MANDATORY INDUCTION PROGRAM (3 WEEKS DURATION)

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

1. INDUCTION PROGRAM

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

It is proposed a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

1.1 PHYSICAL ACTIVITY

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

1.2 CREATIVE ARTS

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

1.3 UNIVERSAL HUMAN VALUES

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through dos and don'ts but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be overemphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

1.4 LITERARY

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

1.5 PROFICIENCY MODULES

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

1.6 LECTURES BY EMINENT PEOPLE

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

1.7 VISITS TO LOCAL AREA

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

1.8 FAMILIARIZATION TO DEPT./ BRANCH & INNOVATIONS

The students should be told about different method of study compared to coaching. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other faculties.

2. SCHEDULE

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

2.1 INITIAL PHASE

Time	**Activity**
Day 0 Whole day	Students arrive - Hostel allotment. (Preferably do pre allotment)
Day 1	
09:00 am - 03:00 pm	Academic registration
04:30 pm - 06:00 pm	Orientation
Day 2	
09:00 am - 10:00 am	Diagnostic test (for English etc.)
10:15 am - 12:25 pm	Visit to respective depts.
12:30 pm - 01:55 pm	Lunch
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group (Same as Universal Human Values groups)

2.2 REGULAR PHASE

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

2.2.1 DAILY SCHEDULE

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Session	**Time**	**Activity**	**Remarks**
	Day 3 onwards 06:00 am	Wake up call	
I	06:30 am - 07:10 am	Physical activity (mild exercise / yoga)	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the Groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary Alternate
	01:00 pm - 02:25 pm	Lunch	
IV	02:30 pm - 03:55 pm	Afternoon Session	See below
V	04:00 pm - 05:00 pm	Afternoon Session	See below
	05:00 pm - 05:25 pm	Break / light tea	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	Rest and Dinner	

VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

2.2.2 AFTERNOON ACTIVITIES (NON-DAILY)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	**Session**	**Remarks**
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	For 3-5 days
Proficiency Modules	V	Daily, but only for those who need it

2.3 CLOSING PHASE

Time	**Activity**
Last But One Day 08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day Whole day	Examinations (if any). May be expanded to last 2 days, in case needed

2.4 FOLLOW UP AFTER CLOSURE

A question comes up as to what would be the follow up program after the formal 3-weekInduction Program is over? The groups which are formed should function as mentor-mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline. Here we list some important suggestions which have come up and which have been experimented with.

2.4.1 FOLLOW UP AFTER CLOSURE - SAME SEMESTER

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

2.4.2 FOLLOW UP - SUBSEQUENT SEMESTERS

It is extremely important that continuity be maintained in subsequent semesters. It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students are shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

SEMESTER I

18SLS101	ENGINEERING CHEMISTRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To make students conversant with water parameters, boilers, need for water treatment and its merits and demerits.
- Students ought to be aware of fundamental principles behind different electrochemical reactions, corrosion of materials and methods to prevent corrosion.
- To learn the chemistry behind polymers, synthesis, merits, demerits and its applications in various field.
- To acquire basic knowledge in renewable, non renewable and alternate energy resources and the chemical reactions involved in cell, batteries and its applications.
- To learn the working principle of various spectroscopy and its applications. To acquire basic knowledge in Nano materials, synthesis, properties and uses.

UNIT I WATER TECHNOLOGY 9+3

Characteristics – alkalinity and its significance – hardness (problems) - types and estimation by EDTA method – specifications of drinking water (BIS and WHO standards) – potable water treatment – boiler feed water - requirements – disadvantages of using hard water in boilers (Scales & Sludge, Boiler corrosion, Priming & Foaming, Caustic embrittlement) – water treatment – Internal treatment – external treatment – zeolite method - Demineraliztion process – desalination – reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION 9+3

Electrochemistry: Electrochemical cells – reversible and irreversible cells – EMF – measurement of EMF – single electrode potential – Nernst equation (Problems) – reference electrode – standard hydrogen electrode and calomel electrode – ion selective electrode – glass electrode and measurement of pH – electrochemical series and its applications.

Corrosion: Corrosion – Pilling Bedworth rule - dry corrosion and its mechanism - electrochemical corrosion and its mechanism – types (galvanic, pitting, differential aeration) – factors influencing corrosion – corrosion control methods – sacrificial anode method – impressed current method – corrosion inhibitors – protective coatings – paints – constituents – functions – metallic coatings – electroplating (Cu) and electro less plating (Ni).

UNIT III POLYMERS AND COMPOSITES 9+3

Polymers: Definition – classification – functionality – polymerization – degree of polymerization – types (addition, condensation, copolymerization) – mechanism (free radical) – plastics – thermoplastics and thermosetting plastics – preparation, properties and uses of individual polymers (PVC, TEFLON, Nylon-6,6, Nylon-6, PET, epoxy resin) – rubber - vulcanization of rubber – applications - Advanced polymeric materials and electronic devices – conducting and semiconducting polymers – liquid crystal properties – dendrimers and their difference from polymers.**Composites:** definition – types polymer matrix composites – Fibre Reinforced Polymers – applications – advanced composite materials – physical and chemical properties – applications.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9+3

Nuclear energy – fission fusion reactions – light water nuclear reactor for power generation – breeder reactor – solar energy conversion – solar cells – wind energy – batteries: alkaline batteries – lead –acid, Ni-Cd, and Li-ion batteries – fuel cells – principles and applications – advantages and disadvantages.

UNIT V	ANALYTICAL TECHNIQUES AND NANOMATERIALS	9+3

Spectroscopy: Electromagnetic spectrum - Fundamentals of spectroscopy – Instrumentation, working principle and applications of UV-Visible spectrophotometer, Atomic Absorbance Spectrophotometer, Flame photometer.

Nanomaterials: Introduction to nanotechnology in electronics - nanomaterials – fullerernes carbon nanotubes **–** nanowires – Electronics and mechanical properties - synthesis of nanomaterials – topdown and bottomup approach – applications of nanomaterials in electronic devices (Semiconductors, LED & OLED) – electronics and telecommunication – medicines.

TOTAL : 60 PERIODS

COURSE OUTCOMES

At the end of the course students should be able to

1.	Apply the knowledge of basic science in identifying, to formulate and to solve the engineering problems.
2.	Analyze water borne problems faced in boilers, need for water treatment and various methods and techniques for treating hard water.
3.	Understand polymerization reactions and electrochemical reactions and its applications.
4.	Acquire Knowledge about energy conversion and chemical reaction taking place in nuclear, solar, wind energy, Batteries, fuel cells and its applications..
5.	Obtain in-depth knowledge on various nanomaterials and its applications in electronic devices. Students get basic knowledge on advanced analytical techniques.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					1	1						3		
CO2		2	2			1	1						3	1	
CO3	2	1											3	2	
CO4	2	1				2							3	1	
CO5	3					2	2						1		

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Vairam S, Kalyani P and Suba Ramesh.,"Engineering Chemistry"., Wiley India PvtLtd.,New Delhi., 2011
2. Dara S.S,UmareS.S."Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

REFERENCES:	
1.	*Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010.*
2.	*Rao, C. N. R.; Govindaraj, A. "Nanotubes and Nanowires" United Kingdom: Royal Society of Chemistry, 2005*
3.	*Advanced Polymeric Materials: From Macro- to Nano-Length Scales edited by Sabu Thomas, Nandakumar Kalarikkal, Maciej Jaroszewski, Josmine P. Jose; Apple Academic press, Canada, 2016*
4.	*Jain and jain , 16th editin, "Engineering Chemistry" Dhanpat Rqai Publishing Co.*
5.	*Sivasankar B, "Engineering Chemistry", Tata Mc Graw-Hill Publishing Company Ltd, New Delhi , 2008.*

18ZBS102	ENGINEERING MATHEMATICS - I	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Matrix algebra and techniques and using them in engineering applications.
- The concept of infinite series and their convergence so that they will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- Differential and integral calculus and their applications in various engineering applications.

UNIT I MATRICES **9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II SEQUENCES AND SERIES **9+3**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS **9+3**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **9+3**

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS **9+3**

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Solve problems on matrices and to apply concepts of matrix theory whenever applicable in the field of engineering.
2. Solve problems using convergence tests on sequences and series and to apply them in engineering field appropriately.
3. Solve problems on differential and integral calculus and will be exposed to their applications in engineering.

COURSE ARTICULATION MATRIX:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2									3	1	
CO2	2	2	1	1									2	2	1
CO3	3	2	1				1						3	2	
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2.	Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:	
1.	*Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd., 2011.*
2.	*Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.*
3.	*Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.*
4.	*Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.*
5.	*Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.*

18ZES103	BASIC ELECTRICAL ENGINEERING	L	T	P	C
		2	1	0	3

OBJECTIVES:	
•	To introduce DC and AC circuits analysis
•	To understand the concepts of transformers and Electrical machines
•	To study about the Electrical installations

UNIT I	DC CIRCUITS	9

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with DC excitation, star delta transformation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II	AC CIRCUITS	9

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

UNIT III	TRANSFORMERS	9

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT IV	ELECTRICAL MACHINES	9

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of dc motor. Construction and working of synchronous generators[Elementary Analysis only]

UNIT V	POWER CONVERTERS AND ELECTRICAL INSTALLATIONS	9

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery Backup.

TOTAL : 45 PERIODS

OUTCOMES:	At the end of this course, students will able to

1.	Analyze the DC circuits using various theorems.
2.	Analyze the AC circuits in time domain.
3.	Analyze the performance of the transformer.
4.	Understand the construction and working of DC and AC motors.
5.	Understand the Power Converters and the components of low-voltage electrical installations.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1			1						3	2	1
CO2	3	2	1	2			1						3	2	1
CO3	3	1	1				1						3	1	1
CO4	3	2	1	2			1						3	2	
CO5	3	1	1				1						3		

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2.	D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

REFERENCES:

1.	*E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.*
2.	*V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.*
3.	*L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.*
4.	*V.K.Mehta and RohitMehta"Basic Electrical Engineering"S.Chand and Company,2012*
5.	*Mittle and Mittal "Basic Electrical Engineering" Tata Mcgraw Hill Education,2005*

18ZES104	ENGINEERING GRAPHICS AND DESIGN	L	T	P	C
		1	0	4	3

OBJECTIVES:

•	This course aims to introduce the concept of graphic communication, develop the drawing skills for communicating concepts, ideas and designs of engineering products and to expose them to existing national standards related to technical drawings
•	To draw the projection of simple solids like prisms, pyramids, cylinder etc.
•	To draw the development of surfaces to estimate the sheet metal requirement and to prepare sectional views of solids.
•	To develop skills in three-dimensional visualization of engineering components and to draw isometric views of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications – use of drafting instruments – BIS / ISO conventions and specifications – size, layout and folding of drawing sheets – lettering and dimensioning.

UNIT I	PLANE CURVES AND FREE-HAND SKETCHING	6+9

Basic geometrical constructions, curves used in engineering. Conics – construction of ellipse, parabola and hyperbola by eccentricity method – drawing of tangents and normal to the above curves. Visualization concepts and free hand sketching: visualization principles –representation of three dimensional objects – layout of views- freehand sketching of multiple views from pictorial views of objects.

UNIT II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	6+9

Orthographic projection – Principles-principal planes - First angle projection - Projection of points - Projection of straight lines inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III	PROJECTION OF SOLIDS	6+9

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids, when the axis is inclined to both the principal planes by rotating object method.

UNIT IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	6+9

Sectioning of prisms, pyramids, cylinders and cones in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – prisms,

pyramids cylinders and cones.

UNIT V	ISOMETRIC PROJECTION AND OVERVIEW OF COMPUTER GRAPHICS	6+9

Principles of isometric projection – isometric scale –isometric projections of simple solids and truncated solids - prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions – Introduction to CAD - The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD- (CAD – evaluation during CA only)

TOTAL: 75 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Familiarize with the fundamentals, standards of Engineering graphics and Perform freehand sketching of multiple views ofbasic geometrical constructions.
2.	Draw orthographic projections of points, lines and plane surfaces.
3.	Draw projections of solids, sectioned solids and development of surfaces.
4.	Visualize and draw isometric views of simple solids.
5.	Appreciate the use of computers in drawing and modelling of simple objects.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	1										3	1	
CO 2	3	2	1										3	2	
CO 3	3	2	1										3	2	
CO 4	3	2	2										1	1	1
CO 5	3	1	2										1	2	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Natrajan K. V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2016.
2.	Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2016.
3.	Shah, M. B. and Rana B. C. “Engineering Drawing and Computer Graphics”, Pearson Education, 2010

REFERENCES:	
1.	*N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.*
2.	*Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas publications, Bangalore, 2014.*
3.	*Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.*
4.	*Luzzader, Warren J. and Duff John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005*
5.	*Bhatt N. D. and Panchal V. M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.*

18SLS106	CHEMISTRY LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To make students conversant with hands on water parameter analysis.
- To make the student to acquire practical skills in the corrosion in metals.
- To acquaint the students with the determination of molecular weight of a polymer by Ostwald viscometer.
- To make the student acquire practical skills in analytical instruments.

LIST OF EXPERIMENTS

1. Determination of total hardness of given water sample by EDTA method.
2. Determination of alkalinity in given water sample.
3. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
4. Conductometric titration using mixture of acids and strong base.
5. Determination of strength of in given hydrochloric acid using pH meter.
6. Estimation of sodium present in water using flame photometer.
7. Estimation of Zn present in effluent using Atomic Absorption Spectroscopy(AAS)
8. Corrosion experiment – weight loss method
9. Estimation of iron content of the given solution using potentiometer meter.
10. Estimation of iron content of the given sample using Spectro photometer (thiocyanate method).

List of equipments for a batch of 30 students

1. Flame photometer - 5 nos
2. Weighing balance - 5 nos
3. Conductivity meter ; Potentiometer; pH meter- 9 nos each.
4. Ostwald viscometer - 30 nos
5. Atomic Absorption Spectrophotometer - 1 no.

Common apparatus: Pipette, Burette, Burette stand, Standard volumetric flask, funnel, Conical flask, porcelain tiles, dropper, reagent bottles, glass rod, beaker, wash bottle, test tube (30 nos each)

COURSE OUTCOMES

TOTAL: 45 PERIODS

At the end of the course students should be able to

1.	The students will be outfitted with hands-on knowledge in the qualitative and quantitative chemical analysis of water quality related parameters, corrosion studies, heavy metal analysis, etc.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2			2	2						3	2	

(1-Low, 2- Moderate, 3-High)

REFERENCES:

1.	Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
2.	Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
3.	Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.
4.	Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.

18ZES107	BASIC ELECTRICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:	
•	To obtain the response of Electrical circuits.
•	To obtain Electrical machines and transformer basic characteristics.
•	To introduce basic power converters.

LIST OF EXPERIMENTS :	
1.	(a) Study of Electrical basic safety precautions. (b) Measurement of voltage, current, Power in resistive loads.
2.	(a) Measurement of waveforms parameters using CRO (b) Identification and calculation of resistors, inductors and Capacitors values.
3.	a) Steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a Step input voltage using a storage oscilloscope. b) Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. c) Observation of phase differences between current and voltage. d) Resonance in R-L-C circuits.
4.	(a) Observation of the no-load current waveform Transformer on an oscilloscope. (b) Load Test on Single phase Transformer.
5.	Measurement of three phase power in a balanced three phase circuits.
6.	Demonstration of cut-out sections of machines (a) DC machine (commutator-brush arrangement) (b)Induction machine (squirrel cage rotor) (c) synchronous machine (field winging – slip ring arrangement) (d) Single-phase induction machine.
7.	Torque Speed Characteristics of DC Shunt motor.
8.	(a)Synchronous speed of two and four-pole, three-phase induction motors. (b)Direction reversal by change of phase-sequence of connections. (c)Torque-Slip Characteristics of an induction motor. (d)Generator operation of an induction machine driven at super-synchronous speed.

9.	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 (d) Components of LT switchgear.
	TOTAL :45 PERIODS

OUTCOMES:	After the course, the student will be able to
1.	Identify common electrical components and their ratings
2.	Make electrical connections by wires of appropriate ratings.
3.	Understand the usage of common electrical measuring instruments.
4.	Understand the basic characteristics of transformers and electrical machines.
5.	Understand the working of power electronic converters.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										3	2	
CO2	3	2	3										3	2	
CO3	3	2	1										2	1	
CO4	3	2	2										2	2	1
CO5	3	2	1										2	1	1

(1-Low, 2- Moderate, 3-High)

SEMESTER II

18SLS201	ENGINEERING PHYSICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To develop knowledge on properties of solids
- To understand the properties of conducting and semiconducting materials
- To become proficient in magnetic and dielectric materials
- To apply principles of quantum physics in the engineering field
- To know about the fundamentals of LASER and fibre optics and its applications

UNIT I PROPERTIES OF MATTER 9+3

Elasticity – Hooke's law – Stress – Types of Stresses – Strain- Types of Strain - Young's Modulus – Rigidity Modulus – Bulk Modulus –Poisson's ratio – Relationship between three elastic constants and Poisson's ratio – Torsional Pendulum – Factors affecting elasticity of materials - Bending moment of a Beam – Depression of cantilever (Theory and Experiment) – Determination of Young's modulus – Uniform and non-uniform bending (Theory and Experiment).

UNIT II CONDUCTING AND SEMICONDUCTING MATERIALS 9+3

Conductors –Ohm's Law – Electrical conductivity – Relation between current density, drift velocity and mobility – Classical free electron theory of metals – Expression for electrical conductivity of a metal –Expression for thermal conductivity of a metal – Wiedemann – Franz law – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states.

Intrinsic semiconductor – Energy band diagram – Direct and indirect semiconductors – Carrier concentration in an intrinsic semiconductor (derivation) – Extrinsic semiconductors – n-type & p-type semiconductors (Qualitative) – Determination of Bandgap of semiconductors (Experiment)

UNIT III MAGNETIC AND DIELECTRIC MATERIALS 9+3

Magnetism in materials – magnetic field and induction – magnetization – magnetic permeability and susceptibility – types of magnetic materials –microscopic classification of magnetic materials –Domain theory of ferromagnetism.

Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation – dielectric breakdown – high-k dielectrics.

UNIT IV QUANTUM PHYSICS 9+3

Blackbody radiation – Wien's displacement law – Rayleigh-Jean's law - Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh-Jean's law – Matter waves – De-Broglie's Hypothesis – Properties of matter waves - Wave-particle duality – Wavefunction

and its physical Significance – Schrodinger wave equation – Time-dependent and time-independent – Application of Schrodinger wave equation: Particle in a 1 D box.

UNIT V	LASER PHOTONICS AND FIBRE OPTICS	9+3

LASER – Interaction of light radiation with materials – Einstein's A and B coefficient derivation – Concept of LASER – Population inversion – Pumping action – Methods for pumping action – Characteristics of LASER – Principle, construction and working of Nd-YAG – Industrial and medical applications of lasers.

Structure of Optical Fibre – Guiding mechanism – Total internal reflection – Critical Angle – Conditions for total internal reflection – Principle and Propagation of light in Optical Fibres – Numerical aperture and acceptance angle – Types of optical fibres (Material, refractive index and mode) – their characteristics and applications.

TOTAL: 60 PERIODS

OUTCOMES:

1.	To learn about three types of elastic moduli and able to calculate them for different materials
2.	To learn about conducting and semiconducting materials and able to derive different parameters relevant to them
3.	To learn about types of magnetic materials and their types and functional knowledge of dielectric materials
4.	To understand the quantum nature of materials and apply fundamental principles of quantum physics to the engineering field
5.	To understand the working principles of lasers and their types and also to know about fiber optics and mechanism of propagation of light through them.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										3	1	
CO2	3	2	1										2	2	
CO3	3	2	1										2	1	
CO4	3	1	1	2									2	1	
CO5	3	1	1	2									3	1	

(1-Low, 2- Moderate, 3-High)

TEXTBOOKS:

1.	P. Mani, "Engineering physics", Dhanam Publications, 2017.
2.	G. Senthil Kumar, "Engineering physics", VRB Publishers

3.	A. Marikani, “Engineering Physics”, PHI Learning Pvt., India 2009
4.	Wahen M. A. “Solid state physics: Structure and properties of materials” Narosa publishing house, 2009
REFERENCES:	
1.	*R. K. Gaur and S.C. Gupta, “Engineering physics”, Dhanpat Rai publications, New Delhi 2003.*
2.	*M. N. Avadhanulu and P. G. Kshirsagar, “A textbook of engineering physics”, S. Chand and Company Ltd, New Delhi, 2005.*
3.	*K. Rajagopal, “Engineering Physics”, PHI, New Delhi, 2011.*
4.	*P. K. Palanisamy, “Engineering Physics”, SCITECH Publication, 2011*
5.	*M. Arumugam, “Engineering physics”, Anuradha publishers*

18ZBS202	ENGINEERING MATHEMATICS - II	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Vector calculus and their uses in various field theoretic subjects.
- Higher order and special type of linear differential equations and methods to find solutions.
- Laplace transforms and properties and their applications in engineering.
- Construction of analytic functions and concepts of concepts of conformal mapping, complex integration and series solutions

UNIT I VECTOR CALCULUS 9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORMS 9+3

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+k$, kz, $1/z$, z^2, e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+3

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Solve problems on vector calculus and to apply them in any other field theory related subjects.
2.	Solve differential equations and will be exposed to their applications in various fields of engineering.
3.	Solve problems on Laplace transforms and will be able to use Laplace transform in finding solutions of differential and integral equations and other engineering

	applications.
4.	Solve complex integration problems and will be exposed to various applications of analytic functions and conformal mapping in engineering.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1									3	1	
CO2	3	2	2	1									2	1	1
CO3	3	2	2	1									2	1	1
CO4	3	2	2	1									2	1	

(1- Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2.	Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1.	*Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd., 2011.*
2.	*Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.*
3.	*Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.*
4.	*Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.*
5.	*Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.*

18ZES203	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the organization of a digital computer and get exposed to the number systems
- Learn to think logically and write pseudo code or draw flow charts for problems and get exposed to the syntax of C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION **8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm –Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS **10**

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS **9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS **9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNION **9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre processor directives.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Know the various number systems and their conversion.
2. Write simple programs in C.
3. Design programs based on arrays.
4. Construct programs using functions and pointers concepts
5. Formulate simple Structures and Files program.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1								3	2	1
CO2	3	2	3	3	1								3	2	1
CO3	3	2	3	3	1								3	2	1
CO4	3	2	3	3	1						1		3	1	

CO5	3	2	3	3	1						1		3	1	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:	
1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2.	Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.

REFERENCES:	
1.	*Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.*
2.	*Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.*
3.	*Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.*
4.	*Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.*
5.	*Herbert Schildt, "C The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2010.*

18ZHS204	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To be able to acquire vocabulary by way of reading skills.
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

UNIT I	Vocabulary Building	6

1.1 The concept of Word Formation 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations

UNIT II	Basic Writing Skills	6

2.1 Sentence Structures 2.2 Use of phrases and clauses in sentences 2.3 Importance of proper punctuation 2.4 Creating coherence 2.5 Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely

UNIT III	Identifying Common Errors in Writing	6

3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés

UNIT IV	Nature and Style of sensible Writing	6

4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion

UNIT V	Writing Practices	6

TOTAL: 30 PERIODS

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

1.	Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
2.	Participate effectively in formal and informal conversations; introduce themselves and express their opinions in English.
3.	Comprehend conversations and deliver short talks in English.
4.	Write essays and descriptions of any kind in English.

5.	Prepare reports, graph presentation and Technical writing.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				1						3		3	1	2	
CO2				2						3		3	3	2	
CO3				1						3		3	3	2	
CO4				1						3		3	3	1	
CO5				1						3		3	3	1	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	William Zinsser, " On Writing Well", Harper Resource Book, 2001
2.	Liz Hamp-Lyons and Ben Heasly, "Study Writing", Cambridge University Press, 2006.
3.	Sanjay Kumar and PushpLata, "Communication Skills", Oxford University Press. 2011.

REFERENCES:

1.	*Richards, C. Jack, "Interchange Students", Book-2 New Delhi: CUP, 2015.*
2.	*Bailey ,Stephen, "Academic Writing: A Practical guide for students", New York: Rutledge, 2011.*
3.	*Seely, John, " The Oxford guide to writing & Speaking", New York, 1998.*
4.	*Bhatia M.P, "A Handbook of APPLIED GRAMMAR" , M.I Publications, AGRA, Sixth Edition.*

18ZMC205	CONSTITUTION OF INDIA	L	T	P	C
		1	0	0	0

Objective:

- To provide understanding ofbasic concepts of Indian Constitution and various organs created by the constitution including their functions.

UNIT I	INTRODUCTION	3

Constitution' Definition and Classification -Constitutional Organs - Indian Constitution: Sources and constitutional history, Salient features of Indian Constitution - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy Rule of Law - Separation of powers Constitution - Doctrine of Basic Structure.

UNIT II	UNION GOVERNMENT & STATE GOVERNMENT AND THEIR ADMINISTRATION	4

Distribution of Powers between Center and States Structure of the Indian Union: Federalism, Centre-State -relationship, President: Role, power and position, PM andCouncil of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha.

Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT III	LOCAL ADMINISTRATION	4

District's Administration head: Role and Importance,Municipalities: Introduction, Mayor and role of ElectedRepresentative, CEO of Municipal Corporation, Pachayatiraj: Introduction, PRI: ZilaPachayat, Elected officials andtheir roles, CEO ZilaPachayat: Position and role, Blocklevel: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials,Importance of grass root democracy Emergency Provisions

UNIT IV	ELECTION COMMISSION	4

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 15 PERIODS

References:

1. V.N. Shukla, Constitution of India
2. M.P. Jain – Indian Constitutional Law.
3.H.M.Seervai : Constitution of India
4.D.D.Basu: Shorter Constitution of India
5.Kagzi : Indian Constitution
6.Pylee : The History of Indian Constitution

18SLS206	PHYSICS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES

•	To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids

LIST OF EXPERIMENTS : PHYSICS LABORATORY (ANY 5 EXPERIMENTS)

1.	Determination of rigidity modulus : Torsion Pendulum
2.	Determination of Young's modulus by non-uniform bending method
3.	(a) Determination of wave length and particle size using LASER (b) Determination of acceptance angle in an optical fibre
4.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
5.	Determination of velocity of sound and compressibility of fluid – Ultrasonic interferometer
6.	Determination of wavelength of mercury spectrum – Spectrometer grating
7.	Determination of band gap of a semiconductor
	TOTAL: 45 PERIODS

COURSE OUTCOME: After the course the students will be able to

•	Apply Principles of elasticity, optical and thermal properties for engineering applications.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2			2	2						3	2	3

18ZES207	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Be familiar with the use of Office software and presentation and visualization tools.
- Be familiar with programming in C and basics of Decision making, Looping constructs.
- Learn to use Arrays, strings, functions and implement the concepts of structure, Union and file organization.

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Programs with Pointers.
9. Program using Recursive Function.
10. Program using structures and unions.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Apply good programming design methods for program development.
2. Design and implement C programs for simple applications.
3. Write C programs, which involve decision making and arrays and strings.
4. Develop programs using functions and pointers.
5. Develop programs using structures and unions.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1							1		3	3	
CO2	3	2	2	1							1		3	3	
CO3	3	2	2	1							2		2	1	
CO4	3	2	2	2							2		2	1	
CO5	3	2	2	2							2		3	1	

(L- Low, M- Moderate, H-High)

REFERENCES:

1. *Herbert Schildt, "C - The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2010.*

18ZES208	WORKSHOP PRACTICES	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES:

•	To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon joint and Cross-Lap joint
•	To make various welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint.

LIST OF EXPERIMENTS:

1. Introduction to use of tools and equipment in Carpentry, Welding, Foundry and Sheet metal
2. Safety aspects in Welding, Carpentry and Foundry
3. Half lap Joint and Dovetail Joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of Sand mold for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal
7. Electrical wiring – simple house wiring
8. Plumbing
9. CNC Machines demonstration and lecture on working principle.
10. Additive manufacturing demonstration and lecture on working principle.

TOTAL: 75 PERIODS

COURSE OUTCOMES:	On completion of this course, students will be able to
1.	Use tools and equipment used in Carpentry, Welding, Foundry and Sheet metal.
2.	Make half lap joint dovetail joint in carpentry and welded lap joint, butt joint and T-joint
3.	Prepare sand mould for cube, conical bush, pipes and V pulley.
4.	Fabricate parts like tray, frustum of cone and square box in sheet metal
5.	Carry out minor works/repair related to electrical wiring and plumbing.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2	1	2
CO2	2	1											2	1	2
CO3	2	1	2										2	2	2
CO4	2	1	2										3	2	2

CO5	2	2	2			1							3	2	2
(1-Low, 2- Moderate, 3-High)															

18ZHS209	COMMUNICATION ENGLISH LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop their communicative competency in English with specific reference to their speaking and listening.
- To enhance their ability to communicate effectively in interviews, Group Discussion and Day to day life communication.
- To comprehend a different types of accent and use them in their communication

UNIT I	PRONUNCIATTION PRACTICE	6

Verbal Ability, Articulation of sounds- Intonation-Stress and Rhythm-Conversation practice-listening Various lectures

UNIT II	COMMUNICATION AT WORKPLACE	6

Creative writing - Writing job applications - cover letter- resume- e-mails- memos- reports.Writing abstracts- summaries- interpreting visual texts.

UNIT III	ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS	6

International English Language Testing System (IELTS)- Test of English as a Foreign Language (TOEFL)- Civil Service(Language related part) –English for competitive examinations

UNIT IV	INTERVIEW SKILLS	6

Different types of Interview format- answering questions- offering information- mock interviews- Body languages.

UNIT V	SOFT SKILLS	6

Motivation- emotional intelligence-Multiple intelligences- managing changes- time management- leadership straits- team work- career planning- creative and critical thinking

TOTAL HOURS	30 Hrs

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

1.	Face interviews, group discussions and other language parameters in the job market
2.	Write any competitive examinations which cover language part in it.
3.	Take part in any English conversations of any kind in English. Flawlessly without fear and shyness.
4.	Write articles for newspapers and magazines or any write-up in English without grammar mistakes.
5.	Come out with leadership qualities, team work and career planning and will also possess critical and creative thinking.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PSO1	PSO2	PSO3
CO1	2					3			2	3			3	2	
CO2	3					2			2	3			3	2	
CO3	2					2			3	3			3	3	
CO4	3					2			3	3			3	3	
CO5	3					2			3	3			3	2	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Communication Skills for Engineers and Scientists, PHI Learning PVT.LTD, Delhi, 2014.
2.	Communication Skills and Soft Skills An Integrated Approach, Dorling Kindersley (INDIA) PVT.LTD, New Delhi, 2012.
3.	Soft Skills, MJP Publishers,Chennai, 2010.

REFERENCES:

1.	*Craven, Miles. Listening Extra-A resource book of multi-level skills activities. Cambridge University Press, 2004.*
2.	*Seely, John. The Oxford guide to writing & Speaking. New Delhi: Oxford University Press,20*
3.	*Comfort, Jeremy, et al. Speaking Effectively: Developing speaking skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.*
4.	*Dutt P. Kiranmai and RajeevanGeetha. Basic Communication Skills, Foundation Books:2013*

SEMESTER III

18ZBS301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES:

•	To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
•	To acquaint the student with Fourier transform techniques used in wide variety of situations.
•	To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	9+3

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II	FOURIER SERIES	9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9+3

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV	FOURIER TRANSFORMS	9+3

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	9+3

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL :60 PERIODS

COURSE OUTCOMES

1.	Solving the problems based on partial differential equations.
2.	Applying the concepts of general and complex fourier series.
3.	Understanding the applications of partial differential equation.

4.	Illustrating the principle and properties of fourier transform.
5.	Understanding the properties of Z-transforms and differential equations.
6.	Summarize the principles of partial differential equations and solve some equations of engineering.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	2	3									2	1	
CO2	3	2	2	2									3	1	
CO3	3	2	2	1									3	2	
CO4	3	1	2	2									3	2	
CO5	3	1	2	1									3		
CO6	3	1	2	3									2		

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. *Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2016.*
2. *Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.*
3. *Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd., 1998.*

REFERENCES:

1. *Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications Pvt Ltd, 9th Edition 2016.*
2. *Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.*
3. *Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2016.*
4. *Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.*
5. *Ray Wylie C and Barrett .L.C, "Advanced Engineering Mathematics", 6th Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, 2012.*
6. *Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.*

18SES302	DIGITAL PRINCIPLES AND SYSTEMS DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To design digital circuits using simplified Boolean functions and analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits and understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES	9

Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations.

UNIT II	COMBINATIONAL LOGIC	9

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers – Real Time Application of Combinational Circuits- Introduction to HDL – HDL Models of Combinational circuits.

UNIT III	SYNCHRONOUS SEQUENTIAL LOGIC	9

Sequential Circuits – Latches and Flip Flops – Shift Registers – Counters- State Reduction and State Assignment - Analysis and Design Procedures – HDL for Sequential Logic Circuits.

UNIT IV	ASYNCHRONOUS SEQUENTIAL LOGIC	9

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

UNIT V	MEMORY AND PROGRAMMABLE LOGIC	9

RAM and ROM – Memory Decoding – Error Detection and Correction – PROM – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices – Application - Specific Integrated Circuits.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Evaluate arithmetic operations on any number system.
2.	Solve the Boolean expression using K-map and tabulation technique and designing a combinational hardware circuit using Boolean simplification technique.
3.	Design a given digital circuit using synchronous sequential logic.
4.	Analyze a given digital circuit using Asynchronous sequential logic.
5.	Design a circuit using PLD.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1		1	1	1					3	1	
CO2	3	3	2	2	1	1	1	1			2		3	2	1
CO3	3	3	2	2	1	1	1	1			1		3	2	1
CO4	3	3	2	2		1	1	1			1		3	2	1
CO5	3	3	2	2	1	1	1	1			2		3	2	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2012.
2. *G. K. Kharate, "Digital Electronics", Oxford University Press, 2010.*

REFERENCES:

1. *John F. Wakerly,"Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007.*
2. *Charles H. Roth Jr, "Fundamentals of Logic Design", Fifth Edition, Jaico Publishing House, Mumbai, 2003.*
3. *Donald D. Givone," Digital Principles and Design", Tata Mc Graw Hill, 2003.*
4. *A P Malvino,D P Leach And Gountansala "Digital Principles And Applications" 7th Edition, Tata Mc Graw Hill, 2010*
5. *Mark K Bach,"Complete Digital Design", Tata Mc Graw Hill, 2003.*

18SPC303	OBJECT ORIENTED PROGRAMMING USING C++ AND JAVA	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Be familiar with the Object oriented programming concepts , basics of programming in C++ using classes and objects.
- Be familiar with the C++ concepts of overloading, Inheritance, polymorphism, Constructors etc.
- Be exposed to the Object oriented programming concepts using Java and features of Java Programming Language

UNIT I OBJECT ORIENTED PROGRAMMING 8+3

Procedural languages, Object oriented approach, Characteristics of object oriented languages – objects, classes, inheritance, reusability, creating new data types, polymorphism and overloading. Introducing C++ classes – Structures and Classes – Unions and Classes – Constructors and Destructors.

UNIT II OBJECTS AND CLASSES IN C++ 10+3

Friend functions – Friend classes – Inline functions – Parameterized constructors – Static class members – Scope resolution operator – Nested classes – Passing objects to functions – Returning objects. Arrays of objects – Pointers to objects – this pointer – Pointers to derived types – Pointers to class members – References – Dynamic allocation operators – new and delete.

UNIT III FEATURES OF C++ 9+3

Function overloading, Copy constructors, Default arguments, Operator overloading, Inheritance, Virtual functions and polymorphism, Templates

UNIT IV JAVA PROGRAMMING LANGUAGE 9+3

Data types, variables and Arrays, Operators, Control Statements. Introducing classes – constructors – this keyword – overloading methods – Arrays – Command line arguments. Inheritance basics – using super – dynamic method dispatch – abstract classes.

UNIT V FEATURES OF JAVA 9+3

Exception handling – Multithreaded Programming – I/O Basics – Streams – Applets. Collections framework – java.util, Event handling – AWT - Swing.

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Illustrate the basic concepts of OOPS using c++.
2. Understand the various concepts of objects and classes in C++.
3. Implement the features of C++.
4. Illustrate the basic concepts of java.
5. Remember the features of java like exception handling method and multithreading.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1								3	3	1
CO2	3	3	2	1									3	2	
CO3	3	3	3	2									3	2	
CO4	3	2	1										3	1	

CO5	3	3											3	1	

(L- Low, M- Moderate, H-High)

TEXT BOOKS:	
1.	Robert Lafore, "Object oriented Programming in C++", Fourth edition, SAMS Publishing, 2002.
2.	Herbert Schildt, "Java: The Complete Reference", Ninth Edition, McGraw-Hill Education, 2014.

REFERENCES:	
1.	*E Balagurusamy, "Object oriented Programming with C++", Sixth edition, 2013.*
2.	*Herbert Schildt, "C++: The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2011.*
3.	*Venugopal K. R., RajkumarBuyya and Ravishankar T, "Mastering C++", Tata McGrawHill Publishing Company, New Delhi, 2009.*
4.	*DT Editorial services, "Core and Advanced Java, Black Book", Dreamtech Press, 2015.*
5.	*Bruce Eckel, "Thinking in java", Fourth edition, Pearson education, 2006.*

18SPC304	FUNDAMENTALS OF DATA STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be familiar with the basics of linear data structures using C programming language and advanced concepts of Linear ADTs
- Learn non linear data structures – Trees, graph and its traversals
- Be exposed to sorting, searching, hashing algorithms

UNIT I LINEAR DATA STRUCTURES – LIST **9**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – Sparse Matrix operations.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES **9**

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – Applications of queues – Evaluating postfix expressions

UNIT III NON LINEAR DATA STRUCTURES – TREES **9**

Tree ADT – Tree traversals - Binary Tree ADT – Expression trees – Applications of trees – Binary search tree ADT – AVL Trees – B-Tree - B+ Tree - Heap – Applications of heaps – Huffman coding

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS **9**

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Connected Components – Minimum Cost Spanning trees – Shortest Paths – Single Source All Destination – All Pairs Shortest Paths - Topological Sort – Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING **9**

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort – Merge Sort - Quick sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Explain the concepts of array, linked list and their types.
2. Develop the programs using stacks and queue.
3. Analyze the use of various trees and search trees.
4. Understand the use of graphs and algorithms in computer applications.
5. Explain the various types sorting, searching and hash functions.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1								3	3	1
CO2	3	3	2	1									3	2	
CO3	3	3	3	3									3	2	
CO4	3	3	1										3	1	
CO5	3	2											2	1	

(L- Low, M- Moderate, H-High)

TEXT BOOKS:

1.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2002.
REFERENCES:	
1.	*Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2011*
2.	*Clifford A. Shaffer, "Data Structures & Algorithm Analysis in C++",Third Edition, Dover Publications, 2011*
3.	*Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.*
4.	*Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C‖, Second Edition, University Press, 2008*
5.	*Thomas H. Cormen , Charles E. Leiseron, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, PHI learning Pvt. Ltd., 2011.*

18ZMC305	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
	(ECE/EEE/CSE/MECH)	1	0	0	0

OBJECTIVES:

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY (CO-a &b)

concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- types of ecosystem (forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - energy flow in the ecosystem – ecological succession processes –types – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds.

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION (CO-a &c)

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards– solid waste management: causes, effects and control measures .

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES (CO-a &d)

Forest resources: Use and over-exploitation, deforestation – Water resources: Use and overutilization of surface and ground water– Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems– Energy resources: renewable and non renewable energy sources, use of alternate energy sources.– Land resources- land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

Field study of local area to document environmental assets – river / forest / grassland / hill

TOTAL : 15 PERIODS

COURSE OUTCOMES

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

1.	Ability to apply the knowledge of environmental science in identifying, to formulate and to solve the environmental problems.
2.	Public awareness of environmental function is at infant stage.
3.	Ignorance and incomplete knowledge has led to misconceptions.
4.	Obtaining knowledge about natural recourses and their functions.

5.	Ability to apply knowledge in conserving various natural resources.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1					2	1	1						2	1
CO2	1					2	2	2						2	1
CO3	1					2	3	2						2	
CO4	1					2	2	2						2	1
CO5	1					2	3	2						2	

(1-Low, 2- Moderate, 3-High)

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.

REFERENCES:

1.	*Cunningham,W.P.Cooper,T.H. Gorhani,'Environmental Encyclopedia', Jaico Publ.,House, Mumbai, 2001.*
2.	*Rajagopalan,R,'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.*
3.	*R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.*
4.	*Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India,*
5.	*Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi,2007.*

18SHS306	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
		3	0	0	2

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values among the students.
- To learn about safety, responsibilities and rights and familiarize about global issues.

UNIT I HUMAN VALUES **9**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **9**

Senses of „Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral dilemmas - Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion - Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination – Gender sensitization.

UNIT V GLOBAL ISSUES **9**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Understand human values and ethics.
2. Understand engineering values and ethics.
3. Explain the engineering as social experimentation and ethics.
4. Analyze safety, Risk and their benefits and Professional Rights.
5. Estimate ethical issues related to engineering.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2	1	3						1	1
CO2						2		3						2	1
CO3						2		3						2	

CO4						2	2	3						2	
CO5						3		3						3	1
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:	
1.	Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:	
1.	*Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.*
2.	*Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009*
3.	*John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003*
4.	*Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001*
5.	*Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.*

18SES307	DIGITAL PRINCIPLES AND SYSTEMS DESIGN LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Understand the various logic gates and various combinational circuits.
- Understand the various components used in the design of digital computers and sequential circuits
- Learn to use HDL.

LIST OF EXPERIMENTS:

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implement a 4-bit binary adder / subtractor.
4. Design and implement Parity generator / checker.
5. Design and implement Magnitude Comparator.
6. Design and implement an application using multiplexers.
7. Design and implement shift –registers.
8. Design and implement synchronous counters.
9. Design and implement asynchronous counters.
10. Coding combinational circuits using HDL.
11. Coding sequential circuits using HDL.
12. Design and implementation of a simple digital system (Mini Project).

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Apply theorems and K-maps to simplify Boolean functions.
2. Design a combinational circuits like arithmetic circuits, decoder and Encoder.
3. Analyze a given digital circuit like combinational and sequential.
4. Design synchronous sequential circuits like registers and counters and asynchronous circuits.
5. Develop a simple digital system for a given specifications and design various circuits for systems design using HDL

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	2				1				3	2	1
CO2	3	2	3	1	2				1				3	2	
CO3	3	3	2	2	2				1				3	2	
CO4	3	3	3	3	2				1				2	2	2

CO5	3	3	3	3	3				1				3	2	1
(1-Low, 2- Moderate, 3-High)															

REFERENCES:

1. *Stephen Brown, Zvonko Vranesic,"Fundamentals of Digital Logic Design With VHDL", Third Edition, McGrawHill India, 2012.*

18SES308	OBJECT ORIENTED PROGRAMMING USING C++ AND JAVA LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	To build software development skills using java programming for real-world applications using generic programming and event handling.
•	To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
•	To develop a java application with threads and generics classes and design and build simple Graphical User Interfaces.

LIST OF EXPERIMENTS:

C++ PROGRAMS

1. Function Overloading.
2. Call by value and Call by Reference.
3. Static Data and Member Function.
4. Friend function and Friend class
5. Objects as Arguments.
6. Static and Dynamic Objects.
7. Constructor and Destructor.
8. Operator Overloading
9. Inheritance.
10. Virtual functions.
11. Template Functions and Template Class.

JAVA PROGRAMS

1. Overloading and Overriding
2. Exception Handling
3. Classes and Inheritance
4. Dynamic method dispatch
5. Multithreaded programming
6. Collections and Generics
7. Applet Development
8. Controls and Layouts
9. Applet Development using Swing
10. Streams
11. JDBC

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Develop a C++ programs using OOPS concepts.
2.	Build a C++ programs using call by value and call by reference.
3.	Construct a C++ programs using virtual functions and templates.
4.	Develop a Java programs for simple applications that make use of classes and inheritance, overloading and overriding.
5.	Build a Java Programs with array list, exception handling and Multithreading, file Processing, generic programming, I/O streams applets and JDBC.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PS O 1	PSO2	PSO3
CO1	3	3	2	2				1					3	3	2
CO2	3	3	2	1				1					3	3	2
CO3	3	3	2	1				1					3	3	2
CO4	3	3	1										3	2	1
CO5	3	3	1										3	2	1
(1-Low, 2- Moderate, 3-High)															

18SPC309	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To implement linear and non-linear data structures.
- To understand the different operations of search trees and graph traversal algorithms.
- To get familiarized to sorting, searching algorithms and hashing technique.

LIST OF EXPERIMENTS:

1. Array implementation of List, Stack and Queue ADTs
2. Linked List implementation of List, Stack and Queue ADTs
3. Polynomial manipulations
4. Sparse matrix operations
5. Evaluating postfix expressions
6. Converting infix to postfix expressions
7. Binary Tree traversals – Recursive and non-recursive functions
8. Implementation of Binary Search trees
9. Huffman coding
10. Graph representations – Adjacency matrix and Adjacency Lists
11. Minimum cost spanning trees – Prim's algorithm
12. Shortest paths
13. Selection sort, Bubble sort and Insertion sort
14. Quicksort and Mergesort
15. Hashing applications

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Apply generic programming technique to implement any data structure.
2. Identify appropriate search trees for an application.
3. Make use of graphs in problem solving.
4. Develop the various sorting algorithms and compare them.
5. Create a program for hash applications.

COURSE ARTICULATION MATRIX:

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

(1- Low, 2- Moderate, 3-High)

SEMESTER IV

18SBS401	PROBABILITY AND QUEUEING THEORY	L	T	P	C
		3	1	0	4

OBJECTIVES:

1.	To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

UNIT I	RANDOM VARIABLES	9+3

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II	TWO - DIMENSIONAL RANDOM VARIABLES	9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

UNIT III	RANDOM PROCESSES	9+3

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT IV	QUEUEING MODELS	9+3

Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little‟s formula - Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

UNIT V	ADVANCED QUEUEING MODELS	9+3

Finite source models - M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/E_K/1 as special cases – Series queues – Open Jackson networks.

TOTAL (L : 45 + T : 15): 60 PERIODS

COURSE OUTCOMES: On completion of this course, students will be able to

1.	Understand discrete and continuous variables and their distributions.
2.	Outline two dimensional random variables distributions and their transformation.
3.	Classify the various random processes.
4.	Understand the queuing models.
5.	Illustrate the advanced queuing models like finite source models and series queues.
6.	Develop probabilistic models which can be used in several areas of science and engineering.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
CO1	3	3	3	3							1		3	2	1

CO2	3	3	3	3							1		3	2	1
CO3	3	3	3	3							2		3	2	
CO4	3	3	3	3							2		3	3	
CO5	3	3	3	3							3		3	3	
CO6	3	3	3	3							3		3	3	1

((1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. *Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", 2nd Edition, Academic press (Elsevier), 2014.*
2. *Gross. D. and Harris. C.M , "Fundamentals of Queueing Theory", 4th Edition, John Wiley and Sons, 2008.*

REFERENCES:

1. *Robertazzi T, "Computer Networks and Systems: Queueing Theory and performance evaluation", 3rd Edition, Springer, 2006.*
2. *Taha H.A., "Operations Research", 10th Edition, Pearson Education, India, 2017.*
3. *Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2016.*
4. *Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", 3rd Edition, Tata Mc Graw Hill Edition, New Delhi, 2014.*
5. *Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 3rd Edition, Wiley India Pvt. Ltd., Bangalore, 2014.*

18SPC402	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Memory addressing modes used by the instructions and to expose the major differentials of RISC and CISC architectural characteristics with performance evaluation of CPU and understand CPU data path and control.
- To understand Concept of pipelining and the various hazards that arise in a pipeline and the typical solutions to the hazards, get familiarized to Concept of memory Technologies and Parallelism and Memory Hierarchies.
- To understand Concepts of Multicore and Shared Memory Multiprocessors.

UNIT I BASIC COMPUTER DESIGN 9

Register Transfer Language – Register Transfer – Bus and Memory Transfers – Arithmetic Microoperations – Logic Microperations – Shift Microoperations-Arithmetic Logic Shift Unit-Instruction Codes – Computer Registers – Computer Instructions-Timing and Control-Instruction Life Cycle –Memory Reference Instructions-IO and Interrupt-Complete Computer Description-Design of Basic Computer-Design of Accumulator Logic.

UNIT II CENTRAL PROCESSING UNIT AND PIPELINING 9

Introduction – General Register Organization – Stack Organization-Instruction Formats-Addressing Modes – Data Transfer and Manipulation-Program Control-RISC-Parallel Processing-Pipelining-Arithmetic Pipeline-Instruction Pipeline-RISC Pipeline-Vector Processing-Array Processors.

UNIT III COMPUTER ARITHMETIC 9

Introduction – Addition and Subtraction – Multiplication Algorithms – Division Algorithms-Floating-Point Arithmetic Operations – Decimal Arithmetic Unit-Decimal Arithmetic Operations.

UNIT IV INPUT-OUTPUT ORGANIZATION 9

Peripheral Devices – Input-Output Interface – Asynchronous Data Transfer – Modes of Transfer-Priority Interrupt-DMA-IOP-Serial Communication.

UNIT V MEMORY ORGANIZATION 9

Memory Hierarchy– Main Memory – Auxiliary Memory– Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Understand Register Transfer Language.
2. Analyze various CPU organizations and Pipelined Circuits.
3. Evaluate Computer Arithmetic Operations using arithmetic algorithms.
4. Interpret IO and its organization.
5. Outline various types of Memory and its organization.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	2	1	1									3	1	
CO2	3	2	1	1									3	1	
CO3	3	3	2	2									3	2	
CO4	3	3	2	1		1						1	3	2	
CO5	3	3	2	1									3	2	1
(1-Low, 2- Moderate, 3-High)															

TEXT BOOKS:

1.	M. Morris Mano "Computer System Architecture", Third Edition, Pearson Education, 2017.
2.	V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation",VIth edition, Mc Graw-Hill Inc, 2012..

REFERENCES:

1.	*William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education, 2006.*
2.	*Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.*
3.	*John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.*
4.	*David A. Patterson and John L. Hennessey, "Computer organization and design', Morgan Kauffman / Elsevier, Fifth edition, 2014.*
5.	*Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications",first edition, Tata McGraw Hill, New Delhi, 2005.*

18SPC403	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts and functions of operating systems, Processes and Threads.
- To analyze Scheduling algorithms and concept of Deadlocks and to understand I/O management and File system
- To analyze various memory management schemes.

UNIT I	INTRODUCTION	9

Definition – History of Operating systems – Review of computer hardware – Types of operating systems – User and operating system interface – System calls – Operating system structure – Monolithic systems – Microkernels – Exokernals – Linkers and loaders – Building and booting an operating system – BIOS – Bootstrap loader.

UNIT II	PROCESSES AND THREADS	9

Process concept – scheduling – operations on processes – interprocess communication – shared memory systems – message passing systems – examples of IPC systems – communication in client server systems. Thread concepts – Multicore programming – Multithreading models – Thread libraries – Implicit threading – issues – examples. CPU Scheduling – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multi-processor scheduling – Real-time CPU scheduling.

UNIT III	PROCESS SYNCHRONIZATION	9

Synchronization tools – Critical Section problem – Peterson's solution – Hardware support for synchronization – Mutex locks – Semaphores – Monitors. Synchronization examples – Classic problems – Synchronization within the kernel – POSIX synchronization. Deadlocks – System model – Deadlock in Multithreaded applications- Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT IV	MEMORY MANAGEMENT	9

Main memory – Contiguous memory allocation – paging – structure of page table – swapping – Segmentation – Segmentation with paging - Examples. Virtual memory – Demand paging – copy-on-write – Page Replacement – Allocation of frames – Thrashing – Memory compression – Allocating Kernel Memory – Examples. Virtual machines – building blocks – types of VMs and their implementations – Virtualization and operating system components – examples.

UNIT V	FILE MANAGEMENT, PROTECTION AND SECURITY, CASE STUDIES	9

File system interface – low level file implementations – supporting high level file abstractions – directories – implementing directories – Memory mapped files. Protection and security – Program threats – System and Network threats – Implementing security defenses – Access matrix – Role based and mandatory access control. Case studies – Linux system – Windows 10.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Understand various operating systems, hardware and its functions.
2.	Outline operating system process, thread concepts and CPU scheduling algorithms.

3.	Remember process synchronization, Deadlock, prevention and avoidance algorithms.
4.	Compare various memory management schemes.
5.	Understand the functionality of file systems.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1		1								3	1	
CO2	3	2	3	2	2								3	2	
CO3	3	3	2	2	2								3	2	
CO4	3	3	3	2	2								3	2	1
CO5	3	3	3	3	3								3	3	2

(1- Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Abraham Silberchatz, Peter Baer Galvin, Greg Gagne "Operating system concepts", 9th edition, John Wiley Publishers, 2012.
2.	Andrew S Tanenbaum and Herbert Bos, "Modern Operating Systems", Fourth edition, Pearson, 2016.

REFERENCES:

1.	*Gary Nutt, "Operating Systems", Addison Wesley, USA, 2009.*
2.	*William Stallings "Operating Systems: Internals and design Principles" 8th Edition, Prentice Hall, 2014.*
3.	*D M Dhamdhere, "Operating Systems: A Concept-based Approach", 2nd Edition, Tata McGraw-Hill Education, 2009.*
4.	*Achyut S.Godbole, Atul Kahate, ―Operating Systems‖, McGraw Hill Education, 2016.*
5.	*Harvey M. Deitel, ―Operating Systems‖, Third Edition, Pearson Education, 2004.*

18SPC404	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand and apply the algorithm analysis techniques and the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques
- To understand the limitations of Algorithmic power.

UNIT I	INTRODUCTION	9

Algorithm – Fundamentals of algorithmic problem solving – Understanding the problem - Algorithm correctness – Analyzing an algorithm – Coding an algorithm. Important problem types. Fundamentals of the analysis of algorithm efficiency – Analysis framework – worst case, best case, average case efficiencies – Asymptotic notations and basic efficiency classes – Mathematical analysis of non-recursive and recursive algorithms – Computing nth Fibonacci number – Amortized analysis.

UNIT II	BRUTE FORCE, EXHAUSTIVE SEARCH, DECREASE AND CONQUER	9

Brute force - Selection sort and Bubble sort, Sequential search and brute force string matching, Closest pair and convex hull problems by brute force, Exhaustive search – Traveling salesman problem, knapsack problem, Depth First search and Breadth first search. Decrease and conquer – Insertion sort, Topological sort, generating permutations. Decrease by a constant factor – binary search. Variable size decrease – Computing a median.

UNIT III	DIVIDE AND CONQUER, TRANSFORM AND CONQUER	9

Divide and Conquer - Merge sort, Quicksort, Binary tree traversals, Multiplication of large integers and Strassen's matrix multiplication. Transform and Conquer – Balanced search trees – AVL, 2-3, Heaps and heapsort, Binary Exponentiation, Horner's rule and binary exponentiation.

UNIT IV	DYNAMIC PROGRAMMING, GREEDY TECHNIQUE	9

Dynamic programming - Basic examples, Knapsack problem and memory functions, Optimal binary search trees, Warshall's and Floyd algorithms. Greedy technique – Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm, Huffman trees and codes. Iterative improvement – Maximum flow problem.

UNIT V	COPING WITH LIMITATIONS OF ALGORITHMIC POWER	9

Backtracking – n Queens problem, Hamiltonian Circuit problem and Subset sum problem. Branch and Bound – Assignment problem, Knapsack problem and traveling salesman problem. Decision trees for sorting. P, NP and NP-Complete problems, Approximation algorithms for NP-Hard problems.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Understand the fundamental of algorithm and Analyze the algorithm efficiency.
2.	Explain the various brute force approach, exhaustive search and decrease and conquer approach.

3.	Explain the various techniques in divide and conquer, transform and conquer.
4.	Outline the dynamic programming approach and greedy approach.
5.	Illustrate the various approaches in backtracking and branch and bound technique.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3										3	3	1	1
CO2	3	2		3								2	3	2	1
CO3	3	2	3	3		3	2				2	3	3	1	2
CO4	3	2	3	2		2	3				2	3	3	3	2
CO5	3	2		2		3						1	3	2	

(1- Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

REFERENCES:

1.	*Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Galgotia Publications, New Delhi, 2010.*
2.	*Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms‖, Pearson Education, Reprint 2006.*
3.	*Harsh Bhasin, ―Algorithms Design and Analysis‖, Oxford university press, 2016.*
4.	*S. Sridhar, ―Design and Analysis of Algorithms‖, Oxford university press, 2014.*
5.	*http://nptel.ac.in/*

18SPC405	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of data models and to represent database system using ER diagrams.
- To study SQL and relational database design and understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.

UNIT I INTRODUCTION TO DATABASES **9**

Traditional approaches – Network model, Hierarchical model, File systems. Databases and database users, advantages of DBMS approach, Database system concepts and architecture – data models, schemas and instances, three schema architecture and data independence, database system environment, Client server architectures, ER models, Enhanced ER model – Specialization and generalization, UNION types.

UNIT II RELATIONAL MODEL **9**

Relational Model - Constraints - Keys - Dependencies - ER to Relational Mapping – Object Relational Mapping - Relational Algebra – Tuple relational calculus - Normalization - First, Second, Third & Fourth Normal Forms - BCNF – Join Dependencies – Inference rules, equivalence and minimal cover, Properties of relational decompositions.

UNIT III SQL & QUERY OPTIMIZATION **9**

Basic SQL - Data definition and data types, specifying constraints, basic retrieval queries. Complex queries – Nested subqueries, Correlated subqueries, Inner joins and Outer joins, Views. PL SQL – Cursors, functions, procedures, triggers. Algorithms for query processing and optimization, Database tuning.

UNIT IV TRANSACTION PROCESSING, CONCURRENCY CONTROL AND RECOVERY **9**

Introduction to Transaction processing, Properties of transaction, Characterizing schedules based on recoverability and serializability. Concurrency control techniques – Two phase locking protocol, time stamp ordering protocols, optimistic concurrency control techniques, multiple granularity locking, Deadlocks. Database recovery techniques – Deferred update and Immediate update, Shadow paging, log based recovery.

UNIT V ADDITIONAL TOPICS **9**

File structures, Indexing – Multilevel indexes, B trees and B+ trees, External Hashing, RAID, Distributed databases, Introduction to data warehousing and data mining, Spatial and temporal databases, Big data applications.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Classify the modern and futuristic database applications based on size and complexity.
2.	Construct Relational model to perform database design effectively.
3.	Create various queries using normalization criteria and optimize queries.
4.	Understand transaction processing, concurrency control techniques and database recovery techniques.
5.	Outline the advanced databases like indexing technique, trees.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1									3	3	
CO2	3	3		1		1							3	2	1
CO3	3	3		2		1							3	2	1
CO4	3	3		3									3	1	
CO5	3	3		3	2	2					1		3	2	2

(L- Low, M- Moderate, H-High)

TEXT BOOKS:

1. Ramez Elmasri, Shamkant B.Navathe, "Fundamentals Of Database Systems", Seventh Edition, Pearson Education, 2016.
2. Abraham Silberchatz, Henry F Korth and Sudarshan S, "Database System Concepts", Sixth edition, Tata McGraw-Hill, New Delhi, 2010.

REFERENCES:

1. *Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Tata McGraw-Hill, New Delhi, 2008.*
2. *C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.*
3. *G.K.Gupta,"Database Management Systems‖, Tata McGraw Hill, 2011.*
4. *Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi,2006.*
5. *Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata Mc Graw Hill,2010.*

18SPC406	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms, Process Creation and Inter Process Communication, Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms, File Organization and File Allocation Strategies

LIST OF EXPERIMENTS:

1. Basic LINUX commands
2. Write programs using the following system calls fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate cp, ls, grep commands
4. Shell Programming examples
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Simulation of Producer consumer problem and dining philosopher's problem
7. Bankers Algorithm for Deadlock Avoidance
8. Implementation of Deadlock Detection Algorithm
9. Implementation of the following Memory Allocation Methods for fixed partition
10. First Fit b) Worst Fit c) Best Fit
11. Implementation of the following Page Replacement Algorithms a) FIFO b) LRU c) LFU
12. Implementation of the following File Allocation Strategies a) Sequential b) Indexed c) Linked

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Illustrate the basic LINUX commands and Developing a program for system calls.
2. Evaluate the performance of various CPU Scheduling Algorithms.
3. Design a Deadlock avoidance and Detection Algorithms, File Organization and File Allocation Strategies.
4. Design a Semaphores Create processes and implement IPC.
5. Analyze the performance of the various Page Replacement Algorithms.

COURSE ARTICULATION MATRIX:

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

(1- Low, 2- Moderate, 3-High)

18SPC407	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To understand data definitions and data manipulation commands
- To learn the use of nested and join queries
- To understand functions, procedures and procedural extensions of data bases
- To be familiar with the use of front end tool
- To understand design and implementation of typical database applications

LIST OF EXPERIMENTS:

1. Data Definition Commands, Data Manipulation Commands, Database constraints,
2. Transaction Control statements
3. Database Querying – Simple queries, Nested queries, Sub queries and Joins
4. Views, Sequences, Synonyms
5. Database Programming with PL/SQL: Implicit and Explicit Cursors
6. Procedures and Functions
7. Triggers
8. Exception Handling
9. Database Design using ER modeling, normalization and Implementation for any application
10. Database Connectivity with Front End Tools
11. Mini project using real life database applications

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Make use of typical data definitions, manipulation commands, Database constraints and Transaction control statements.
2.	Design applications for Database querying and Views.
3.	Develop simple applications for Database Programming with PL/SQL.
4.	Creating applications that make use of procedures, triggers and exception handling.
5.	Developing an application that requires a Front-end Tool and Normalizations and develop real life database application.

COURSE ARTICULATION MATRIX:

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

(L- Low, M- Moderate, H-High)

SEMESTER V

18SBS501	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

1.	To extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

UNIT I	LOGIC AND PROOFS	9+3

Propositional Logic – Propositional equivalences - Predicates and Quantifiers – Nested Quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II	COMBINATORICS	9+3

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT III	GRAPHS	9+3

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV	ALGEBRAIC STRUCTURES	9+3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphisms – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	9+3

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL (L : 45 + T : 15): 60 PERIODS

COURSE OUTCOMES: On the completion of course, students will be able to

1.	Understand the concepts needed to test the logic of a program.
2.	Infer various combinatory and its applications.
3.	Outline the concepts of graphs and its representation.
4.	Defining the properties of algebraic structure such as groups, rings and fields.
5.	Discuss the concepts and properties of lattices and Boolean algebra.
6.	Understand basic terminologies used in computer science courses and application of ideas to solve practical problems.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	1		1									3	2	1
CO2	3	1		1									3	2	1
CO3	3	2		1									3	2	
CO4	3	1		1									3	3	
CO5	3	1		1									3	3	
CO6	3	2	2	2							3		3	3	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7 th Edition, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Mc Graw Hill Education, New Delhi, Indian Edition, 2017.

REFERENCES:

1. *Ralph.P.Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4 th Edition, Pearson Education Asia, Delhi, 2007.*
2. *Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications, 2006.*
3. *Seymour Lipschutz, Mark Lipson and Varsha H Patil, "Discrete Mathematics", Schaum's Outlines, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, Revised 3rd Edition, 2017.*

18SPC502	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand basics of Computer Networks and get familiar with ISO/OSI Model and various modes of transmission in physical layers.
- Understand in detail the protocols in Data Link layer and Network layer.
- Be familiar with various protocols in transport layer and application layer

UNIT I INTRODUCTION& PHYSICAL LAYER 9

Building a Network - Network Edge and Core – Delay, Loss and throughput – Protocol layers and their service models - OSI Reference Model - Network Topologies - Internet Architecture - Networking Devices - Modems - Routers - Switches – Gateways. Physical Layer - Signal Characteristics - Data Transmission - Physical Links and Transmission Media - Signal Encoding Techniques - Channel Access Techniques - TDM - FDM.

UNIT II DATA LINK LAYER, LANs and MULTIMEDIA 9

Link Layer Services – Framing - Error Control - Media Access Control - Ethernet - CSMA/CD - FDDI – 802.11 Wireless LANs – Multimedia networking applications – Streaming stored video – Voice over IP – Protocols for real time conversational applications – Network support for Multimedia.

UNIT III NETWORK AND ROUTING 9

Virtual Circuit and Datagram Networks - Switching - Routing – Internet Protocol (IP) – Routing Algorithms – Link state and Distance vector – Routing in the Internet – Broadcast and Multicast Routing - Global Address - Datagram Forwarding - Subnetting - CIDR - ARP - DHCP - ICMP - Ipv6.

UNIT IV TRANSPORT LAYER 9

Overview of Transport Layer – Multiplexing and Demultiplexing – Connectionless Transport: UDP – Principles of Reliable data transfer – Connection oriented transport: TCP - Reliable Data Transfer - Flow Control – Principles of Congestion Control - Congestion Avoidance.

UNIT V APPLICATION LAYER 9

Principles of Application Layer Protocols - Web and HTTP - FTP - Electronic Mail (SMTP - POP3 - IMAP - MIME) - DNS – SNMP – Peer to peer applications – Socket programming.

TOTAL : 45 PERIODS

OUTCOMES: On the completion of course, students will be able to

1. List network devices and trace the flow of information from one node to another node in the network.
2. Explain the link layer and multimedia applications.
3. Evaluate the protocols in network layer from QoS perspective.
4. Choose functionalities at each layer for different applications.
5. Define the various application layer protocols.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1							1	2	3	1	1

CO2	3	2	2	2	1							2	3	2	1
CO3	3	3	2	2	1						1	1	3	2	2
CO4	3	3	2	1							1	3	3	3	1
CO5	3	3	2	3	2						2	3	3	3	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Andrew S Tanenbaum and David J Wetherall, "Computer Networks", Prentice Hall of India/ Pearson Education, New Delhi, Fifth Edition, 2012.
2. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Sixth Edition, Pearson Education, 2012.

REFERENCES:

1. *William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.*
2. *Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.*
3. *Behrouz A. Forouzan and Firouz Mosharraf, "Computer Networks a Top Down Approach", Tata McGraw-Hill, 2011.*
4. *Douglas E. Comer, ―Internetworking with TCP/IP (Volume I) Principles, Protocols and Architecture, Sixth Edition, Pearson Education, 2013.*
5. *Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.*

18SPC503	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Develop models using UML Notation and analyze requirements with use cases and create domain models
- Relate analysis, design artifacts, document and present project deliverables
- Apply concepts to semester long software engineering projects

UNIT I INTRODUCTION & SOFTWARE PROCESS 9

Evolving role of software – software characteristics – software applications – software myths. Software Process models – Generic process model, Prescriptive process models – Waterfall, Incremental, Evolutionary, Concurrent, Specialized process models – Component based development, Formal methods model, Aspect oriented software development, Unified Process, Personal and Team Process models. Agile Development – Process, Extreme Programming, Scrum.

UNIT II REQUIREMENTS ENGINEERING & ANALYSIS 9

Identifying stakeholders – Eliciting requirements – Developing usecases – Building the requirements model - Negotiating and validating requirements. Requirements Modeling – Analysis, Scenario based modeling, UML models that supplement use case – Activity diagram, Swimlane diagram. Data Modeling - Data Objects - Attributes and Relationships - Data Flow Diagrams - The Data Dictionary – Creating a behavioral model – identifying events with use case, state representations.

UNIT III DESIGN 9

Design concepts – Modularity - Functional Independence - Cohesion - Coupling - Object oriented design concepts – Design classes – Design model. Architectural design – Software architecture, architectural genres, architectural styles, architectural mapping using data flow. Component level design, User interface design, Pattern based design – Design patterns, pattern based software design, architectural patterns, component level and user interface design patterns.

UNIT IV TESTING TECHNIQUES 9

Strategic approach to Software Testing – Issues, Unit testing, Integration testing, System testing, Art of debugging. Testing conventional applications - White Box Testing – Basis Path Testing – Control structure testing – Black box Testing – Testing for specialized environments – Patterns for software testing, Testing object oriented applications – OOA and OOD testing models, strategies, testing methods at class level, Interclass test case design.

UNIT V SOFTWARE QUALITY ASSURANCE & SOFTWARE CONFIGURATION MANAGEMENT 9

SQA tasks, Goals and metrics – Formal approaches to SQA – Statistical software quality assurance, Software reliability - Six sigma, ISO 9000 standards – SQA Plan. Software configuration management – Elements, Baselines, Configuration items, SCM repository, SCM Process – Version control, Change control – Configuration Audit.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Understand the various process models for software design.

2.	Determine the requirements for developing software.
3.	Understand the fundamental principles underlying Object-Oriented software design.
4.	Develop error identification and testing strategies for code development.
5.	Define approaches of SQA and SCM process.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1			3	2		1	3		3	2	1
CO2	3	3	2	1		2	3	2		1	3		3	2	1
CO3	3	3	2	2	1	2	3				3		3	2	1
CO4	3	3	3	3	1	1	3	3		2	3		3	3	1
CO5	3	3	3	3	2	2	3	3		2	3		3	3	2

(1- Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Roger S Pressman, "Software Engineering - A Practitioner's Approach", 7th Edition, McGraw Hill, 2017
2.	Michael R Blaha, James R Rumbaugh, "Object oriented modeling and design with UML", Second edition, Pearson Education India, 2007

REFERENCES:

1.	*Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified modeling language user guide", Second edition, Addison Wesley, 2017*
2.	*Ali Bahrami, "Object oriented systems development", 1st Edition, Tata McGraw-Hill Education, 2017*
3.	*Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, PHI, 2018*
4.	*Ian Sommerville, ―Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.*
5.	*Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007.*

18SPC504	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be familiar with Regular languages and Finite Automata, Context Free Languages and Push Down Automata
- Be exposed with Turing Machines, Recursively and Recursively Enumerable Languages
- To Learn with Undecidable problems.

UNIT I	REGULAR LANGUAGES AND FINITE AUTOMATA	11

Mathematical tools and techniques - Logic and Proofs, Sets, Functions and Equivalence Relations, Langauges, Recursive definitions, Proof techniques. Regular Languages - Regular expressions, DFA, NFA, NFA Epsilon, Converting NFA-Epsilon to NFA, Converting NFA to DFA, Minimizing DFA, Kleene's Theorem, Pumping Lemma, Decision problems.

UNIT II	CONTEXT FREE LANGUAGES AND PUSH DOWN AUTOMATA	11

Context Free grammars (CFG), Derivation trees, Ambiguity, Normal forms – CNF, GNF - Push down automata (PDA) – Computation trees, Equivalence of deterministic and non-deterministic PDA's, Conversion of PDA to CFG and CFG to PDA, Properties of Context free languages (CFL), Pumping lemma for context free languages, Decision problems.

UNIT III	TURING MACHINES	8

Turing machines as language acceptors, Computing partial functions, Multi-track turing machines, Multi-tape turing machines, Church Turing thesis, Non-determinstic turing machines, Universal turing machines.

UNIT IV	UNDECIDABLE PROBLEMS AND COMPUTABLE FUNCTIONS	7

Recursive and Recursively Enumerable languages, Chomsky Hierarchy, Decidable and Undecidable problems, Reductions and the Halting problem, Diagonalization method, Decision problems involving Turing machines, Rice theorem, Post Correspondence problem, Modified Post correspondence problem.

UNIT V	COMPUTATIONAL COMPLEXITY	8

Primitive Recursive functions and μ-recursive functions, Godel numbering, Tractability and Intractability, P and NP Classes, Polynomial time reductions and NP-Completeness, Satisfiablity problem, Cook Levin theorem.

TOTAL : 45 PERIODS

OUTCOMES: On the completion of this course, students will be able to,

1.	Create automata, regular expression for any pattern.
2.	Illustrate context free grammar for any construct.
3.	Design turing machines for any language.
4.	Evaluate the undecidable and decidable problems and computational functions.
5.	Develop the computation solutions using turing machines.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	3	2	1								2	3	2	
CO2	3	3	3	2								1	3	3	
CO3	3	3	3	2								2	3	3	
CO4	3	3	3	3		2		1			1	2	3	3	1
CO5	3	3	2	3		1		1			1	1	3	2	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	John C Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw Hill Publishing Company, New Delhi, 2009.
2.	H.R. Lewis and C.H. Papadimitriou, "Elements of the Theory of Computation", Second Edition, Pearson Education, 2003.

REFERENCES:

1.	*John E Hopcroft and Jeffery D Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education Asia, New Delhi, 2009..*
2.	*Michael Sipser, "Introduction of the Theory and Computation", Third Edition, Cengage learning, 2014.*
3.	*Peter Linz, "An Introduction to Formal Language and Automata", Fifth Edition, Jones & Bartlett Learning, New Delhi, 2011.*
4.	*Adam Brooks Webber, "Formal languages: a practical introduction", Jim Leisy, 2008*
5.	*Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education 2009*

18SPC505	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

•	To learn socket programming, use network commands.
•	To gain knowledge about the working of routing algorithms.
•	To use simulation tools to analyze the performance of protocols in different layers in computer networks and implementation of error correction code.

LIST OF EXPERIMENTS:

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. The following experiments are to be implemented in C/Java
   i. Simple Chat Program using TCP Sockets
   ii. Sliding Window Protocol using TCP Sockets
   iii. DNS using UDP Sockets
3. Study of Wireshark Tool
4. Tracing of TCP and UDP Connection using Wireshark
5. Implementation of Subnetting
6. Study of Network Simulator(NS-3) Tool
7. Simulation of TCP Performance using NS-3
8. Simulation of UDP Performance using NS-3
9. Performance Comparison of Routing Protocols using NS-3
10. Simulation of error correction code (like CRC).

PLATFORM NEEDED

- Java / Equivalent Compiler
- Network simulator like NS3/ Glomosim/ OPNET/ Equivalent

TOTAL : 45 PERIODS

OUTCOMES:

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

1.	Outline the network based commands.
2.	Develop the protocols using TCP and UDP Sockets.
3.	Compare the performance of different routing algorithms using simulation tools.
4.	Compare the performance of different transport layer protocols.
5.	Implement simulation of error correction code.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2			2			2	2	1		3	2	2
CO2	3	2	2	1		3			2	1	2		3	2	3
CO3	3	2	3	2	3	1			2	1	3		3	2	1
CO4	3	2	3	1	1	2			2	1	3		3	2	1
CO5	3	2	3	1	1	2			2	1	3		3	2	1

(1-Low, 2- Moderate, 3-High)

18HSC506	SOFT SKILLS AND PERSONALITY DEVELOPMENT LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES

•	To help the students to improve the listening, speaking, reading and writing skills.
•	To make them prepare for national and international examinations and placements.
•	To help them to face the interviews and to improve soft skills.

UNIT I	LISTENING AND SPEAKING SKILLS

Conversational skills (formal and informal)-making effective presentations using computers, listening/watching debates, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

UNIT II	READING AND WRITING SKILLS

Reading different genres of tests ranging from newspapers to creative writing. Writing different types of Applications and complaints- Writing reviews – film appreciation- thesis writing – posture making-advertisement-magazine preparation

UNIT III	ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS ANDPLACEMENTS

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service (Language related)- Verbal Ability.

UNIT IV	SOFTSKILLS

Motivation- emotional intelligence-Multiple intelligences- - career planning -creative and critical thinking.

UNIT V	EMPLOYABILITY AND CORPORATE SKILLS

Interview skills – Types of interview, preparation for interview, mock interview. Group Discussion leadership and co-ordination. Time management and effective planning- Stress management – causes and effect-stress relief techniques

TOTAL	45 PERIODS

OUTCOMES	On completion of this course, students will be able to
1	Make presentations and participate in group discussions.
2	Take international examinations such as IELTS and TOEFL.
3	Successfully answer questions in interviews.
4	Create postures, advertisements and magazine making which are the parts of writing skills.
5	Write film – appreciation, book review and Thesis writing which are the part of analytical thinking and creative writing

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1										3	3	3	1	2	1
CO2										3	3	3	3	3	1
CO3										3	3	3		2	1
CO4										3	3	3		2	1
CO5										3	3	3		2	1

(1-Low, 2- Moderate, 3-High)

18SPR507	Project I	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

•	To identify the problem based on societal needs and suggest creative solutions to societal problems
•	To interview people on societal problems that require computerization
•	To explore possible alternative solutions and estimate risk and develop a prototype

1. The students have to complete a project by implementing the knowledge they have acquired in the following course of study
   - Data Structures
   - Operating Systems
   - Computer Networks
   - Algorithms

A detailed report has to be submitted comprising of Title, Problem Definition, Feasibility Study, Significance of the project, Methodology, Tools &Platform used, Sample Source Code, Screen Shots and References. The Students should have their Projects approved by the Department Project Review committee before commencing the projects.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Analyze professional issues, including ethical, legal and security issues, related to computing projects.
2.	Apply prior knowledge to designing and implementing solutions to open-ended computational problems while considering multiple realistic constraints.
3.	Make use of CASE tools for solving case studies.
4.	Analyze Database, Network, Algorithms and Application Design methods.
5.	Design and use performance metrics to evaluate a designed system.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1					1	3				2	3
CO2		3	2	3					1	3		1		2	3
CO3		3	3	3	3	2				3	3	2	1	1	2
CO4		3	3	3					3	3	3		2	3	3
CO5	3	3	3						2	3	3	1		1	2

(1- Low, 2- Moderate, 3-High)

SEMESTER VI

18SPC601	COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	To learn the various parsing techniques and different levels of translation and how to obtain specific object code from source language
•	To learn how to optimize the code and schedule for optimal performance
•	To Learn how to schedule code and to be familiar with the concept of parallelism

UNIT I	INTRODUCTION & LEXICAL ANALYZER	10

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Design of Lexical Analyzer Generator – State minimization in Lexical Analyzers.

UNIT II	SYNTAX ANALYSIS	9

Role of Parser – Representative Grammars – Syntax Error Handling – Context-free grammars – Parse trees and derivations – Top Down Parsing - Recursive Descent Parsing - Predictive Parsing – Bottom up Parsing - Shift Reduce Parsing - LR Parser-LR (0) Items - Construction of SLR Parsing Tables – Canonical LR(1) Items - Constructing LALR Parser - YACC.

UNIT III	INTERMEDIATE CODE GENERATION	9

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Construction of syntax trees – Syntax directed translation schemes - Intermediate Languages: Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control flow, Backpatching.

UNIT IV	RUN-TIME ENVIRONMENT AND CODE GENERATION	9

Storage Organization, Stack Allocation of Space, Access to Non-local Data on the Stack, Heap Management. Issues in the design of Code Generator – Addresses in the target code – Basic blocks and Flow graphs – Code generation algorithm – Register allocation and assignment.

UNIT V	CODE OPTIMIZATION	8

Principal Sources of Optimization – Optimization of Basic Blocks - Peep-hole optimization - Data Flow Analysis – Reaching definitions, Live variable analysis, Available expressions, Loops in flow graphs, Region based analysis.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to,

1.	Design compiler phases from language specification.
2.	Analyze the syntax and parsing and use of tools.
3.	Develop the intermediate languages.
4.	Design code generators for the specified machine.
5.	Apply the various optimization techniques.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1									3	1	

CO2	3	3		1									3	1	
CO3	3	3	2	2									3	2	
CO4	3	3	2	2	1	1	1				1	1	3	2	1
CO5	3	3									1	1	3	1	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Alfred V Aho, Monica Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers - Principles, Techniques and Tools", Essex Pearson, Harlow, 2014.
2.	Keith D Cooper and Linda Torczon, "Engineering a Compiler", Second Edition, Morgan Kaufmann Publishers Elsevier Science, 2011.

REFERENCES:

1.	*V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2016.*
2.	*Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993. Freely downloadable at https://holub.com/goodies/compiler/compilerDesignInC.pdf*
3.	*Steven S. Muchnick, ―Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003*
4.	*Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.*
5.	*Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education,2008.*

18SES602	WIRELESS COMMUNICATION AND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the signals and transmission and basics of mobile telecommunication system.
- To be familiar with the network layer protocols and Ad-Hoc networks and know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

UNIT I	WIRELESS TRANSMISSION & MEDIUM ACCESS CONTROL	9

Frequencies for Transmission – Signals – Antennas – Signal Propagation-Multiplexing-Modulation-Spread Spectrum-Cellular Systems-Motivation for Specialized MAC-SDMA-FDMA-TDMA-CDMA-Comparison of S/F/T/CDMA.

UNIT II	TELECOMMUNICATION SYSTEMS & SATELLITE SYSTEMS	9

GSM-DECT-TETRA-UMTS and IMT-2000-Satellite Systems-History-Applications-Basics-Routing-Localization-Handover-Cyclical Repetition of Data-Digital Audio Broadcasting-Digital Video Broadcasting-Convergence of broadcasting and Mobile Applications.

UNIT III	WIRELESS LAN	9

Infrared vs radio transmission – Infrastructure and ad hoc network – IEEE802.1(1-HIPER LAN-Bluetooth

UNIT IV	MOBILE NETWORK LAYER & MOBILE TRANSPORT LAYER	9

Mobile IP-Dynamic Host Configuration Protocol-Mobile ad-hoc networks –Traditional TCP-Classical TCP improvements-TCP over 2.5/3G wireless networks-Performance enhancing proxies – Introduction to 4G and 5G wireless networks.

UNIT V	SUPPORT FOR MOBILITY	9

File Systems– World Wide Web – Wireless Application Protocol(version 1.x)-i-mode-syncML-WAP 2.0

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Evaluate various MAC schemes.
2.	Analyze various network architectures for mobile communications.
3.	Compare the Wireless LAN Technologies.
4.	Understand Mobile Network and Transport Layers
5.	Define Wireless Application Protocol.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3

CO1	1	1	2		2							2		3	
CO2	3	3			2							2	2	3	
CO3	3	2										2	2	3	
CO4	2	1	2									3	1	3	
CO5	2	1	2									3	1	3	
(1-Low, 2- Moderate, 3-High)															

TEXT BOOKS:

1.	Jochen Schiller "Mobile Communications", Second Edition, Pearson Education, 2008.
2.	Asoke K. Talukder and Roopa R Yavagal, "Mobile Computing, Technology, Application and Service Creation", Second Edition, Tata McGraw Hill, 2010.

REFERENCES:

1.	*Jon W.Mark and Weihua Zhuang, "Wireless Communication and Networking", Prentice Hall, 2002.*
2.	*C D M Cordeiro and D. P. Agarwal, "Adhoc and Sensor Networks: Theory and Applications", World Scientific, 2006.*
3.	*Pei Zhang, Feng Zhao, David Tipper, Jinmei Tatuya, Keiichi Shima, Yi Qian, larry L. Peterson, Lionel M. Ni, Manjunath D, Qing Li, Joy Kuri, Anurag Kumar, Prashant Krishnamurthy, Leonidas Guibas, Vijay K. Garg, Adrian Farrel, Bruce S. Davie, "Wireless Networking Complete", Elsevier, 2010.*
4.	*Behrouz A. Forouzan, "Data Communications And Networking" Fourth Edition, Tata McGraw Hill*
5.	*William Stallings, "Data and Computer Communications", Eith Edition, Pearson Education*

18SPC603	EMBEDDED COMPUTING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the architecture and programming of ARM processor.
- To become familiar with the embedded computing platform design and analysis.
- To get thorough knowledge in interfacing concepts and to design an embedded system and to develop programs

UNIT I	INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS	9

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II	EMBEDDED COMPUTING PLATFORM DESIGN	9

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing

UNIT III	SENSOR INTERFACING WITH ARDUINO	9

Basics of hardware design and functions of basic passive components-sensors and actuators- Arduino code - library file for sensor interfacing-construction of basic applications

UNIT IV	REAL TIME OPERATING SYSTEM (RTOS) BASED DESIGN	9

Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization - Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering Machine.

UNIT V	EMBEDDED C PROGRAMMING	9

Introduction-Creating _hardware delays' using Timer 0 and Timer (1-Reading switches-Adding Structure to the code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Discuss the basic of embedded processors.
2.	Describe the architecture and programming of ARM processor.
3.	Understand the Concepts of peripherals and interfacing of sensors.
4.	Capable of using the system design techniques to develop firmware
5.	Illustrate the code for constructing a system

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PS O 1	PS O 2	PS O 3
CO1	3	1	2								3		3	1	2
CO2	3	1	2								3		3	2	2
CO3	3	1	2								3		3		
CO4	3	1	3								3		2	1	2
CO5	3	1	3								3		2	1	2

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition —Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (Unit I & II)
2. https://www.coursera.org/learn/interface-with-arduino#syllabus (Unit III)
3. Michael J. Pont, "Embedded C", 2nd Edition, Pearson Education, 2008.(Unit IV & V)

REFERENCES:

1. *Shibu K.V, "Introduction to Embedded Systems", McGraw Hill.2014*
2. *Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition, Cengage Learning, 2012*
3. *Raj Kamal, "Embedded Systems-Architecture,programming and design", 3rd edition, TMH, 2015*
4. *Lyla, "Embedded Systems", Pearson , 2013*
5. *David E. Simon, "An Embedded Software Primer", Pearson Education, 2000.*

18SPC604	COMPILER LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	Be exposed to compiler writing tools.
•	Learn to implement the different Phases of compiler, translator with input and object language.
•	Be familiar with control flow, data flow analysis, simple optimization techniques

LIST OF EXPERIMENTS:

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
2. Implementation of lexical analyzer using LEX.
3. Implementation of a calculator that takes an expression (with digits, + and *), computes and prints its value, using YACC.
4. Parser using LEX and YACC to validate loops
5. Symbol table creation.
6. Implementation of Predictive parser.
7. Implementation of Shift Reduce Parsing Algorithm.
8. Implementation of LR parsing.
9. Generate three address code for a simple language with:
   One data type integer, arithmetic operators, relational operators, variable declaration statement, one conditional construct, one iterative construct and assignment statement.
10. Implement back end of the compiler which takes three address code as input and produces assembly language instructions that can be assembled and run using an 8086 assembler. The target assembly instructions can be simple move, add, sub, and jump.
11. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation).

PLATFORM NEEDED

- C/ C++ / Equivalent Compiler

TOTAL : 60 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Develop the lexical analyzer for token specification.
2.	Build the parser from the syntax specification using tools.
3.	Design an intermediate code generator.
4.	Design simple code optimizations techniques.
5.	Create a program for generating target assembly instructions and translator with specific input and object language.

COURSE ARTICULATION MATRIX:

	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PS O 1	PSO 2	PSO 3
CO1	3	2	3		3	2	1					1	3	2	
CO2	3	2	3		2	1						1	3	2	
CO3	3	3			1	1						1	3	3	1
CO4	3	3			3	1						1	3	3	
CO5	3	3			2	1	1					1	3	3	
(1-Low, 2- Moderate, 3-High)															

18SPC605	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- Understand how to work with various mobile application development frameworks and the capabilities, limitations of mobile devices.
- Learn the basic and important design concepts and issues of development of mobile applications.

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers -30 Nos

TOTAL : 60 PERIODS

OUTCOMES:

On completion of this course, students will be able to

1.	Design various mobile applications using emulators
2.	Implement the design of mobile application using development tools
3.	Understand the various Mobile Application Development Tools
4.	Develop an application to hand-held devices.
5.	Understand capabilities and limitations of mobile devices.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		1	2	1			3	3		3	2	1
CO2	3	3	3	2	1	1	2			3	3		3	2	2
CO3	3	3	3		1	2	1			3	3		3	2	1
CO4	3	3		2	1	1	2			3			3		
CO5	3	3			1	2	1			3			3		

(1-Low, 2- Moderate, 3-High)

18SPC606	EMBEDDED COMPUTING SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Introduce students to embedded systems design tools and hardware programmers
- Make students familiar with Embedded C Programming.
- Give the students skills in both simulation and practical implementation of the basic building blocks including timers, counters, PWM generation, I/O techniques and requirements, A/D conversion, serial communications

LIST OF EXPERIMENTS:

1. Develop a C program for Seven Segment LED Display.
2. Develop a C program for ADC.
3. Develop a C program for DAC.
4. Develop a C program for PWM.
5. Develop a C program for RTC.
6. Develop a C program for Keyboard Matrix.
7. Develop a C program for LCD.
8. Develop a C program for Flashing of LEDS.
9. Develop a C program for stepper motor.
10. Develop a C program for temperature sensor.
11. Develop a C program for EPROM.
12. Develop a C program for interrupt.
13. Interrupt performance characteristics of ARM and FPGA.
14. Speed performance characteristics of ARM and FPGA.
15. Implementing zigbee protocol with ARM.

TOTAL : 60 PERIODS

OUTCOMES:

On completion of this course, students will be able to

1.	Experiment with a set of tools for embedded systems programming and debugging
2.	Do embedded C Programming
3.	Experience with implementing several embedded systems with particular focus on the interaction between multiple devices.
4.	Understand RTOS
5.	Develop existing embedded systems by formulating the system design problem including the design constraints.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2								3		3	1	2
CO2	3	1	2	2		2					3		3	2	2
CO3	3		2	3		2					3		3		
CO4	3		3	3		3					3		2	1	2
CO5	3	1	3	3		3					3		2	1	2

(1-Low, 2- Moderate, 3-High)

SEMESTER VII

18SHS701	MANAGEMENT AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Explain fundamentals management functions of a manager. Also explain planning and decision making processes
- Explain the organizational structure, staffing and leadership process and understanding of motivation and different control systems in management.
- Explain understanding of Entrepreneurships and Entrepreneurship development process and illustrate Small Scale Industries, various types of supporting agencies and financing Available for an entrepreneur.

UNIT I	INTRODUCTION	9

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as art or science, art or profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modem management approaches. Planning: Nature, importance and purpose of planning process objectives - Types of plans (meaning only) - Decision making, Importance of planning - steps in planning & planning premises - Hierarchy of plans.

UNIT II	ORGANIZING, DIRECTING & CONTROLLING	9

Organizing and staffing: Nature and purpose of organization, Principles of organization – Types of organization-Department Committees-Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of staffing- - :Process of Selection & Recruitment (in brief). Directing: Meaning and nature of directing Leadership styles, Motivation, Theories, Communication - Meaning and importance - coordination, meaning and importance - Techniques of coordination. Controlling: Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief).

UNIT III	ENTREPRENEURSHIP	9

Meaning of Entrepreneur; Evolution of the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

UNIT IV	SMALL SCALE INDUSTRIES & INSTITUTIONAL SUPPORT	9

Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only). Institutional support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC

UNIT V	PROJECT PREPARATION & INDUSTRIAL OWNERSHIP	9

Preparation of project: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of

Business Opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study. Industrial ownership: Definition and meaning of Partnership, Characteristics of Partnership, Kinds of Partners, Partnership Agreement or Partnership Deed, Registration of Partnership Firm, Rights, Duties and Liabilities of Partners, Advantages and Disadvantages of Partnership, Sole proprietorship, Features, Scope Advantages and Disadvantages of Sole Proprietorship.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Define management functions of and explains planning and decision making processes.
2.	Understand the organizational structure, staffing, directing and controlling concepts.
3.	Understand of Entrepreneurships and Entrepreneurship development process
4.	Illustrate Small Scale Industries, various types of supporting agencies and financing available for an entrepreneur
5.	Summarize the preparation of project report, need significance of report. Also to explain about industrial ownership

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2	1	3						1	1
CO2						2		3						2	1
CO3						2		3						2	
CO4						2	2	3						2	
CO5						3		3						3	1

(L- Low, M- Moderate, H-High)

TEXT BOOKS:

1.	P. C. Tripathi, P.N. Reddy, "Principles of Management", 5th edition, Tata McGraw Hill, 2012.
2.	Vasant Desai , "Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House, 2011.

REFERENCES:

1.	*Poornima. M. Charantimath, "Entrepreneurship Development and Small Business Enterprises", 2nd Edition, Pearson Education, 2014.*
2.	*S. S. Khanka, "Entrepreneurship Development", Revised edition, S. Chand & Co. New Delhi, 2006.*
3.	*Stephen P. Robbins, Mary Coulter, "Management", Thirteenth edition, Pearson Education,13th Edition, 2017.*
4.	*RobersLusier, "Management Fundamentals - Concepts, Application, Skill Development", Thomson/South-Western, 2003.*
5.	*B.Badhai, "Entrepreneurship Development", Second Edition, B.K Publications,2013.*

18SPC702	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of cloud computing and evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing and the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

UNIT I INTRODUCTION **9**

Cloud computing – vision, definition, reference model, characteristics and benefits, challenges. Historical developments – Distributed systems, Virtualization, Web 2.0, Service oriented computing, Utility oriented computing, Building cloud computing environments. Principles of Parallel and Distributed Computing – Elements of Parallel computing – hardware architecture, levels of parallelism, Elements of distributed computing – Components, Architectural styles, models for interprocess communication, technologies – RPC, Distributed object framework, Service oriented computing

UNIT II VIRTUALIZATION **9**

Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud computing, Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU Memory I/O Devices, Virtual clusters and resource management, Virtualization for data center automation, Technology examples – Xen: Paravirtualization, VMware: Full virtualization, Microsoft Hyper-V.

UNIT III CLOUD COMPUTING ARCHITECTURE **9**

Cloud reference model – Architecture, Infrastructure and hardware as a service, Platform as a service, Software as a service, Types of clouds – public clouds, private clouds, hybrid clouds, community clouds – examples, Economics of the cloud, open challenges – interoperability, scalability, fault tolerance, standards – Openstack architecture

UNIT IV CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENTS **9**

Parallel and distributed programming paradigms – Mapreduce, Twister, Iterative MapReduce, Hadoop, Programming support of Google App Engine – Google file system, BigTable, Google's NOSQL system, Programming on Amazon AWS and Microsoft Azure – Programming on Amazon EC2, Amazon simple storage service (S3), Amazon Elastic Block store (EBS) and SimpleDB, Microsoft Azure programming support, Emerging cloud software environments – Eucalyptus, OpenNebula, OpenStack, Aneka.

UNIT V CLOUD APPLICATIONS AND SECURITY **9**

Scientific applications – Healthcare, Biology, Geoscience, Business and consumer applications – CRM and ERP, Productivity, Social networking, Media applications, Multiplayer online gaming. Cloud Security and Trust Management – Defense strategies, Distributed intrusion, Data and software protection techniques, reputation guided protection of data centers.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Explain the main concepts, key technologies, Strength and limitations of cloud computing.
2.	Understand the different virtualization techniques.

3.	Outline the architecture of cloud service models and deployment models.
4.	Make use of current cloud technologies and software environments.
5.	Discuss the various cloud applications and cloud security and trust management.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1							1		3	2	
CO2	2	2	3	1							2		2	2	
CO3	3	2	3	1	3						2		3	2	1
CO4	3	2	3	2	3						3		3	2	3
CO5	3	3	3	2	3						3		3	2	1

(1- Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S, "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited, New Delhi, 2013.
2.	Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

REFERENCES:

1.	*Dan Marinescu, "Cloud computing: theory and practice", Second edition, Morgan Kaufmann, 2017*
2.	*Barrie Sosinsky, "Cloud computing bible", Wiley Publishing Inc, 2011.*
3.	*Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017*
4.	*Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.*
5.	*Tim Mather, Subra Kumaraswamy, Shahed Latif "Cloud Security & Privacy" O'ReillyMedia, September 2009.*

18SPC703	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques
- To build protection mechanisms in order to secure computer networks.

UNIT I	CLASSICAL CRYPTOGRAPHY & NUMBER THEORY	10

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic- Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem- Discrete logarithms

UNIT II	BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY	10

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. **Public key cryptography:** Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT III	HASH FUNCTIONS AND DIGITAL SIGNATURES	8

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

UNIT IV	SECURITY PRACTICE & SYSTEM SECURITY	8

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security

UNIT V	E-MAIL, IP & WEB SECURITY	9

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys-privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. **IPSecurity:** Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). **Web Security:** SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3-

Exportability-Encoding-Secure Electronic Transaction (SET) – FIPS

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Compare various Cryptographic Techniques and Defining the various finite fields and number theory.
2. Analyze various block ciphers and public key cryptographic techniques.
3. Understand Hash Functions and Digital Signature Algorithms
4. Illustrate the security mechanisms like Kerberos, firewalls, IDS.
5. Understand various security services for e-mail and web.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1							3		3	2	1
CO2	3	3	3	2		1					3		3	3	1
CO3	3	2	3	2	1	2					3		3	3	1
CO4	3	2	1	2	1	1					3		3	2	2
CO5	3	3	1	3	1	1					3		3	3	2

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, 2017
2. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of India, 2002.

REFERENCES:

1. *Atul Kahate , "Cryptography and Network Security", 3rd Edition, McGraw Hill Education India, 2013.*
2. *Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc-Graw Hill, 2007.*
3. *Wade Trappe, Lawrence C.Washington, “Introduction to Cryptography with Coding Theory”, 2nd Edition, Pearson Education, 2006.*
4. *Bruce Schneier and Neils Ferguson, “Practical Cryptography”, First Edition, Wiley Dreamtech India Pvt Ltd, 2003.*
5. *C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd*

18SPC704	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

•	To develop web applications in cloud
•	To learn the design and development process involved in creating a cloud based application
•	To learn to implement and use parallel programming using Hadoop

LIST OF EXPERIMENTS:

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7/8/10 and Ubuntu 18.04.1/16.04.5/14.04.5
2. Find procedure to run the virtual machines of different configurations. Check how many virtual machines can be utilized at particular time
3. Install a C compiler in the virtual machine and execute Simple Programs.
4. Show the virtual machine migration based on the certain condition from one node to the other.
5. Install Google App Engine. Create hello world app and other simple web applications using python/java.
6. Use GAE launcher to launch the web applications.
7. Find a procedure to transfer the files from one virtual machine to another virtual machine.
8. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
9. Install Hadoop single node cluster and run simple applications like wordcount.
10. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
11. Sizing Virtual Machines for Azure IaaS (Resource Manager)

SOFTWARE REQUIRED:

OpenNebula/ OpenStack/ Windows Azure/ Eucalyptus/ Aneka/ Google App Engine /CloudSim

TOTAL : 60 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Learn the configuration various virtualization tools such as Virtual Box, VMware workstation.
2.	Design a web application in a PaaS environment.
3.	Learn to simulate cloud environment to implement new schedulers.
4.	Make use of a generic cloud environment that can be used as a private cloud.
5.	Evaluate large data sets in a parallel environment.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO	PSO2	PSO3

													1		
CO1	2	3	2	3	3						3		3	2	1
CO2	3	3	2	2	2						3		3	2	2
CO3	3	3	2								3		3	2	2
CO4	3	3	3								3		3	3	1
CO5	3	3	3								3		3	3	2
(1-Low, 2- Moderate, 3-High)															

18SPC705	NETWORK SECURITY LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn different cipher techniques.
- To implement the algorithms DES, RSA,MD5, SHA-1.
- To use network security tools and vulnerability assessment tools.

LIST OF EXPERIMENTS:

1. Implement the following SUBSTITUTION TECHNIQUES:
    a. Caesar Cipher
    b. Affine Cipher
    c. Play Fair Cipher
    d. Vignere Cipher
    e. Auto key Cipher
    f. Hill Cipher
2. Implement the following Transposition Techniques
    a. Rail-Fence Cipher
    b. Columnar Transposition Cipher
3. Number Theory
    a. Chinese Remainder Theorem
    b. Extended Euclidean Algorithm.
    c. Miller-Rabin's Algorithm.
4. Implement the following Private Key and Public Key Cryptography Algorithms
    a. DES
    b. RSA
    c. Diffie-Hellmann Key Exchange
5. Implement the following Hash Functions
    a. SHA 512
    b. MD5
6. Implement the following Digital Signature Algorithms
    a. DSS
    b. Elgamal
    c. RSA
7. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
8. Setup a honey pot and monitor the honeypot on network (KF Sensor)
9. Installation of rootkits and study about the variety of options
10. Perform wireless audit on an access point or a router and decrypt WPS and WPA2. (Net Stumbler)

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

C / C++ / Java or equivalent compiler

GnuPG, KF Sensor or Equivalent, Net Stumbler or Equivalent

HARDWARE:

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

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Create a program for substitution and transposition techniques.
2. Build a program for the algorithms in Number Theory
3. Develop algorithms for Public Key Cryptography and Private Key Cryptography
4. Design a program for the various Hash Functions and Digital Signature Algorithms.
5. Make use of different open source tools for network security and analysis

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3					1		2		3	3	2
CO2	3	3	3	3					1		2		2	2	2
CO3	3	3	3	3					1		2		2	2	2
CO4	3	3	3	3					1		2		3	2	1
CO5	3	3	3	3	3				1		2		3	3	1

((1-Low, 2- Moderate, 3-High)

REFERENCES:

1. *WebTutorial: http://www.cis.syr.edu/~wedu/seed/cryptography.html as on 14/04/2016*
2. *www.practicalcryptography.com*

18SPR706	Project II	L	T	P	C
		0	0	6	3

OBJECTIVES:

•	To identify the problem based on societal needs and interview people on societal problems that require computerization
•	To suggest creative solutions to societal problems and explore possible alternative solutions
•	To estimate risk and develop a prototype

Students may identify any real word problem and develop the following deliverables

1 Software requirements specification document
2 Use Case modeling
3 Identify the conceptual classes and develop a domain model with UML Class diagram.
4 Using the identified scenarios, find the interaction between objects and represent them
5 using UML Sequence diagrams, State charts and activity diagrams
6 Coding (any programming language)
7 Develop test cases – white box and black box
8 Project report preparation and presentation.

Students may choose any interesting problem in the subjects studied till this semester, Some of the project topics for reference are:

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

TOTAL : 90 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Analyzing professional issues, including ethical, legal and security issues, related to computing projects.
2.	Applying prior knowledge to designing and implementing solutions to open-ended computational problems while considering multiple realistic constraints.
3.	Make use of CASE tools for solving case studies.
4.	Analyzing Database, Network, Algorithms and Application Design methods.
5.	Design and use performance metrics to evaluate a designed system.

COURSE ARTICULATION MATRIX:															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3		1			1	2	3		1		3	1	3
CO2		3	2	3		3	1		3					2	3
CO3			3	3	3			3						3	3
CO4							3	3					3	3	3
CO5	3	3	2	3	3	3	1		3		3		3	3	3
(1- Low, 2- Moderate, 3-High)															

SEMESTER VIII

18SPR801	Project III	L	T	P	C
		0	0	12	6

OBJECTIVES:

- To identify the problem based on societal needs and interview people on societal problems that require computerization
- To suggest creative solutions to societal problems and explore possible alternative solutions
- To estimate risk and develop a prototype

The aim of this course is to encourage the students to identify projects that help in exploring variables that promote creativity and innovation. Each student is expected to choose a real life or socially relevant problem. At the end of the project, students should be familiar with the state of art in their respective fields. They would be able to apply the concepts learnt to relevant research problems or practical applications. This course is to motivate them to learn concepts, models, frameworks, and tools that engineering graduates'need in a world where creativity and innovation is fast becoming a pre-condition for competitive advantage.

1. Internals
    a. First Review
        i. Block Diagram of the proposed solution for a societal / creative problem
        ii. New Contribution in terms of modifications to existing algorithm or suggestion of new ones
        iii. Detailed Design of each module
        iv. Evaluation Metrics
        v. Test Cases
    b. Second Review
        i. Implementation - Justifying pros and Cons
        ii. Coding - highlighting what has been reused and what is being written
    c. Third Review
        i. Test Runs
        ii. Performance Evaluation based on Metrics
        iii. Project Documentation
2. Externals

Presentation, Viva-Voce, Report submission.

TOTAL : 180 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Analyze professional issues, including ethical, legal and security issues, related to computing projects.
2.	Synthesize and applying prior knowledge to designing and implementing solutions to open-ended computational problems while considering multiple realistic constraints.
3.	Practice CASE tools for solving case studies.
4.	Analyze Database, Network and Application Design methods.
5.	Design and use performance metrics to evaluate a designed system and Perform SWOT Analysis.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1		2	2					2	2		3
CO2	3	2	2	2		1	2					2	3	3	3
CO3	2	2				2	2					2	3	3	3
CO4	2	3				1	2					2	2	2	3
CO5	2	2				1	2					2	3	3	3
(1- Low, 2- Moderate, 3-High)															

PROFESSIONAL ELECTIVES

18SPE001	FUNDAMENTALS OF IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

•	Introduce basic concepts and methodologies for digital image processing and spatial methods for image processing, image smoothing and edge detection techniques.
•	Analyze images in the frequency domain using various transforms and Categorize various compression techniques and evaluate compression standards
•	Understand 3D image representation and processing techniques.

UNIT I	DIGITAL IMAGE FUNDAMENTALS	9

Fundamental Steps in Digital Image Processing-Components-Elements of visual perception-Image sensing and Acquisition-Image Sampling and Quantization-Relationships between pixels-Mathematical tools used in Digital Image Processing.

UNIT II	INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING	9

Histogram processing-Fundamentals of spatial filtering-smoothing spatial filters and sharpening spatial filters-Combining spatial enhancement methods-Using Fuzzy techniques-Sampling and the Fourier transform of sampled functions-Frequency domain filters-Image smoothing, Image Sharpening-Selective Filtering

UNIT III	IMAGE RESTORATION AND RECONSTRUCTION	9

Image restoration process-Noise Models-Restoration in the presence of noise only-Spatial filtering-Periodic noise reduction by frequency domain filtering-Linear ,Position –Invariant Degradations-Estimating the Degradation function-Inverse filtering-Image Reconstruction from projections

UNIT IV	COLOUR AND MORPHOLOGICAL IMAGE PROCESSING	9

Color Fundamentals-Color Models-Color transformations-Smoothing and sharpening-Image segmentation based on color-Color image compression-Morphological Processing: Erosion and Dilation-The Hit-or-Miss Transformation-Basic Morphological Algorithms-Gray-Scale morphology

UNIT V	IMAGE COMPRESSION AND RECOGNITION	9

Fundamentals-Basic Compression Methods-Digital Image Watermarking-Patterns and Pattern Classes-Recognition based on decision-theoretic methods-Structural methods.

	TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Understand the image representation.
2.	Experiment with image transformation methods.
3.	Apply the image processing algorithms.
4.	Create the face detection and recognition algorithms.
5.	Remember the basic compression methods.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PS O 1	PS O 2	PS O 3
CO1	3												3		
CO2	3	2											3	2	
CO3	3	2											3	2	
CO4	3	3											3	3	
CO5	3	2		3									3	1	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Rafael C Gonzalez, Richard E Woods, "Digital Image Processing" Third Edition Pearson Education, 2013.
2.	Milan Soanka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision", Fifth Edition, Cengage Learning, 2014.

REFERENCES:

1.	*Anil K. Jain, "Fundamentals of Digital Image Processing", Second Edition, Pearson, 2011.*
2.	*Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, _Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.*
3.	*Kenneth R. Castleman, _Digital Image Processing', Pearson, 2006.*
4.	*William K. Pratt, "Digital Image Processing", John Wiley, New York, 2002*
5.	*Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.*

18SPE002	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand and articulate the importance of Project Management in any business project, project planning in an organized step-by-step manner.
- Carry out an evaluation and selection of projects against strategic, technical and economic criteria and the importance of manageable project schedule.
- Visualize and assess the state of a project, ways to administer a contract from its signing to completion and the characteristics of the various team structures that can be employed.

UNIT I	INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT	9

Introduction-Importance of Software Project Mangement – Activities Covered by Software Project Management, Plan, Methods and Methodologies- Ways of Categorizing Software Projects Problem with Software Projects – Setting Objectives Stakeholders- Requirements Specification, Management Control

UNIT II	PROJECT EVALUATION AND PROJECT PLANNING	9

Project Portfolio Management-Evaluation of Individual Projects-Programme Management - Managing the Allocation of Resources - Strategic Programme Management - Creating a Programme - Aids to Programme Management - Benefits Management– Overview of Project Planning – Stepwise Project Planning.

UNIT III	ACTIVITY PLANNING AND RISK MANAGEMENT	9

Objectives of Activity Planning – Project Schedule – Project and Activities - Sequencing and Scheduling Activities – Network Planning Models – Formulating a Network Model – Adding the Time Dimension -Forward Pass – Backward Pass –Identifying Critical Path - Activity Float – Shortening Project Duration – Identifying Critical Activities - Activity on Arrow Networks – Risk Management – Categories -Risk - Framework – Identification – Assessment – Planning – Management – Evaluating Risk to the Schedule – PERT Technique – Monte Carlo Simulation – Resource Allocation – Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost - Publishing the Resource Schedule.

UNIT IV	MONITORING AND CONTROL	9

Framework – Collecting the Data –Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting Project Back to Target – Change Control – Managing Contracts – Introduction – The ISO/IEC 12207 Approach –Supply process –Types of Contract – Stages in Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance.

UNIT V	MANAGING PEOPLE AND ORGANIZING TEAMS	9

Introduction – Understanding Behavior – Organizational Behavior - Selecting the Right Person for the Job – Instruction in the Best Methods – Motivation – The Oldham – Hackman Job Characteristics Model – Working in Groups – Becoming a Team –Decision Making –

Leadership – Organizational Structures – Stress – Health and Safety.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Explain the roles of the project manager.
2. Identify the threats and opportunities in project management.
3. Estimate the knowledge about size, effort and cost.
4. Utilize the techniques available to keep the project‘s aims and objectives, under control.
5. Understand the organizational behavior.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3									2				2
CO2	2	3	2								3			2	3
CO3	1	3	2								3			1	1
CO4	2	2	2		3						2			1	2
CO5	3	2	2		2						3			1	3

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, “Software Project Management”, Fifth Edition, McGraw Hill Education, 2012.
2. Ramesh, Gopalaswamy, "Managing Global Projects", Third Edition, Tata McGraw Hill, 2006.

REFERENCES:

1. *Royce, “Software Project Management”, Pearson Education, Second Edition, 1999.*
2. *Robert T. Futrell, Donald F. Shefer and Linda I. Shefer, “Quality Software Project Management”, Third Edition , Pearson Education, 2003.*
3. *Jalote, “Software Project Management in Practice”, Pearson Education, Second Edition, 2002.*
4. *Robert K. Wysocki “Effective Software Project Management” – Wiley Publication,2011*
5. *Joel Henry,” Software Project Management”, Pearson Education,2004.*

18SPE003	FOUNDATIONS OF IT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Develop algorithms for user problem statements; introduce object oriented modeling using UML and fundamentals of object-oriented programming in Java.
- Design ER-models to represent simple database application, write SQL queries.
- Design webpages using HTML, CSS and Javascript and Illustrate how to test java code and web application.

UNIT I	FOCUS AREA 1: OBJECT ORIENTED PROGRAMMING USING JAVA	9

Problem Solving Techniques: Introduction to problem solving - Computational problem and it's classification - Logic and its types - Introduction to algorithms - Implementation of algorithms using flowchart - Searching and sorting algorithms - Introduction and classification to Data Structures - Basic Data Structures - Advanced Data Structures.

Tools: Understanding basic programming constructs using Scratch Tool - Flowcharts implementation through RAPTOR tool.

UNIT II		8

Programming Basics: Identifiers – variables - data types – operators - control structures - type conversion - casting - arrays - strings - Introduction to UML: Use case diagrams – Class diagrams.

Object Oriented Concepts fundamentals: class & object – instance variables & methods – access specifiers – reference variables – parameter passing techniques – constructors – this reference – static – command line arguments-Tools-Eclipse IDE for Java programming.

UNIT III		10

Relationships -Inheritance – types of inheritance – aggregation – association – Static Polymorphism - method overloading – constructor overloading – Dynamic polymorphism-method overriding – abstract – interface – introduction to packages - Industry Coding Standards and Best Practices – code tuning & optimization – clean code & refactoring.

UNIT IV	FOCUS AREA 2: RELATIONAL DATABASE MANAGEMENT SYSTEM	9

RDBMS: data processing – the database technology – data models- ER modeling concept – notations – converting ER diagram into relational schema - Logical database design - normalization (1NF, 2NF and 3NF).

SQL: DDL statements – DML statements – DCL statements - Joins - Sub queries – Views - Database design Issues – SQL fine tuning.

UNIT V	FOCUS AREA 3: WEB TECHNOLOGIES AND SOFTWARE ENGINEERING	9

Introduction to user interface and web technologies: web fundamentals – types web content – HTML – text formatting tags in HTML – HTML form elements - and tags - text formatting using CSS-embedded CSS, inline CSS and external CSS – JavaScript and its features Software Engineering: Definition – role of software and software crisis – SDLC models-waterfall model, incremental model and spiral model – software testing – static & dynamic testing – types testing-unit testing, integration testing, system testing, performance testing and regression testing.

	TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Identify the solution for problem solving using algorithms.
2.	Design and testing simple programs to implement object oriented concepts using Java.
3.	Interpret artifacts using common quality standards.
4.	Recognize the concepts of RDBMS .
5.	Understand the basics of web technology and software engineering .

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3										2		3		
CO2	3	2									2		3	2	
CO3	3	2									2		3	2	
CO4	3	3									2		3	3	
CO5	3	2		3							3		3	1	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	M T Goodrich, Roberto Tamassia, “Algorithm Design”, Third Edition, John Wiley, 2002.
2.	Alfred V.Aho, Ullman, Hopcroft, “Data Structures and Algorithms”, Second edition, Addison-wesely. 2007.

REFERENCES:

1.	*Elmasri, Navathe, "Fundamentals of Database Systems", Third edition, Addison Wesley.2007*
2.	*Thomas Powell, “HTML & CSS: The Complete Reference”, Fifth Edition (Complete Reference Series) Paperback.*
3.	*John L. Hennessy, David Goldberg, David A. Patterson, “Computer Architecture: A Quantitative Approach”, 2nd Edition, Published by Morgan Kaufman Publishers, 1996.*
4.	*Silberschatz and Galvin, “Operating System Concepts”, John Wiley & Sons, Sixth edition, 2009*
5.	*Andrew Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson Education, 2007*

18SPE004	DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Interpret the contribution of data warehousing and data mining to the decision-support systems and Evaluate the performance of different data-mining algorithms.
- Differentiate between situations for applying different data-mining techniques: frequent pattern mining, association, correlation, classification, prediction, and cluster and outlier analysis.
- Understand the algorithms for association rule mining, the impact of big data for business decisions and strategy and the challenges of text mining and web mining.

UNIT I INTRODUCTION **9**

Moving towards the Information Age – Kinds of Data – Kinds of Patterns – Technologies – Business intelligence – Web search engines – Major issues in Data mining – Data objects and attribute types – Basic statistical descriptions of data – Data visualization – Measuring data similarity and dissimilarity – Data Preprocessing – Data cleaning, Data integration, Data reduction, Data transformation and data discretization.

UNIT II DATA WAREHOUSING & MINING **9**

Basic concepts – Data warehouse modeling: Data Cube and OLAP – Data warehouse design and usage – Data warehouse implementation – Data generalization by attribute oriented induction. Mining frequent patterns, associations and correlations – Basic concepts, Frequent itemset mining methods – Apriori algorithm, Generating Association rules, Pattern growth approach, Closed and Max patterns - Pattern evaluation methods.

UNIT III CLASSIFICATION **9**

General approach to Classification – Decision tree induction – Bayes classification methods – Rule based classification – Model evaluation and selection – Techniques to improve classification accuracy – Bayesian belief networks – Multilayer feed forward neural network – backpropagation – Support vector machines – Classification using frequent Patterns – Lazy learners – k nearest neighbor classifiers.

UNIT IV CLUSTER ANALYSIS **9**

Requirements for cluster analysis – Partitioning methods – k Means, k Medoids – Hierarchical methods – Agglomerative, Divisive – BIRCH – Chameleon – Density based methods – DBSCAN, OPTICS, DENCLUE – Grid based methods – STING, CLIQUE – Evaluation of clustering. Probabilistic model based clustering – Expectation Maximization algorithm – Clustering high dimensional data: problems, challenges and methodologies – Dimensionality reduction methods – Clustering Graph and Network data – Outliers and Outlier Analysis.

UNIT V DATA MINING TRENDS AND APPLICATIONS **9**

Mining Sequence Data: Time series, Symbolic sequences and biological sequences – Mining Graphs and Networks – Statistical data mining – Applications – Financial Data analysis, Retail and telecommunication industries, Intrusion detection and prevention, Recommender Systems – Privacy, security and social impacts of data mining.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Demonstrate the various architectures and its application with data mining.
2. Create programs for classification, clustering and association rule mining.
3. Evaluate various mining techniques on complex data objects.

4.	Develop applications using Big Data Mining Tools.
5.	Implement apache hadoop, text and web mining.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2										3		2	3	
CO2	2	1		1							3		2	3	
CO3	2	2	2	2							3		2	3	
CO4	1	1	2	3							2		2	3	
CO5	1	1	3	3							2		1	3	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Jiawei Han, Micheline Kamber, Jian Pei"Data Mining: Concepts and Techniques", Third Edition, Morgan Kaufmann Publisher, 2012.
2.	Pang-Ning Tan, Michael Steinbach and Vipin Kumar," Introduction to Data Mining", Pearson Education, 2007.

REFERENCES:

1.	*Ian H.Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Second Edition, Elsevier,2005*
2.	*Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, 35th Reprint 2016.*
3.	*K.P. Soman, ShyamDiwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.*
4.	*Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.*
5.	*G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.*

18SPE005	C # AND .NET FRAMEWORK	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Write and understand C# language constructs syntax and semantics, Create, compile and run object-oriented C# programs.
- Develop reusable .NET components via interface realization and standard design patterns, data-query logic for databases.
- Acquire the knowledge and skills to design and develop dynamic web applications and the .NET framework to build distributed applications.

UNIT I INTRODUCTION TO C# 9

Introducing C# - .NET Architecture:.NET Framework classes-Assemblies-Namespaces-Creating .NET applications using C#-Role of C# in the .NET Enterprise Architecture-Core C#:Fundamentals of C# -Variables- Predefined data types-Flow Control-Enumerations-Namespaces-The Main() Method-Console I/O –Using Comments-The C# Preprocessor Directives

UNIT II OBJECT ORIENTED CONCEPTS IN C# 9

Objects and Types: Creating Classes-Classes and Structs – Objects – Inheritance – Generics – Arrays and Tuples-Operators and Casts-Delegates, Lambdas and Events-Strings and Regular Expressions-Collections-Memory Management-Reflection-Errors and Exceptions

UNIT III CORE ADO.NET 9

Overview of ADO.NET – Asynchronous Data Access-Managing Data and Relationships-XML Schemas-Working with ADO.NET-ADO.NET Entity Framework-Manipulating XML:xml Standards Support in .NET, Using System.XML Classes-Reading and Writing Streamed XML-Using the DOM in .NET-Using XPath Navigators-XML and ADO.NET-Serializing Objects in XML-Working with Different XML Objects

UNIT IV CORE ASP.NET 9

Core ASP.NET-.NET Frameworks for web Applications-Web Technologies--ASP.NET Identity System-ASP.NET Web Forms-Windows Communication Foundation(WCF)-Windows Workflow Foundation(WWF)-Overview of ASP.NET MVC

UNIT V .NET FRAMEWORK 9

Assemblies – Diagnostics-Tasks, Threads and Synchronization-Security in .NET.-Interop-Manipulating Files and the Registry-Transactions-Networking

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Inspect the basic structure of a C# application.
2. Analyze the major elements of the .NET frame work.
3. Summarize how C# fits into the .NET platform.
4. Identify .NET framework to build distributed applications.
5. Design and developing Web based applications on .NET.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3										3		

CO2	2	3	3										3	3	
CO3	3	3	3	3							3		3	3	1
CO4	3	3	3	3							3		2	3	1
CO5	3	2	3								2		2	3	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Christian Nagel et al. "Professional C#5.0 with .NET 4.5.1", Fifth edition, Wiley India, 2012.
2.	Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill, Fourth Edition, 2010.

REFERENCES:

1.	*Andrew Troelsen, "Programming C# 2010 and the .NET 4 Platform", Fifth edition, A Press, 2010.*
2.	*Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010.*
3.	*Paul Deitel, Harvey Deitel (2011), C# 2010 For Programmers, Deitel Developer Series, Fourth Edition, Pearson Education, New Delhi,2010.*
4.	*Robinson et al., Professional C# -2nd Edition, Wrox Press (John Wiley, New York), 2002.*
5.	*S. Thamarai Selvi, R. Murugesan, "A Textbook on C#", Pearson Education, NewDelhi, 2003.*

18SPE006	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment and tools that can reduce paper waste and carbon footprint by user.
- Understand how to minimize equipment disposal requirements and to Impart necessary skills in energy saving practices in their use of hardware
- Demonstrate the application of the principles and practices of Green IT with case studies for improved environmental sustainability.

UNIT I FUNDAMENTALS **9**

Green IT Fundamentals - Business, IT, and the Environment –Green IT Opportunity-Challenges of Carbon Economy-Green IT Strategies - Drivers, Dimensions, and Goals – Environmentally Responsible Business - Policies - Practices and Metrics.

UNIT II GREEN ASSETS AND MODELING **9**

Green Assets - Buildings -Data Centers – Networks – Devices - Computer and Earth Friendly peripherals - Greening Mobile devices – Green Business Process Management : Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems : Design and Development Models.

UNIT III ASPECTS OF GREEN IT **9**

Socio-Cultural Aspects of Green IT :Green Social Stakeholders-Green Washing-Green Virtual Communities-Green Enterprise Transformation Roadmap: Green Enterprise Transformation-Equipment Life Cycle-End-User Computing-Software Architecture-Business Applications-Configuring a GET Road Map

UNIT IV GREEN COMPLIANCE **9**

Green Compliance: Protocols, Standards-Government Initiatives- Green IT Audits: Audit Types-Comparative Audits- – Emergent Carbon Issues - Technologies and Future: Cloud Computing-Nanotechnologies-Eco design-Biomimicry -Best Ways to Make Computer Greener.

UNIT V CASE STUDIES **9**

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Hospital, Packaging Industry and Telecom Sector.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Outline the basics of Green IT.
2. Create Green Assets and their management.
3. Classify the Socio-Cultural Aspects of Green IT And Green Enterprise Transformation Roadmap.
4. Apply Green IT strategies and applications.
5. Develop case studies related to Environmentally Responsible Business Strategies

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1	3	3							3

CO2						2	3	3						2	3
CO3						2	3	3						2	3
CO4						3	3	3						1	3
CO5						3	3	3						1	3
(1-Low, 2- Moderate, 3-High)															

TEXT BOOKS:	
1.	Bhuvan Unhelkar, "Green IT Strategies and Applications using Environmental Intelligence", Fourth Edition, CRC Press, June 2011.
2.	Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", Second Edition, August 2009.

REFERENCES:	
1.	*John Lamb, "The Greening of IT", Third Edition, Pearson Education, 2009.*
2.	*Jason Harris, "Green Computing and Green IT- Best Practices on Regulations and Industry", Third Edition, Lulu.com, 2008.*
3.	*Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency‖, CRC Press*
4.	*Carl Speshocky, "Empowering Green Initiatives with IT", John Wiley and Sons, 2010.*
5.	*Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journey", Fourth Edition, Shoff IBM rebook, 2011.*

18SPE007	AGILE SOFTWARE DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Examine the principles and practices associated with each of the agile development methods: Lean, Scrum, Extreme Programming, Feature-driven development
- Provide knowledge on how to manage a project using Scrum framework, agile practices such as test-driven development, standup meetings, and pair programming to their software engineering practices.
- Ability to identify and address most common problems encountered in adopting Agile methods.

UNIT I	FUNDAMENTALS OF AGILE	9

The Genesis of Agile - Introduction and background - Agile Manifesto and Principles - Overview of Scrum - Extreme Programming - Feature Driven development - Lean Software Development - Agile project management - Design and development practices in Agile projects - Test Driven Development - Continuous Integration – Refactoring - Pair Programming - Simple Design - User Stories - Agile Testing - Agile Tools.

UNIT II	AGILE SCRUM FRAMEWORK	9

Introduction to Scrum - Project phases - Agile Estimation - Planning game - Product backlog - Sprint backlog - Iteration planning - User story definition - Characteristics and content of user stories - Acceptance tests and Verifying stories - Project velocity - Burn down chart - Sprint planning and retrospective - Daily scrum - Scrum roles – Product Owner - Scrum Master - Scrum Team - Scrum case study - Tools for Agile project management.

UNIT III	AGILE TESTING	9

The Agile lifecycle and its impact on testing - Test-Driven Development (TDD) - xUnit framework and tools for TDD - Testing user stories - acceptance tests and scenarios - Planning and managing testing cycle - Exploratory testing - Risk based testing - Regression tests - Test Automation - Tools to support the Agile tester.

UNIT IV	AGILE SOFTWARE DESIGN AND DEVELOPMENT	10

Agile design practices - Role of design Principles including Single Responsibility Principle - Open Closed Principle - Liskov Substitution Principle - Interface Segregation Principles - Dependency Inversion Principle in Agile Design - Need and significance of Refactoring - Refactoring Techniques - Continuous Integration - Automated build tools - Version control.

UNIT V	INDUSTRY TRENDS	8

Market scenario and adoption of Agile - Agile ALM - Roles in an Agile project - Agile applicability - Agile in Distributed teams - Business benefits - Challenges in Agile - Risks and Mitigation - Agile projects on Cloud - Balancing Agility with Discipline - Agile rapid development technologies.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Understand the background and driving forces for taking an Agile approach to software development.
2.	State the business value of adopting Agile approaches.
3.	Compare the Test Driven Development approaches.

4.	Deploy automated build tools, version control and continuous integration.
5.	Test activities within an Agile project.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2		2					2				3	
CO2	3	3			2					2			2	3	
CO3	3	2								2			2	3	
CO4	2	1	2							3			1	3	
CO5	2	1	2							3			1	3	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	The courseware including PowerPoint slides is available for the course. Following websites provides articles/ freely downloadable eBook on Agile Software Development: www.it-ebooks.info/tag/agile , http://martinfowler.com/agile.html

REFERENCES:

1.	Ken Schawber, Mike Beedle, "Agile Software Development with Scrum" , Pearson 2008.(Unit I,II)
2.	*Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2002. (Unit III)*
3.	*Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams", Addison Wesley, 2008. (Unit IV)*
4.	*Alistair Cockburn, "Agile Software Development: The Cooperative Game", Addison Wesley, 2006.(Unit I)*
5.	*Mike Cohn, "User Stories Applied: For Agile Software" , Addison Wesley, 2004. (Unit II)*

18SPE008	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Compare and contrast conventional networking approaches and basic concepts, architecture of SDN.
- Analyze the implementation of SDN through Open Flow Switches and pros and cons of applying SDN in WAN and data centers.
- Program a sample SDN for a given task, Configure an example service using SDN and NFV.

UNIT I	INTRODUCTION	9

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of Switches and Control planes, Cost, Data center innovation – Compute and storage virtualization, Inadequacies in networks today, Data center needs – Evolution of networking technology – Forerunners of SDN – Characteristics of SDN – SDN: operation, devices, controller, applications.

UNIT II	OPEN FLOW AND SDN CONTROLLERS	9

Open Flow Specifications – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor based Overlays – SDN via Opening up the Device – Emerging Protocol, Controller and Application models – Definitions, Protocol models, Controller models, application models, SDN Security.

UNIT III	DATA CENTERS	9

SDN in Data centers - Data center demands, Tunneling technologies, Path technologies, Ethernet fabrics, SDN Use cases in the data center, Comparison of Open SDN, Overlays and APIs. SDN in other Environments – Wide area networks, Service provider and Carrier networks, Campus networks, Hospitality networks, Mobile networks, Optical networks - Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE.

UNIT IV	SDN PROGRAMMING	9

Programming SDNs - Northbound Application Programming Interface - Current Languages and Tools - Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks – Concepts - Implementation and Applications.

UNIT V	SDN FRAMEWORK	9

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Use cases for Bandwidth scheduling, manipulation and calendaring – Use cases for Data center overlays, big data and network function virtualization - Use cases for input traffic monitoring, classification and triggered actions.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Analyze the evolution of software defined networks.
2.	List the various components of SDN and their uses.

3.	Explain the use of SDN in the current networking scenario.
4.	Develop various applications of SDN.
5.	Implement the software defined network framework.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2								3		2	3	
CO2	2	2	2								3		2	3	
CO3	3	3	3								3		2	3	1
CO4	3	2	2								3		2		
CO5	3	3	2		3						3		2		

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", First Edition, Morgan Kaufmann, 2014.
2.	Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.

REFERENCES:

1.	*Siamak Azodolmolky, "Software Defined Networking with Open Flow", Packet Publishing, 2013.*
2.	*Vivek Tiwari, "SDN and Open Flow for Beginners", Amazon Digital Services, Inc., 2013.*
3.	*Fei Hu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", CRC Press, 2014.*
4.	*William Stallings "Foundations of Modern Networking : SDN, NFV, QoE, IoT, and Cloud." 1st edition,,Pearson Education, Inc. 2016.*
5.	*Kreutz et al.: Software-Defined Networking: A Comprehensive Survey, Proceedings of the IEEE , Vol. 103, No. 1, January 2015.*

18SPE009	SOCIAL NETWORKS ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Apply knowledge for current web development in the era of Social Web
- Develop a model for integrating data for knowledge representation and learn about tools and an algorithm for mining in social networks
- Examine the human behavior and trust disputes of social networks and Apply visualization technique in Social network

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

Data mining and web mining – web community and social network analysis – Characteristics of web data – web community – The evolution of social networks – basic concept in social networks.

UNIT II **SOCIAL NETWORK DATA AND REPRESENTATION** **9**

Structural – composition-affiliation variables-modes-boundary specification and sampling- type of networks- measurement and collection - Review of graph theory- Data set- Tools - Pajek, Netdraw, UCInet

UNIT III **STRUCTURAL PROPERTIES OF SOCIAL NETWORKS** **9**

Notions of centrality - cohesiveness of subgroups - roles and positions - structural equivalence - equitable partitions.

UNIT IV **WEB CONTENT MINING** **9**

Boolean model - vector space model - web search – feature enrichment of short texts- - automatic topic extraction from web document – opinion search and opinion spam.

UNIT V **WEB LINKAGE MINING** **9**

Hyperlinks- co-citation and bibliographic coupling- page rank and HITS algorithm – web community discovery – web graph measurement and modeling - using link information for webpage classification.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Construct semantic web related applications.
2. Demonstrate knowledge using ontology.
3. Determine human behavior in social web and related communities.
4. Experiment with social networks visualization tools.
5. Support the algorithms for web linkage mining.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3								3		2	3	
CO2	3	2									2		2	3	
CO3	3	3									3		1	3	
CO4	3	3									2		1	3	
CO5	3	3			3						3		2	3	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Stanley Wasserman, Katherine Faust, "Social network analysis: methods and applications", Cambridge University Press, 2009.
2.	John Scott, "Social Network Analysis: A Handbook", SAGE Publications, 2000.
REFERENCES:	
1.	*Guandong xu, yanchun zhang, "Web mining and social networking: techniques", Springer science and business media, 2011.*
2.	*Charles Kadushin, "Understanding Social Network: Theories, Concepts, and Findings", Oxford Press, 2011.*
3.	*Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.*
4.	*John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.*
5.	*Max Chevalier, Christine Julien and Chantal Soulé -Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.*

18SPE010	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Enable the students to understand the fundamentals of Pattern recognition, pattern classification algorithm for a pattern recognition problem, proper implementation of the algorithm.
- Enrich the student's knowledge with non linear and linear classification along with its applications.
- Understand the techniques of feature generation and template matching and know about Support Vector Machines and Clustering Approaches

UNIT I	INTRODUCTION	9

Introduction: Example: Polynomial Curve Fitting-Probability Theory –Model Selection-The Curse of Dimensionality-Decision Theory-Information Theory-Probability Distributions: Binary Variables-Multinomial Variables-The Gaussian Distribution-The Exponential Family-Nonparametric Methods

UNIT II	LINEAR MODELS FOR REGRESSION AND CLASSIFICATION	9

Linear Basis Function Models-The Bias-Variance Decomposition-Bayesian Linear Regression-Bayesian Model Comparison-The Evidence Approximation-Limitations of Fixed Basis Functions-Linear Models for Classification Discriminant Functions-Probabilistic Generative Models-Probabilistic Discriminative Models-Laplace Approximation-Bayesian Logistic Regression

UNIT III	NEURAL NETWORKS	9

Feed-forward Network Functions-Network Training-Error Backpropagation -The Hessian Matrix-Regularization in Neural Networks-Mixture Density Networks-Bayesian Neural Networks-Kernel Methods: Dual Representations-Constructing Kernels-Radial Basis Function Networks- Gaussian Processes.

UNIT IV	GRAPHICAL,MIXTURE MODELS AND EM	9

Bayesian Networks-Conditional Independence-Markov Random Fields-Inference in Graphical Models-Mixture Models and EM: K-means Clustering-Mixture of Gaussians-An Alternative View of EM-The EM Algorithm in General-Combining Models: Bayesian Model Averaging-Boosting-Tree-Based Models-Condition Mixture Models.

UNIT V	SAMPLING METHODS	9

Basic Sampling Methods-Markov Chain Monte Carlo-Gibbs Sampling-Slice Sampling-The Hybrid Monte Carlo Algorithm-Estimating the Partition Function-Continuous Latent Variables: Principal Component Analysis-Probabilistic PCA-Kernel PCA-Nonlinear Latent Variable Models.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Determine the classifiers for pattern recognition.
2.	Examine feature selection and dimensionality reduction techniques.
3.	Make use of the MC and HMM models.
4.	Classify the data objects and develop template matching module to recognize the patterns.
5.	Build unsupervised learning algorithms and clustering algorithms to data objects.

COURSE ARTICULATION MATRIX:

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1									2	3	
CO2	2	2	1	1									2	3	
CO3	2	2											2	3	
CO4	2	1		1									2	3	
CO5	2	2	1	1									2	3	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Christopher M.Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag, 2011
2.	Sergios Theodoridis, Konstantinos Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009.

REFERENCES:

1.	*Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition,Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.*
2.	*Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.*
3.	*Russell, S. and Norvig, N. "Artificial Intelligence: A Modern Approach" Prentice Hall Series in Artificial Intelligence, 2003.*
4.	*Duda, R.O., Hart, P.E., and Stork, D.G. "Pattern Classification" Wiley-Interscience, 2nd Edition, 2001.*
5.	*T.M. Mitchell, Machine learning, Mc Graw-Hill, New York, 1997.*

18SPE011	BUILDING ENTERPRISE APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Exposed to essentials of building enterprise applications and analysis of enterprise application and business process modeling.
- Learn to design and develop high quality enterprise applications.
- Be familiar with the approaches of testing enterprise application

UNIT I	INTRODUCTION TO ENTERPRISE APPLICATION	9

Introduction to enterprise applications and their types - software engineering methodologies - life cycle of raising an enterprise application - introduction to skills required to build an enterprise application - key determinants of successful enterprise applications and measuring the success of enterprise applications.

UNIT II	INCEPTING ENTERPRISE APPLICATION AND BUSINESS PROCESS MODELING	8

Inception of enterprise applications - enterprise analysis - business modeling - requirements elicitation - use case modeling - prototyping - non-functional requirements - requirements validation - planning and estimation.

UNIT III	ENTERPRISE ARCHITECTURE AND DESIGNING ENTERPRISE APPLICATION	10

Concept of architecture - views and viewpoints - enterprise architecture - logical architecture - technical architecture – design - different technical layers - best practices - data architecture and design – relational - XML and other structured data representations - Infrastructure architecture and design elements – Networking - Internetworking and Communication Protocols - IT Hardware and Software – Middleware - Policies for Infrastructure Management - Deployment Strategy - Documentation of application architecture and design.

UNIT IV	CONSTRUCTING ENTERPRISE APPLICATION	9

Construction readiness of enterprise applications - defining a construction plan - defining a package structure - setting up a configuration management plan - setting up a development environment - introduction to the concept of Software Construction Maps - construction of technical solutions layers - methodologies of code review - static code analysis - build and testing - dynamic code analysis – code profiling and code coverage.

UNIT V	TESTING AND ROLLING OUT ENTERPRISE APPLICATION	9

Types and methods of testing an enterprise application - testing levels and approaches - testing environments - integration testing - performance testing -penetration testing - usability testing - globalization testing and interface testing - user acceptance testing - rolling out an enterprise application.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Recall relevant knowledge from the concept of Enterprise Analysis and Business Modeling.

2.	Understand requirements validation, planning and estimation.
3.	Discuss the application architecture and importance of application framework.
4.	Compose Code review, Code analysis, build process.
5.	Understand different testing involved with enterprise application and the process of rolling out an enterprise application.
6.	Motivate the concept of Software Construction Maps.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										2	3	
CO2	3	2	2	1									2	2	
CO3	3	3	3			1							2	3	
CO4	3	2	2										2	3	
CO5	3	2	2	1									2	2	
CO6	3	3	3										2	3	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu,"Raising Enterprise Applications", John Wiley, 2010
2.	Brett McLaughlin, "Building Java Enterprise Applications", O'Reilly Media, 2002

REFERENCES:

1.	*Soren Lauesen, "Software Requirements: Styles & Techniques", Addison-Wesley Professional, 2002.*
2.	*Brian Berenbach, "Software Systems Requirements Engineering: In Practice", McGraw-Hill/Osborne Media, 2009*
3.	*Dean Leffingwell, Don Widrig, "Managing Software Requirements: A Use Case Approach", 2nd Edition , Pearson, 2003*
4.	*Vasudeva Varma, "Software Architecture: A Case Based Approach", Pearson, 2009*
5.	*"Designing Enterprise Applications with the J2EE Platform" (PDF available at- http://java.sun.com/blueprints/guidelines/designing_enterprise_applications_2e/.*

18SPE012	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the concept of speech processing in NLP.
- To understand the morphological fundamentals of various words, word forms in NLP and theories of parsing in NLP.
- To understand the role of semantics, pragmatics and representations of semantics and applications of natural language processing.

UNIT I SOUND **9**

Biology of Speech Processing - Place and Manner of Articulation - Word Boundary Detection - Argmax based computations - HMM and Speech Recognition.

UNIT II WORDS AND WORD FORMS **9**

Morphology fundamentals - Morphological Diversity of Indian Languages - Morphology Paradigms - Finite State Machine Based Morphology - Automatic Morphology Learning - Shallow Parsing - Named Entities - Maximum Entropy Models - Random Fields.

UNIT III STRUCTURES **9**

Theories of Parsing, Parsing Algorithms - Robust and Scalable Parsing on Noisy Text as in Web documents - Hybrid of Rule Based and Probabilistic Parsing - Scope Ambiguity and Attachment Ambiguity resolution.

UNIT IV MEANING **9**

Lexical Knowledge Networks, Wordnet Theory - Indian Language Wordnets and Multilingual Dictionaries - Semantic Roles - Word Sense Disambiguation - WSD and Multilinguality – Metaphors – Coreferences.

UNIT V WEB 2.0 APPLICATIONS **9**

Sentiment Analysis - Text Entailment - Robust and Scalable Machine Translation - Question Answering in Multilingual Setting - Cross Lingual Information Retrieval (CLIR).

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Compare and contrasting approaches to natural language processing.
2. Discover the various elements of speech processing.
3. Design and developing the machine learning techniques in the area of NLP.
4. Outline the lexical knowledge networks and wordnet.
5. Explain the web applications and CLIR.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2								3		3	2	
CO2	3	3	3								3		3	2	
CO3	3	3	3	3							3		3	3	
CO4	3	3	3	3							3		3	3	
CO5	3	3	3	3							3		3	2	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:	
1.	Daniel Jurasfsky. James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 3rd Edition, Prentice Hall, 2013.
2.	Manning, Christopher, Heinrich, Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.

REFERENCES:	
1.	*Allen James, "Natural Language Understanding", 2nd edition, Benjamin Cumming, 1995.*
2.	*Charniack, Eugene, "Statistical Language Learning", MIT Press, 1993.*
3.	*Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.*
4.	*Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, O_Reilly Media, 2009.*
5.	*Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and NaturalLanguage Processing", Wiley-Blackwell, 2012.*

18SPE013	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the theoretical basis behind the standard models of IR and the difficulty of representing and retrieving documents, images, speech
- Understand the standard methods for Web indexing and searching, Parallel and Distributed IR along with its applications.
- Understand how techniques of web retrieval is established using search engine architecture in IR

UNIT I INTRODUCTION **9**

Information Retrieval – Early Developments – The IR Problem – The User‘s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II MODELING AND RETRIEVAL EVALUATION **9**

IR models – Classic Information Retrieval – Alternative Set Theoretic Models – Alternative Algebraic Models – Alternative Probabilistic Models – Other Models – Hypertext Models – Web based Models – Retrieval Evaluation – Cranfield Paradigm – Retrieval Metrics – Reference Collections – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback – Clicks – Implicit Feedback Through Local Analysis – Global Analysis – Documents: Languages & Properties – Queries - Languages & Properties.

UNIT III TEXT CLASSIFICATION AND CLUSTERING **9**

A Characterization of Text Classification – Unsupervised Algorithms – Supervised Algorithms – Feature Selection or Dimensionality Reduction – Evaluation metrics – Organizing the classes – Indexing and Searching – Inverted Indexes –Signature Files – Suffix Trees & Suffix Arrays – Sequential Searching – Multi-dimensional Indexing.

UNIT IV WEB RETRIEVAL AND CRAWLING **9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures– Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms –Evaluation.

UNIT V RECOMMENDER SYSTEM **9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Utilize the open source search engine framework and exploring its capabilities.
2.	Analyze the documents in different ways and discuss its effect on similarity.
3.	Experiment with calculations and on search.

4.	Design and applying the innovative feature in a search engine.
5.	Make use of enterprise search and parallel & distributed IR.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3										1		
CO2	3	2	3										1	2	
CO3	3	3			1								1	2	1
CO4	3	3											1	2	
CO5	3	3											1	2	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press Books, 2011.
2.	Ricci, F, Rokach, L. Shapira, B.Kantor, "Recommender Systems Handbook", First Edition, 2011.

REFERENCES:

1.	*C. Manning, P. Raghavan, H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.*
2.	*Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.*
3.	*Bruce Croft, Donald Metzle, Trevor Strohman, "Search Engines: Information Retrieval in Practice", First Edition, Addison Wesley, 2009.*
4.	*Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.*
5.	*Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ",2nd Edition, Springer, 2004.*

18SPE014	GPU ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of parallelism with GPU, GPU paradigms
- To understand the programming issues and algorithms in GPUs
- To introduce different GPU programming models

UNIT I GPU ARCHITECTURE **9**

Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

UNIT II CUDA PROGRAMMING **9**

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT III PROGRAMMING ISSUES **9**

Common Problems - CUDA Error Handling - Parallel Programming Issues – Synchronization - Algorithmic Issues - Finding and Avoiding Errors.

UNIT IV OPENCL BASICS **9**

OpenCL Standards-Kernels-Host Device Interaction-Execution Environment-Memory Model-Basic OpenCL Examples

UNIT V ALGORITHMS ON GPU **9**

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Explain GPU Architecture.
2. Construct the instances of CUDA.
3. Implement algorithms in GPUs to get maximum occupancy and throughput.
4. Appraise the program in any heterogeneous programming model.
5. Build OpenCL and GPU programming models.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2									2		3		1
CO2	3	2	3	1							2		3	2	1
CO3	3	1	3	1							2		3	2	
CO4	3	2	1	3							2		3	3	
CO5	3	2	3	1							3		3	1	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:	
1.	Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)”, First Edition, Morgan Kaufmann, 2012.
2.	David R.Kaeli, Perhead Mistry, Dana Schaa, Dong Ping Zhang, ”Heterogenous Computing with OpenCL”, 3rd Edition, Morgan Kauffman,2015.

REFERENCES:	
1.	*Nicholas Wilt, “CUDA Handbook: A Comprehensive Guide to GPU Programming”, Addison - Wesley, 2013.*
2.	*David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors - A Hands-on Approach”, Second Edition, Morgan Kaufmann, 2012.*
3.	*Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General Purpose GPU Programming”, Addison - Wesley, 2010.*
4.	*http://www.nvidia.com/object/cuda_home_new.html*
5.	*http://www.openCL.org*

18SPE015	BUSINESS INTELLIGENCE AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be exposed with the basic rudiments of business intelligence system and data integration
- Understand the modeling aspects behind business intelligence
- To learn the basics of enterprise reporting, different data analysis tools and techniques

UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE **4**

Introduction to OLTP and OLAP - BI Definitions & Concepts - Business Applications of BI - BI Framework - Role of Data Warehousing in BI - BI Infrastructure Components – BI Process - BI Technology - BI Roles & Responsibilities.

UNIT II BASICS OF DATA INTEGRATION **12**

Concepts of data integration need and advantages of using data integration - introduction to common data integration approaches - introduction to ETL using SSIS - Introduction to data quality - data profiling concepts and applications.

UNIT III INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING **6**

Introduction to data and dimension modeling - multidimensional data model - ER Modeling vs. Multi-dimensional modeling - concepts of dimensions - facts - cubes - attribute – hierarchies - star and snowflake schema - introduction to business metrics and KPIs - creating cubes using SSAS.

UNIT IV BASICS OF ENTERPRISE REPORTING **12**

Introduction to enterprise reporting - concepts of dashboards - balanced scorecards - introduction to SSRS Architecture - enterprise reporting using SSRS.

UNIT V CASE STUDIES **11**

The assignments for the course can include the following.

1. Seminars from the topics related to Business Intelligence space
2. Relevant lab exercises to get exposure to BI concepts & tool

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Distinguish the Transaction Processing and Analytical applications
2. Relate the technology and processes associated with Business Intelligence framework.
3. Summarize the Data Warehouse implementation methodology and project life cycle.
4. Make recommendations to achieve the business goal.
5. Demonstrate the application of concepts in Microsoft BI suite.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2		2								3		

CO2	3	2	3		2								3	3	
CO3	2		2		2								3	3	1
CO4	2		2		2								3	3	1
CO5	2	2	2		2								3	3	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	R.N. Prasad, Seema Acharya, "Fundamentals of Business Analytics ", Second Edition, Wiley 2016.
2.	David Loshin, "Business Intelligence: The Savvy Manager's Guide", Morgan Kaufmann, 2012.

REFERENCES:

1.	*Mike Biere, "Business intelligence for the enterprise", IBM Press, 2003*
2.	*Larissa Terpeluk Moss, Shaku Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications", Addison Wesley, 2003*
3.	*Cindi Howson, "Successful Business Intelligence: Secrets to making Killer BI Applications", Second edition, McGraw-Hill Education, 2013*
4.	*Brain, Larson, "Delivering business intelligence with Microsoft SQL server 2008", 4th edition, McGraw-Hill Education, 2016*
5.	*Lynn Langit, "Foundations of SQL Server 2005 Business Intelligence ", Apress, 2007*

18SPE016	GAME THEORY	L	T	P	C
		2	1	0	3

OBJECTIVES:

- Be familiar with the process of game design, development and processes, mechanics, issues in game design
- To analyze the game design principles and architecture of game programming
- To know about game engine development, modeling, techniques and frameworks

UNIT I INTRODUCTION 9

Geometrical Methods: Transformations-Coordinate Systems-Quaternions-Euler Angles-Standard 3D Objects-Distance Methods

UNIT II GRAPHICS PIPELINE 9

Model and World Coordinates-Perspective Projection-Camera Models-Culling and Clipping-Surface and Vertex Attributes-Rasterizing-An Efficient Clipping and Lighting Pipeline-Issues of Software, Hardware and APIs

UNIT III HIERARCHICAL SCENE REPRESENTATIONS 9

Tree-Based Representation-Updating a Scene Graph-Rendering a Scene Graph-Collision Detection-Design Issues-Intersection of Dynamic Objects and Lines-Intersection of Dynamic Objects and Planes-Static Object-Object Intersection-Dynamic Object-Object Intersection-Processing of Rotating and Moving Objects

UNIT IV GEOMETRIC LEVEL OF DETAIL 9

Sprites and Billboards-Discrete level of Detail- Continuous Level of Detail-Animation of Characters: Key Frame Animation-Inverse Kinematics-Skinning

UNIT V SPATIAL SORTING AND SPECIAL EFFECTS 9

Quadtrees-Octrees-Portals-Binary Space Partioning-Special Effects: Lens Flare-Environmental Mapping-Bump Mapping-Volumetric Mapping-Projected Lights-Projected Shadows-Particle Systems

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Develop the game programming skills and create interactive games.
2. Apply rasterization and illumination for game programming.
3. Model collision detection for design principles.
4. Implement the hardware and software rendering.
5. Experiment 2D and 3D interactive games.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3									3	2	
CO2	3	3	3										3	2	2
CO3	3	2	2										2	2	1
CO4	3	3	3										3		1
CO5	3	3	3										2		1

(1-Low, 2- Moderate, 3-High)	
TEXT BOOKS:	
1.	David H. Eberly, "3D Game Engine Design: A Practical Approach to Real Time Computer Graphics", Second Edition, Morgan Kaufmann, 2010.
2.	Jonathan S. Harbour,"Beginning Game Programming", Course Technology, Third Edition PTR, 2009.
REFERENCES:	
1.	*Scott Rogers, "Level Up: The Guide to Great Video Game Design", First Edition, Wiley, 2010.*
2.	*Jim Thompson, Barnaby Berbank-Green, Nic Cusworth, "Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer", First Edition, Wiley, 2008.*
3.	*A.Dixit and S. Skeath, "Games of Strategy", W W Norton & Co Inc, 3rd Edition 2009.*
4.	*Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.*
5.	*Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2nd Edition Prentice Hall /New Riders, 2009.*

18SPE017	OPEN SOURCE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about Open source operating systems and databases
- To acquire the knowledge of open source programming languages, open source tools and techniques
- To get introduces to Python programming constructs

UNIT I PRINCIPLES **9**

Introduction to Open Source, The Philosophy of OSS, The Cathedral and Bazaar Model, Commercial Software and OSS, Free Software and Freeware, Open Source Licenses, Copyrights and Copyleft, Patents - Economics of FOSS - Zero Marginal Cost, Income, Generation Opportunities, Problems with Traditional Commercial Software, Internationalization.

UNIT II OPEN SOURCE OPERATING SYSTEMS AND DATABASE **9**

Kernel Types - Architectures - Supported File Systems -Security Issues - Case Study: Flavors Of Linux - SQL Standard Compliance - Supported Platforms - Programming Interfaces. Case Study: Mysql - Internals and Portability - Data Types - Security - Scalability - Connectivity - Localization - Postgresql - Couchdb - Hbase

UNIT III OPEN SOURCE PROGRAMMING LANGUAGES **9**

Introduction to Open Source Programming and Scripting Languages- Execution Environment - Programming in Web Environment - File Handling and Data Storage - Working with Forms - Case Study: PHP - Python.

UNIT IV OPEN SOURCE WEB SERVER **9**

Web Server - Feature – Architectures - Case Study: Apache Web Server - Configuring and Using Web Server - Comparison of Apache Web Server with Commercial Web Servers

UNIT V TOOLS AND TECHNOLOGIES **9**

Integrated Development Environment for Development and Testing - Text Processing Tools - E-Learning Tools - Version Control and Content Management Tools - Parallel and System Programming Tools - Virtualization and Cloud Computing - Social Network Engine.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Interpret the open source systems and databases.
2. Create programs using open source programming languages.
3. Interview PHP programming and SQL database.
4. Build programs using python.
5. Justify the file handling mechanisms.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2		2					2				3	

CO2	3	3			2					2			2	3	
CO3	1	2								3			2	3	
CO4	2	1	2							3			1	3	
CO5	2	1	2							1			1	3	
(1-Low, 2- Moderate, 3-High)															

TEXT BOOKS:	
1.	Kailash Vadera and Bhavyesh Gandhi, "Open Source Technology", Second Edition, University Science Press, New Delhi, 2009
2.	Peter Wainwright, "Professional Apache", Third Edition, Wrox Press, 2004.

REFERENCES:	
1.	*Steve Suchring, "PHP6 and MySQL Bible", John Wiley, 2009.*
2.	*Rasmus Lerdorf, Levin Tatroe, "Programming PHP", O'Reilly, 2002.*
3.	*Wesley J. Chun, "Core Python Programming", Second Edition, Prentice Hall, 2011.*
4.	*Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2003*
5.	*Stephen J. Mellor, Marc Balces, "Executable UMS: A foundation for MDA", AddisonWesley, 2002*

18SPE018	BIG DATA AND ANALYTICS	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To understand the competitive advantages of big data analytics and big data frameworks
- To learn data analysis methods
- To gain knowledge on Hadoop related tools such as MongoDB, HBase, Cassandra, Pig and Hive for big data analytics and Jasper Reports.

UNIT I INTRODUCTION TO BIG DATA **8**

Digital Data: Types of Digital Data - Structured - Sources of structured data - Ease with Structured data - Semi-Structured - Sources of semi-structured data - Unstructured - Sources of unstructured data - Issues with terminology - Dealing with unstructured data.
Introduction to Big Data: Characteristics of data - Challenges with big data - Big data stack.

UNIT II HADOOP **10**

Technology Landscape:Big Data Analytics - Analytics 1.0, Analytics 2.0, Analytics 3.0 - Traditional BI vs. Big Data Environment - Big Data technology Landscape - NoSQL Databases - NoSQL Vs. RDBMS- New SQL - Hadoop - Hadoop 1.0 vs. Hadoop 2.0 - Data Science is multi-disciplinary - Data Scientist - Your new best friend.

Introduction to Hadoop: Introducing Hadoop - Why not RDBMS - Distributed Computing Challenges - A Brief History of Hadoop - Hadoop Overview - Hadoop Components - High Level Architecture of Hadoop - Hadoop Distributed File System -HDFS Architecture - Daemons Related to HDFS - Working with HDFS Command - Special Features of Hadoop - Processing Data With Hadoop - Introduction - How Map Reduce Works - Map Reduce Example - Word Count Example using Java - Managing Resources and Applications with YARN - Introduction - Limitation of Hadoop 1.0 - Hadoop 2: HDFS - Hadoop 2: YARN - Interacting with Hadoop EcoSystem - Hive - Pig - HBASE - Sqoop - Business Intelligence on Hadoop.

UNIT III MONGO DB, CASSANDRA, HIVE **11**

Mongo DB:Recap of NoSQL databases - MongoDB – CRUD - MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations.
Cassandra:Cassandra- CQLSH - CRUD, Counter, List, Set, Map, Tracing.
Introduction to Hive:Introduction to Hive - The Problem -Solution - Hive Use Case - Data Growth - Schema Flexibility and Evolution - Extensibility - What is Hive - History of Hive and Recent Releases of Hive - Hive Features - Hive Integration and Work Flow - Hive Data Units - Hive Architecture - Hive Primitive Data Types and Collection Types - Hive File Formats - Hive Query Language - Statements - DDL - DML - Hive Partitions, Bucketing, Views, Sub query, joins, Hive User Defined Function - Aggregations in Hive, Aggregations in Hive, Serialization and Deserialization, - Hive Analytic Functions.

UNIT IV PIG **10**

Introduction to Pig:Introducing Pig - History and Anatomy of Pig - Pig on Hadoop - Pig Features - Pig Philosophy - Word count example using Pig - Use Case for Pig - Pig Primitive Data Types , Collection Types and NULL - Pig Latin Overview - Pig Latin Grammar - Comments, Keywords, Identifiers - Case sensitivity in Pig - Common Operators in Pig - Pig Statements - LOAD - STORE - DUMP - Interactive Shell - GRUNT - FILTER - SORT - GROUP BY - ORDER BY - JOIN - LIMIT - Pig Latin Script - Local Mode - Map Reduce Mode - Running Pig Script - Working with -Field - Tuple - Bag - User Defined Function -

Parameters in Pig.

UNIT V	JASPER REPORT	6

Introduction to Jasper Report:Introduction to Jasper Report using Jasper Soft Studio - Reporting using MongoDB - Reporting using Cassandra.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Interpret the concepts of big data.
2.	Demonstrate about hadoop DFS.
3.	Construct the DDL and DML statement and introduction to hive.
4.	Recall the knowledge on MongoDB and Cassandra.
5.	Explain the concepts on pig and jasper studio.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										3	2	2
CO2	3	2	2										2	2	1
CO3	3	3	3										3		1
CO4	3	3	3										2		1
CO5	2	3	3										3	3	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	The courseware (PowerPoint and notes) is available for the course.
2.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3.	Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.

REFERENCES:

1.	*Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley and SAS Business Series, 2012.*
2.	*Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill, 2011.*
3.	*Edward Capriolo, Dean Wampler, and Jason Rutherglen, “Programming Hive”, O'Reilly Media*

18SPE019	MACHINE LEARNING	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning, Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques, evolutionary models of machine learning
- To understand graphical models of machine learning algorithms

UNIT I INTRODUCTION **9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation, Algorithm, Hypothesis Space Search, Issues in decision tree learning.

UNIT II NEURAL NETWORKS & EVALUATION **9**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Face Recognition example – Error functions, Error minimization procedures – Recurrent networks – Dynamically modifying network structure – Evaluating Hypotheses – Estimating hypothesis accuracy – Basics of sampling theory – Central limit theorem.

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 – Computational learning theory – Finite and Infinite hypothesis spaces, Mistake bound model of learning.

UNIT IV INSTANCE BASED LEARNING & GENETIC ALGORITHMS **9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based reasoning. Genetic algorithms – Illustrative example, Hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

UNIT V ADVANCED LEARNING **9**

Learning Sets of Rules – Sequential Covering Algorithm, Learning Rule Sets, First Order Rules, FOIL, Induction on Inverted Deduction, Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation based Learning – Combining Inductive and Analytical learning – KBANN, TANGENTPROP, FOCL algorithms – Reinforcement Learning – Q-Learning, Temporal Difference Learning.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Distinguish between supervised, unsupervised and semi-supervised learning.
2.	Identify the apt machine learning strategy for any given problem.
3.	Recommending supervised, unsupervised or semi-supervised learning algorithms for any given problem.
4.	Create systems that use the appropriate graph models of machine learning.
5.	Modify existing machine learning algorithms to improve classification efficiency.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PS O 1	PS O 2	PS O 3
CO1	3	2	3									2	2	3	
CO2	2	3	2									2	2	3	
CO3	2	2	3									2	2	3	
CO4	2	2	3									2	2	3	
CO5	2	2	3									2	2	3	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013.
2.	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", First edition, MIT Press, 2012.

REFERENCES:

1.	*Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014.*
2.	*Richard Sutton and Andrew Barto, Reinforcement Learning: An introduction. MIT Press,1998.*
3.	*Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.*
4.	*Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.*
5.	*David Barber, "Bayesian Reasoning and Machine Learning" , Cambridge University Press, 2012.*

18SPE020	GEOGRAPHICAL INFORMATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamentals and components of geographic information system.
- Be known to details of data classification and map projections, various geo processing tools.
- To have a thorough understanding of editing features in GIS and applications of geographical information systems.

UNIT I INTRODUCTION TO GIS **9**

Geographic Information: Science, Systems and society-Principles: Nature of Geographic Data-Representing Geography- Georeferencing

UNIT II TECHNIQUES **9**

GI System Software-Geographic Data Modeling-Data Collection-Creating and Maintaining Geographic Databases-The GeoWeb

UNIT III ANALYSIS **9**

Cartography and Map Production-Geovisualization-Spatial Data Analysis-Spatial Analysis and Inference-Spatial Modeling With GI Systems

UNIT IV POLICY AND MANAGEMENT **9**

Managing GI Systems: Managing Risk-Case for GI System: ROI-The process of Developing a sustainable GI System-Sustaining a GI System-Information and Decision Making: Information as Infrastructure-Different Forms of GI-Open Data and Open Government

UNIT V ACTIONS OF GIS **9**

Navigating the Risks: Clashes between Scientists and the Judiciary-Business Models For GI-Related Enterprises-Legal and Regulatory Constraints-Privacy and GI Systems-Partnerships, Up-Scaling Activities and Risk Mitigation-Epilog: GISS in the Service of Humanity: The Process-Grand Challenges

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Define the graphical information system.
2. Understand map projections and census data.
3. Summarize about geocoding.
4. Illustrate the basic concepts of web mapping and QGIS.
5. Relate the applications of GIS.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1			2		1						3		
CO2	1	1	3		2		1			1			3		
CO3	1	2			2					1			3		
CO4	1						3			2			3	2	

CO 5	2						2			2			3	1	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Longley A. Paul, Michael F. Goodchild, David J. Maguire, David W. Rhind "Geographical Information Systems and Science", Fourth Edition, Hoboken, NJ: John Wiley & Sons, 2005.
2.	Maantay, Julie, John Ziegler, "GIS for the Urban Environment", Redlands, CA:Esri Press, 2006.

REFERENCES:

1.	*Peters, Alan H., Heather MacDonald, "Unlocking the Census with GIS", Redlands, CA:EsriPress, 2004.*
2.	*US Census Bureau, "A Compass for Understanding and Using American Community Survey Data:What General Users Need to Know (Issued October 2008)", Washington, DC: US CensusBureau, 2010.*
3.	*Peterson, Gretchen,"Colors for Maps", 2011.*
4.	*Schlossberg, Marc. "GIS, the US Census and Neighbourhood Scale Analysis."Planning, Practice & Research. 2003*
5.	*Kent, Robert B. and Richard E. Klosterman. "GIS and Mapping: Pitfalls for Planners." Journal of the American Planning Association, 2000.*

18SPE021	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn XML fundamentals and web services technology elements for realizing SOA
- Understand the key principles behind SOA
- Be exposed to build applications based on XML and web service standards

UNIT I XML TECHNOLOGY **9**

XML – XML and Web - Name Spaces – XML Document Structure - Structuring with Schemas and DTD - Modeling Databases in XML – XQuery.

UNIT II SOA BASICS **9**

Service Oriented Architecture (SOA) – Comparing SOA with Client-Server and Distributed architectures - Characteristics of SOA – Benefits of SOA - Principles of Service orientation – Service layers - Business Process management.

UNIT III WEB SERVICES **9**

SOA and Web Services – Web Services Protocol Stack – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service Level Interaction patterns – XML and Web Services - Enterprise Service Bus - .NET and J2EE Interoperability.

UNIT IV WS TECHNOLOGIES AND STANDARDS **9**

Web Services Technologies - JAX-RPC, JAX-WS - Web Service Standards – WS-RM, WS-Addressing, WS-Policy - Service Orchestration and Choreography – Composition Standards – BPEL - Service Oriented Analysis and Design.

UNIT V XML AND WS SECURITY **9**

XML Security Overview – Canonicalization – XML Security Framework – XML Encryption – XML Signature – XKMS Structure - Web Services Security - XACML - WS-Security.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Design and developing real work applications using the concepts of SOA and Web services.
2. Choose approaches for providing security for XML documents as well as messages exchanged among Web Services.
3. Construct an application using .NET and J2EE enterprise technology.
4. Experiment with JAX-WS and web service standards.
5. Categorize XML security framework .

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1		2											
CO2	1	2	3										2		
CO3	1	3	3										2		
CO4	1	3	3										2		

CO5	1			2	3								3		3

((1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1..	Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, first edition, 2005.
2.	Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.

REFERENCES:

1.	*James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2011.*
2.	*Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Addison Wesley, 2005.*
3.	*Ron Schmelzer et al. "XML and Web Services", Third Edition, Pearson Education, 2008.*
4.	*Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002.*
5.	*Muninder Singh & Michael Huhns, "Service Oriented Computing", Wiley, 2005.*

18SPE022	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn to create web pages and web applications using HTML
- Understand the method of adding client side behavior to HTML pages using Javascripts
- Be familiar with servlet programming and development using PHP

UNIT I	INTRODUCTION TO HTML	9

HTML- List – Tables – Images – Forms – Frames - Cascading Style sheets - XML- Document type definition - XML Schemas -Document Object model.

UNIT II	JAVA SCRIPT	9

Java Script -Control statements – Functions – Arrays – Objects – Events - Dynamic HTML with Java Script - Ajax.

UNIT III	SERVLETS	9

Web servers – IIS (XAMPP, LAMPP) and Tomcat Servers - Java Web Technologies – Servlets - JavaServer Pages - Java Server Faces - Web Technologies in Netbeans - Building a Web Application in Netbeans - JSF Components - Session Tracking - Cookies.

UNIT IV	PHP	9

PHP – Basics - String Processing and Regular Expressions - Form Processing and Business Logic -Using Cookies - Dynamic Content - Operator Precedence Chart.

UNIT V	DATABASE CONNECTIVITY	9

Database Connectivity with MySQL – Servlets – JSP - PHP - Case Studies- Student information system - Health Management System.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Select and constructing client side scripting techniques.
2. Build real world applications using client side and server side scripting languages.
3. Eloborate an e-Governance application using web technology.
4. Apply Regular expressions and using cookies.
5. Develope database connectivity and apply case studies.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2		2								3		
CO2	3	2	3		2								3	3	
CO3	2		2		2								3	3	1
CO4	2		2		2								3	3	1
CO5	2	2	2		2								3	3	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet & World Wide Web How to Program”, 5th edition, Deitel series, 2012.
2.	Jason Gilmore,”Beginning PHP and MySQL From Novice to Professional”, 4th Edition, Apress Publications, 2010.

REFERENCES:

1.	*Robert W. Sebesta, “Programming with World Wide Web”, 4th edition, Pearson, 2008.*
2.	*David William Barron, “The World of Scripting Languages”, Wiley Publications, 2000.*
3.	*Darie, Cristian, Balanescu, Emilian, “Beginning PHP and MySQL E-Commerce”, Apress,2008.*
4.	*Uttam K Roy, “Web Technologies”, Oxford University Press, 2010.*
5.	*David Flanagan , “JavaScript: The Definitive Guide, 5th Edition”, O'Reilly, 2006.*

18SPE023	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand the basic 2D and 3D Graphics viewing pipeline that includes, Modeling, manipulation and rendering along with advanced Graphics for visual realism
- To Learn the various shading models and Visible Surface Detection methods and get introduced to OpenGL programming
- To Understand basic elements of multimedia and to learn the theory behind data compression and different Multimedia Applications

UNIT I INTRODUCTION 9

Overview of Graphics Systems: Video Display Devices-Raster-Scan Systems-Graphics Workstations and viewing Systems-Input Devices-Graphics Networks-Introduction to OpenGL-Coordinate Reference Frames-Line-Drawing Algorithms –OpenGL Point Functions- OpenGL Line Functions-Parallel Curve Algorithms-OpenGL Polygon Fill- Area Functions-OpenGL Vertex Arrays-OpenGL Character Functions-Attributes of Graphics Primitives: OpenGL Color Functions -OpenGL Point-Attributes Functions

UNIT II TWO-DIMENSIONAL GEOMETRIC TRANSFORMATIONS 9

Basic Two-Dimensional Geometric Transformations-Matrix Representations and Homogeneous Coordinates-Inverse Transformations-Two-Dimensional Composite Transformations- Two Dimensional Viewing :Clipping Window-Normalization and Viewport Transformations-OpenGL Two-Dimensional Viewing Functions-Clipping Algorithms- Two-Dimensional Line Clipping: Cohen-Sutherland Line Clipping-Polygon Fill-Area Clipping-Curve Clipping

UNIT III THREE DIMENSIONAL VIEWING AND OBJECT REPRESENTATIONS 9

Overview of Three Dimensional Viewing- Three Dimensional Viewing Pipeline-Transformation from world to viewing Coordinates-Projection Transformations-Oblique Parallel Projections-Perspective Projections-The Viewport Transformation and Three Dimensional Screen Coordinates-OpenGL Three Dimensional Viewing Functions- Three Dimensional Clipping Algorithms- OpenGL Optional Clipping Planes

UNIT IV ILLUMINATION MODELS AND SURFACE-RENDERING METHODS 9

Light Sources-Surface Lighting Effects-Basic Illumination Models-Transparent Surfaces-Displaying Light Intensities-Halftone Patterns and Dithering Techniques-Polygon Rendering Methods-Ray-Tracing Methods-Texture Mapping- OpenGL Illumination and Surface-Rendering Functions- OpenGL Texture Functions-Color Models and Applications: Color Model-RGB Color Model-Color Selection and Applications

UNIT V COMPUTER ANIMATION 9

Raster Methods for computer Animation-Design of Animation Sequences-Traditional Animation Sequences-General Computer- Animation Functions – Computer Animation Languages-Key –Frame Systems-Motion Specifications-Articulated Figure Animation-Periodic Motions-OpenGL Animation Procedures

	TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Solve 2D applications of computer graphics.
2.	Appraise advanced 3D Graphics that leads to visual realism and perceive knowledge on fractal theory, color models, Animation.
3.	Create programs in OpenGL for drawing basic 3D scenes and add realism.
4.	Recall the basic elements of multimedia and to learn the theory behind data compression both lossless and lossy.
5.	Organize the multimedia applications.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1									3	2	
CO2	3	2		1									3	2	
CO3	3	2		1									3	2	
CO4	3	2		1									3	1	
CO5	3	2	2	1									3	1	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:	
1.	Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", Third Edition, Pearson Prentice Hall, 2010.
2.	Francis S Hill, Jr., Stephen M Kelley,"Computer Graphics Using OpenGL", Third Edition, Prentice Hall, 2007.

REFERENCES:

1.	*Peter Shirley, "Fundamentals of Computer Graphics", Third Edition, A K Peters, 2009.*
2.	*Shalini Govil Pai, "Principles of Computer Graphics Theory and Practice Using OpenGL and Maya", Springer, 2004.*
3.	*Ralf Steinmetz and Klara Nahrstedt, "Multimedia Computing, Communications and Applications", First Edition, Pearson 2005.*
4.	*Jeffrey McConnell, ―Computer Graphics: Theory into Practice‖, Jones and Bartlett Publishers,2006.*
5.	*Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design‖, PHI, 2003.*

18SPE024	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various characteristics of Intelligent agents and different search strategies in AI.
- To learn to represent knowledge in solving AI problems and different ways of Machine Learning.
- To know about the various applications of AI.

UNIT I	INTRODUCTION	9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II	PROBLEM SOLVING METHODS	9

Breadth-First Search - Uniform Cost Search - Depth-First Search - Depth-Limited Search - Iterative Deepening Search - Bidirectional Search - Heuristic Search Techniques - A* Search - AO* Algorithm - Adversarial Search - Minimax Algorithm, Alphabeta Pruning – Constraint satisfaction problems.

UNIT III	KNOWLEDGE REPRESENTATION	9

Representation - First Order Predicate Logic – Inference – Unification - Forward and Backward Chaining - Resolution - Reasoning with Default Information - Truth Maintenance Systems - Acting under Uncertainty - Statistical Reasoning - Probability and Bayes Theorem - Certainty Factors and Rule Based Systems - Dempster-Shafer Theory

UNIT IV	PLANNING AND LEARNING	9

Planning with State Space Search - Partial Order Planning - Planning Graphs – Hierarchical planning – Multiagent planning. Forms of Learning – Supervised Learning, Learning decision trees, choosing best hypothesis - Explanation Based Learning - Statistical Learning - Learning with Complete data – Reinforcement learning

UNIT V	APPLICATIONS	9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robotics -Path Planning – Handwritten digit classification using deep learning.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Make use of appropriate search algorithms for any AI problem.
2. Illustrate a problem using first order and predicate logic.
3. Support the apt agent strategy to solve a given problem.
4. Understand the fundamental issues and challenges of machine learning.
5. Designing applications for NLP that uses Artificial Intelligence.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1										2	3	
CO 2	3	2	1										2	1	

CO3	3	2	1										2	1	
CO4	3	2	1										2	1	
CO5	3	3	1										2		
(1-Low, 2- Moderate, 3-High)															

TEXT BOOKS:	
1.	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition , Prentice Hall, , 2017.
2.	Elaine Rich and Kevin Knight, —"Artificial Intelligence", Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES:	
1.	*Nils J. Nilsson, "The Quest for Artificial Intelligence", Third Edition, Cambridge University Press, 2009.*
2.	*David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Second Edition, Cambridge University Press, 2010.*
3.	*Nils J. Nilsson, —The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.*
4.	*Dan W. Patterson, " Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India, 2006.*
5.	*Deepak Khemani, " A First Course in Artificial Intelligence", Tata Mc Graw Hill Education 2013*

18SPE025	PARALLEL AND DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the need and fundamentals of parallel computing paradigms and nuances of parallel algorithm design
- To understand the programming principles in parallel computing architectures and concept of distributed computing architectures
- To learn few problems that are solved using parallel algorithms

UNIT I	INTRODUCTION TO PARALLEL COMPUTING	9

Scope of Parallel Computing – Parallel Programming Platforms – Implicit Parallelism, Limitations of Memory System Performance, Dichotomy of Parallel computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing mechanisms, Impact of Process-Processor Mapping and Mapping Techniques.

UNIT II	PARALLEL ALGORITHM DESIGN	9

Principles - Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models – Basic Communication Operations – One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of some Communication Operations – Analytical modeling of parallel programs

UNIT III	PARALLEL PROGRAMMING PARADIGMS	9

Principles of Message Passing Programming, Building Blocks, MPI – Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators. Programming Shared Address space platforms – POSIX thread API - OpenMP: a Standard for Directive based Parallel Programming – Applications - Matrix-Matrix Multiplication – Solving Systems of Equations – Sorting Networks – Graph algorithms – Parallel Depth First Search.

UNIT IV	DISTRIBUTED COMPUTING PARADIGM	9

Paradigms for Distributed applications – Basic algorithms in Message passing Systems – Leader Election in Rings – Mutual Exclusion in Shared Memory

UNIT V	FAULT TOLERANT DESIGN	9

Synchronous Systems with Crash Failures – Byzantine Failures – Impossibility in Asynchronous Systems - Formal Model for Simulation – Broadcast and Multicast – Specification of a Broadcast Service – Implementing a Broadcast Service – Multicast in Groups – Distributed Shared Memory – Linearizable – Sequentially Consistent Shared Memory – Algorithms.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Model the parallel and distributed computing architectures for any given problem.
2.	Construct the problem solving (analysis, design, and development) skills to distributed applications.
3.	Propose the applications by incorporating parallel and distributed computing architectures.
4.	Modify the applications by incorporating fault tolerance.

5.	Translate the sequential algorithm to a parallel one.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1		1									1	3	
CO2	2	2		1										3	
CO3	2	2												3	
CO4	2	1			2									3	
CO5	2	1			1								1	3	

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, "Introduction to Parallel Computing", Second Edition, Pearson Education, 2009.
2. Haggit Attiya and Jennifer Welch, "Distributed Computing – Fundamentals, Simulations and Advanced Topics", Second Edition, Wiley, 2012.

REFERENCES:

1. *Michael Quinn, "Parallel Computing - Theory and Practice", Second Edition, Tata McGraw Hill, 2002.*
2. *Wan Fokkink, "Distributed Algorithms: An Intuitive Approach", MIT Press, 2013.*
3. *M.L. Liu, "Distributed Computing - Principles and Applications", First Edition, Pearson Education, 2011.*
4. *Norman Matloff, "Parallel Computing for Data Science With Examples in R, C++ and CUDA", Chapman and Hall/CRC, 2015.*
5. *David B. Kirk and Wen-mei W. Hwu, Programming Massively Parallel Processors - A Hands-on Approach , MK. 2nd edition, 2014.*

18SPE026	ESSENTIALS OF PYTHON PROGRAMMING	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To know the basics of algorithmic problem solving and learn to read and write simple Python programs.
- To develop Python programs with conditionals and loops, functions and call them.
- To use Python data structures –- lists, tuples, dictionaries, input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

UNIT II 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 III 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 IV 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 V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Develop algorithmic solutions to simple computational problems.
2.	Execute the hand simple Python programs.
3.	Build simple Python programs for solving problems.
4.	Divide the Python program into functions.
5.	Recommend the compound data using Python lists, tuples, and dictionaries.

COURSE ARTICULATION MATRIX:															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1		3							3	3		
CO2	3	1	1		3							3	3		
CO3	3	1	1		3							3	3		
CO4	3	2	1		3							3	3		
CO5	3	2	1		3							3	3		
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/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. *Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.*
2. *Dr.A.Kannan, Dr.L.Sairamesh, "Problem Solving and Python programming", United Global Publishers Pvt. Ltd., 2017.*
3. *Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.*
4. *Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.*
5. *Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.*

18SPE027	GRAPH THEORY AND ITS APPLICATIONS	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To understand fundamentals of graph theory and proof techniques related to various concepts in graphs.
- To explore modern applications of graph theory and basic concepts on matrix representation.
- To get hands on shortest path and fundamental circuit.

UNIT I INTRODUCTION TO GRAPH THEORY 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&CONNECTIVITY 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 REPRESENTATION OF GRAPHS 9

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

UNIT IV MATRICES,COLOURING&PARTIONING 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 GRAPH ALGORITHMS &CIRCUITS 9

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

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Summarize the basic concepts of graphs, and different types of graphs
2. Rephrase the properties, theorems and be able to prove theorems.
3. Apply the suitable graph model and algorithm for solving applications.
4. Implement the different matrices.
5. Discover the shortest paths and fundamental circuits.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2										3		
CO2	2	3	1										3		
CO3	2	3	1										3	2	
CO4	2	3	1										1	2	
CO5	2	3	1										1	2	

(1-Low, 2- Moderate, 3-High)	
TEXT BOOKS:	
1.	Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Third Edition,Prentice-Hall of India Pvt.Ltd, 2003.
2.	L.R.Foulds , "Graph Theory Applications", Fourth Edition, Springer ,2016.
REFERENCES:	
1.	*West, D. B., "Introduction to Graph Theory", Second Edition, Pearson Education, 2011.*
2.	*Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication, Third Edition, 2008.*
3.	*Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill , 2007.*
4.	*Diestel, R, "Graph Theory", Springer,3rd Edition,2006.*
5.	*John Clark, Derek Allan Holton, ―A First Look at Graph Theory‖, World Scientific Publishing Company, 1991.*

18SPE028	FUNDAMENTALS OF SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of discrete time signals, systems and their classifications, the discrete time signals in both time and frequency domain.
- To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using fourier method, window technique and concept and usage of DSP in various engineering fields.

UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 9

Introduction to DSP – Basic elements of DSP– Sampling of Continuous time signals– Representation, Operation and Classification of Discrete Time Signal–Classification of Discrete Time Systems– Discrete Convolution: Linear and Circular–Correlation.

UNIT II ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS 9

Analysis of LTI Discrete Time Systems using DFT–Properties of DFT–Inverse DFT– Analysis of LTI Discrete Time Systems using FFT Algorithms– Inverse DFT using FFT Algorithm.

UNIT III INFINITE IMPULSE RESPONSE FILTERS 9

Frequency response of Analog and Digital IIR filters–Realization of IIR filter–Design of analog low pass filter–Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method–Design of digital IIR filters (LPF, HPF, BPF, and BRF) using various transformation techniques.

UNIT IV FINITE IMPULSE RESPONSE FILTERS 9

Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRF) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.

UNIT V APPLICATIONS OF DSP 9

Multirate Signal Processing: Decimation, Interpolation, Spectrum of the sampled signal – Processing of Audio and Radar signal.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Construct mathematical operations on signals.
2. Understand the sampling theorem and perform sampling on continuous-time sig als to get discrete time signal by applying advanced knowledge of the sampling theory
3. Translate the time domain signal into frequency domain signal and vice-versa
4. Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.
5. Analyze the applications and sampled signals.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											1	2	
CO2	2	2											1	3	

CO3	2	3											1	3	
CO4	2	3											1	3	
CO5	2	3											2	3	
(1-Low, 2- Moderate, 3-High)															

TEXT BOOKS:	
1.	John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.
2.	Emmanuel C.Ifeachor, & Barrie.W.Jervis, *—Digital Signal Processing*‖, Second Edition, Pearson Education / Prentice Hall, 2002.

REFERENCES:	
1.	*Richard G. Lyons, "Understanding Digital Signal Processing" Second Edition, Pearson Education.*
2.	*A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.*
3.	*William D. Stanley, —Digital Signal Processing‖, Second Edition, Reston Publications.*
4.	*SanjitK.Mitra, —Digital Signal Processing A Computer - Based Approach‖, Second Edition, Tata McGraw-Hill, 2001.*
5.	*JohnyR.Johnson, —Introduction to Digital Signal Processing‖, Prentice Hall of India/Pearson Education, 2002.*

18SPE029	ADVANCED DATASTRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand and evaluate the various implementations of dictionaries and skip lists and their probabilistic analysis.
- Evaluate the various hashing techniques and search data structures.
- Experiment string matching algorithms and algorithms for simple geometrical problems.

UNIT I	INTRODUCTION	8

Algorithm analysis – Best, Worst and Average cases, Aysmptotic Analysis – Upper bounds, Lower bounds, Theta notation - Analyzing problems - Space bounds – Analysis techniques – Summation Techniques, Recurrence relations – Substitution method, Recursion tree method, Master method, Amortized analysis – Aggregate analysis, Accounting method, Potential method, Dynamic tables - Probabilistic analysis and randomized algorithms.

UNIT II	SORTING AND ORDER STATISTICS	9

Average case analysis of Quicksort, Randomized version of Quicksort and its analysis - Sorting in Linear time – Lower bounds for sorting, counting sort, radix sort, bucket sort – External sorting - Medians and Order Statistics – minimum and maximum, selection in expected linear time and worst case linear time.

UNIT III	HEAPS, SETS & SEARCH TREES	10

Min max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – decreasing a key and deleting a node, bounding the maximum degree - Disjoint sets – Dynamic set operations – Analysis of union by rank with path compression - Van Emde Boas Trees – AVL Trees – Red black trees – Splay trees.

UNIT IV	GRAPHS, STRING MATCHING	9

All Pairs Shortest paths – shortest paths and matrix multiplication, Floyd Warshall algorithm, Johnson's algorithm for sparse graphs - Maximum Flow – Flow networks, Ford-Fulkerson method, Maximum bipartite matching - String matching – Rabin Karp algorithm, Knuth-Morris-Pratt algorithm.

UNIT V	SELECTED TOPICS	9

Multithreaded algorithms – Dynamic multithreading, multithreaded matrix multiplication, multithreaded merge sort – Number Theoretic algorithms – Greatest common divisor, Solving modular linear equations, Chinese remainder theorem, Primality testing, Integer factorization – Computational geometry – Finding convex hull and closest pair of points – NP Completeness and reducibility – Approximation algorithms – vertex cover problem, traveling salesman, subset sum problem.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Utilize the dictionaries and dictionary abstract data type.
2.	Illustrate the implementation of symbol table using hashing techniques.
3.	Develop and analyzing algorithms for red-black trees, B-trees and Splay trees.
4.	Create the algorithms for text processing applications.
5.	Identify the suitable data structures .

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
CO 1	3	3	1										3	3	2
CO 2	3	3	2										3	3	1
CO 3	3	3	1										3	3	2
CO 4	3	3	2	2									3	3	1
CO 5	3	3	2	2									3	3	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, Massachusetts, 2010.
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson, 2004.

REFERENCES:

1.	*Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2011.*
2.	*Dinesh P. Mehta, Sartaj Sahni "Handbook of Data Structures and Applications, Chapman & Hall/CRC 2005" Chapman & Hall/CRC, 2005.*
3.	*Salaria R S, "Data Structures and Algorithms using C", Fifth Edition, Khanna Book Publishing, New Delhi, 2012.*
4.	*Jean Paul Tremblay and Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill Publishing Company, New Delhi, 2012.*
5.	*Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 2011.*

18SPE030	OPERATIONS RESEARCH	L	T	P	C
		2	1	0	3

OBJECTIVES:

- Be familiar with resource management techniques
- Learn to solve problems in linear programming and Integer programming
- Be exposed to CPM and PERT

UNIT I	LINEAR PROGRAMMING	9

Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis.

UNIT II	DUALITY AND NETWORKS	9

Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and assignment model - Shortest route problem.

UNIT III	INTEGER PROGRAMMING	9

Cutting plane algorithm – Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV	CLASSICAL OPTIMIZATION THEORY	9

Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

UNIT V	OBJECT SCHEDULING	9

Network diagram representation – Critical path method – Time charts and resource leveling – PERT.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Solvethe optimization problems using simplex method.
2. Originate the transportation and assignment problems.
3. Apply the integer programming and linear programming to solve real-life applications.
4. Discuss classical optimization theory.
5. Make use of PERT and CPM for problems in project management.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3			1								3		1
CO2	2	3			1								3		1
CO3	2	3	1		1								3		1
CO4	2	3	1		1								3		1
CO5	2	3	1		1								3		1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:	
1.	H.A. Taha, "Operations Research", 10th Edition, Pearson Education, India, 2017.
2.	Paneer Selvam, "Operations Research", 2nd Edition, Prentice Hall of India, 2004.

REFERENCES:	
1.	*Vohra, "Quantitative Techniques in Management", 5th Edition, Tata Mc-Graw Hill Education, New Delhi, 2017*
2.	*Anderson D.A, et.al, "Quantitative Methods for Business", 13th Edition, Cengage Learning, 2015.*
3.	*Wayne Winston, "Operation Research", 4th Edition, Thomson Learning, 2003.*
4.	*A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2005.*
5.	*Anand Sarma, "Operation Research", Himalaya Publishing House, 2010.*

OPEN ELECTIVES

18SOE001	PROGRAMMING IN C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understanding the principles of object oriented programming and object oriented way of problem solving.
- To gain familiarity with the syntax, class hierarchy, environment.
  .
- Learn application construction for an object-oriented programming language

UNIT I	INTRODUCTION TO FUNDAMENTAL CONCEPTS OF OOP	8

Survey of programming paradigms – Object-Oriented Paradigm: Elements of Object Oriented Programming – Merits and demerits of object oriented methodology. Benefits of object oriented programming - structure of C++ program– Static members, Working with classes, Classes and Objects-Class specification- class objects accessing class members- defining member functions - Passing and returning objects – Array of objects - inline functions - accessing member functions within class.

UNIT II	OBJECT INITIALIZATION AND CLEANUP	10

Constructors - Parameterized constructors – Constructor overloading. Copy constructor, Destructors, Default arguments - new, delete operators - "this" pointer, friend classes and friend functions.

UNIT III	OVERLOADING AND GENERIC PROGRAMMING	9

Function overloading – Operator overloading- Non-over loadable operators- unary operator overloading- operator keyword- limitations of increment/decrement operators- binary operator overloading- Generic programming with templates-Function templates- class templates

UNIT IV	INHERITANCE	9

Inheritance-Base class and derived class relationship-derived class declaration-Forms of Inheritance- inheritance and member accessibility- constructors in derived class, abstract class, virtual functions, pure virtual function.

UNIT V	EXCEPTION HANDLING AND STREAMS	9

Files and Streams-Opening and Closing a file- file modes- file pointers and their manipulation, sequential access to a file-random access to a file-Reading and Writing – Exception handling.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Retrieve a full Object Oriented perspective for analyzing, defining, implementing and Evaluating real world problems.
2.	Analyze a problem, identifying and defining the computing requirements appropriate to its solution.
3.	Experiment with interpreted data.
4.	Make use of current techniques, skills and tools necessary for computing and Engineering practice.

5.	Utilize exception handling methods to solve error

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1								3	3	1
CO2	3	3	2	1									3	2	
CO3	3	3	3	2									3	2	
CO4	3	2	1										3	1	
CO5	3	3											3	1	

(L- Low, M- Moderate, H-High)

TEXT BOOKS:

1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C++", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2.	Yashavant P. Kanetkar. "Let Us C++", BPB Publications, 2011.

REFERENCES:

1.	*Byron S Gottfried, "Programming with C++", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.*
2.	*Kernighan,B.W and Ritchie,D.M, "The C++ Programming language", Second Edition, Pearson Education, 2006.*
3.	*Bjarne Stroustrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2007.*
4.	*B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.*
5.	*Michael T Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++",7th Edition, Wiley Publishers, 2004.*

18SOE002	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Have the ability to write a computer program to solve specified problems and able to use the Java SDK environment to create, debug and run simple Java programs.

UNIT I OVERVIEW OF JAVA LANGUAGE **8**

Introduction – Simple Java Program – Comments – Java Program Structure – Tokens – Java Statements – Implementing a Java Program – JVM – Command Line Arguments. Constants – Variables – Data Types – Type Casting.

UNIT II OPERATORS AND EXPRESSIONS **10**

Arithmetic Operators – Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Special Operators – Arithmetic expressions, Evaluation of expression – Precedence of Arithmetic Operators – Type Conversions – Operator Precedence and associativity – Mathematical Functions. Decision Making and Branching: If – if…..else – Nesting of if……. Else – else if – switch - ? : Operator. Decision Making and Looping:
While – do – for – jump in loops – labelled loops.

UNIT III CLASSES-OBJECTS AND METHODS **9**

Defining a class – Adding variables, methods – Creating objects – Accessing Class Members– Constructors – Methods overloading – static members – Nesting of Methods – Inheritance – Overriding methods – final Variables and methods – Final classes – finalizer methods – Abstract methods and classes – visibility control. Arrays, Strings and Vectors: Arrays – One Dimensional Arrays – Creating an array – Two Dimensional Arrays – Strings – Vectors – Wrapper Classes Interfaces: Multiple Inheritance Defining interfaces – Extending interfaces – implementing interfaces – Accessing interface variables.

UNIT IV PACKAGES **9**

Java API Packages – Using system packages – Naming conventions – Creating Packages – Accessing a Package – Using a Package – Adding a Class to a Package – hiding classes. Multithreaded Programming: Creating Threads – Extending the Thread Class – Stopping and Blocking a Thread – Life Cycle of a Thread – Using Thread methods – Thread Exceptions – Thread Priority – Synchronization – Implementing the ‘Runnable’ Interface

UNIT V APPLET PROGRAMMING **9**

How applets differ from Applications – preparing to write applets – Building Applet Code – Applet life cycle – creating an Executable Applet – Designing a Web Page – Applet Tag – Adding Applet to HTML file – Running the Applet – Passing parameters to Applets – Displaying Numerical values – Getting input from the user.

TOTAL : 45 PERIODS

OUTCOMES:	On completion of this course, students will be able to
1.	Recognize the knowledge of the structure and model of the Java programming language.
2.	Make use of the Java programming language for various programming technologies.
3.	Develop software in the Java programming language
4.	Remember knowledge of programming and knowledge of Operating systems.
5.	Create Packages for implementing more functions.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1								3	3	1
CO2	3	2	2	1	1								3	2	1
CO3	3	2	3	2	1								3	2	
CO4	2	2	1	1										1	
CO5	2	3	1											1	
CO6	2	3	2	2	1									2	1

(L- Low, M- Moderate, H-High)

TEXT BOOKS:	
1.	Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eleventh Edition, Sun Microsystems Press, 2018.
2.	Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2011.

REFERENCES:	
1.	*Ken Arnold, James Gosling, David Holmes, "The JAVA programming language", Third edition, Pearson Education, 2005.*
2.	*Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.*
3.	*C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.*
4.	*Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers‖, 3rd Edition, Pearson, 2015.*
5.	*Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2011.*

18SOE003	DATABASE CONCEPTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of data models and to represent database system using ER diagrams, SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.

UNIT I	INTRODUCTION TO DATABASES	9

Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Types of Database Models, Relational Databases, Database Design, Database Architecture, Database Users and Administrators

UNIT II	DATABASE DESIGN & RELATIONAL MODEL	9

Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams and it's design issues - Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Algebra and its Operations – ER to Relational mapping

UNIT III	STRUCTURED QUERY LANGUAGE	9

Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas.

UNIT IV	PL/SQL	9

Basic Concepts, Types, Control Structures, Expressions and Operators, SQL within PL/SQL, Built-in SQL Functions, Cursors, Error Handling, Collections, Procedures, Functions, and Triggers

UNIT V	ADVANCED TOPICS	9

Indexing – Basics of Transactions - Concurrency control – 2PL, Dealing with deadlocks – Log based recovery mechanisms – RAID – Spatial and temporal databases – Information retrieval – Distributed databases – Big data applications.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Solve societal problems by identifying, describing and analyzing requirements of the system
2.	Apply database concepts to design and develop the databases and database objects of the systems
3.	Understand database server and client systems
4.	Implement database systems
5.	List the Big data applications.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PS O 1	PS O 2	PS O 3
CO1	3	3		1									3	3	
CO2	3	3		1		1							3	2	1
CO3	3	3		2		1							3	2	1
CO4	3	3		3									3	1	
CO5	3	3		3	2	2					1		3	2	2

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Silberschatz, Korth and Sudarshan,, "Database System Concepts", Seventh Edition McGraw Hill, 2010
2. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems‖, Sixth Edition, Pearson Education, 2011.

REFERENCES:

1. *C.J date," An introduction to database systems", Second Edition, Addison Welsley.2000*
2. *George Koch & Kevin Loney, "Oracle 9i Complete reference", Third Edition, McGraw Hill, 2005.*
3. *Scott Urman, "Oracle 9i: PL/SQL Programming", Third Edition, Oracle press 2007.*
4. *Raghu Ramakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.*
5. *G.K.Gupta,"Database Management Systems‖, Tata McGraw Hill, 2011.*

18SOE004	WEB DESIGNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Acquire knowledge and Skills of Adobe Photoshop and create Web pages using HTML.
- To learn the characteristics of Adobe Dreamweaver, JavaScript, AJAX and ADOBE Flash
- To be familiarized with Web Hosting and SEO Concepts

UNIT I ADOBE PHOTOSHOP 9

Stock photography – Types of Image Graphics – Vector graphics and tools – Scalar graphics and tools – Adobe photoshop – interface tour – color modes and resolution options – file types – layers, grouping and smart objects – image adjustments – layer masking – layer clipping – blending options – analysis, view and window menu – filter effects – actions – animation – applications - brochure designing, create business card, design banners for website – real time website layout design

UNIT II HTML 9

Markup language – Structure of HTML page – Structure tags – Table, Div, Frames – Content/ Media tags – header, paragraph, span, anchor links, image hotspots, object tag – Working with frames – POST and GET – File upload and hidden fields – Creating a live website form – XHTML – Doc types, Validation – HTML5 – Media tags – Cascading style sheets – CSS Selectors, Properties – Custom form design

UNIT III ADOBE DREAMWEAVER 9

Basics – types of views – defining dreamweaver site – Toolbars – Standard, Common, Layout – Text tags – Spry elements – Forms – form validations – FTP Client – Extensions – Template design – Importing a website design – compatibility issues.

UNIT IV JAVASCRIPT, AJAX & ADOBE FLASH 9

Client side scripting – Variables and operators in JS – Conditions statements – Loops – Popup boxes – JS Events – Arrays – Objects – Functions – Using JS in realtime – Ajax concepts. Introduction to animation – Tools in adobe flash – shape tween and motion tween – frame animation – flash effects – flash banners – Creating flash website – Basics of action scripting

UNIT V Web Hosting & SEO Concepts 9

Basics – types of hosting packages – registering domains – defining name servers – using control panel – creating emails in Cpanel – Using FTP Client – Maintaining a website – SEO Concepts – Importance of SEO - Onpage optimization basics – Ajax Libraries, Basics of JQuery, Jquery scripts.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Improve the knowledge in Photography.
2.	Create and designing the website using HTML language.
3.	Infer the layout, spry elements, form validation in website.
4.	Build the website using client side scripting languages.
5.	Understand the hosting and its packages.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3			1								3		1
CO2	2	3			1								3		1
CO3	2	3	1		1								3		1
CO4	2	3	1		1								2		1
CO5	2	3	1		1								2		1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1.	Themas A. Powell, "The Complete Reference–Web Design", Tata McGraw Hill, Third Edition, 2003.
2.	Deke Mc Clelland, "Photoshop 7 Bible‖, Professional Edition", Wiley John and Son Inc., 2000.

REFERENCES:

1.	*H.M. Deitel, P.J. Deitel, A.B. Goldberg, "Internet and World Wide Web – How to Program", Third Edition, Pearson Education, 2004.*
2.	*Curtis Hillman, "Flash Web Design", First Edition, New Riders Publishing, 2000*
3.	*Van Duyne, Landay and Hong, "The Design of Sites: Patterns for Creating Winning Websites", Second Edition, Prentice Hall, 2006.*
4.	*John Duckett, "Beginning HTML, XHTML, CSS, and JavaScript", Wiley India, 2010.*
5.	*Steven M. Schafer, "HTML, XHTML, and CSS Bible", 5th edition, Wiley India, 2010.*

18SOE005	ANDROID APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand how to work with various mobile application development frameworks.
- Learn how UI for mobile application development is done for Android and tools used in android application development
- Learn the basic and important design concepts and issues of development of mobile applications and the process of android application development

UNIT I INTRODUCTION **9**

Mobile Applications – Characteristics and Benefits – Frameworks and Tools – Introduction to Java – Classes and Objects – Inheritance – Packages and Interfaces – Strings – I/O – Event handling.

UNIT II USER INTERFACE **9**

Generic UI Development – Multimodal and Multichannel UI – Designing the right UI– Introduction to XML –XML basics – Attributes – DTD - XML schema – Screen Elements and Layouts.

UNIT III TOOLS **9**

Google Android Platform – Android Application Architecture – Android Studio – Android Widgets and Menus – Event handling – Packaging and Deployment - Apple iPhone Platform.

UNIT IV APPLICATION DESIGN **9**

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Intents and Services – Fragments – Graphics – Animation.

UNIT V APPLICATION DEVELOPMENT **9**

Storing and Retrieving data – Communication via the Web – Notification and Alarms – Telephony – Location based services – Apps with Firebase Real Time Database – Project on respective Discipline.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Design and implementing the user interfaces for mobile applications.
2. Develop the mobile applications that are aware of the resource constraints of mobile devices.
3. Create advanced mobile applications that access the databases and the web.
4. Compose useful mobile applications in the current scenario using Google Android Studio.
5. Remember the knowledge of java.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	3	3			2	1				3		3	2	1
CO2	3	3	3	2		1	2				3		3	2	2
CO3	3	1	3			2	1				3		3	1	1
CO4	3	2					2						3	2	2
CO5	3	2					1						3	2	1

(1-Low, 2- Moderate, 3-High)

TEXT BOOKS:

1. Jeff Friesen, "Learn Java for Android Development: Java 8 and Android", Fifth Edition Paperback, 2014.
2. Share Conder, Lauren Darcey, "Android Wireless Application Development", Third Edition, Pearson,2009.

REFERENCES:

1. *Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, Third Edition,"Programming Android", O"Reilly, 2011.*
2. *Jeff Mcherter, Scott Gowell, "Professional mobile Application Development", paperback, , Wiley India Private Limited, 2012*
3. *Reto Meier, Wrox Wiley, "Professional Android 2 Application Development", second Edition, 2010.*
4. *Alasdair Allan, "iPhone Programming", Third Edition, O"Reilly, 2010.*
5. *Michael Gregg, " Build Your Own Security Lab", Wiley India Private Limited, 2012*

18SOE006	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make students understand the basic structure and operation of digital computer and hardware-software interface
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations and hierarchical memory system including cache memories and virtual memory
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

UNIT I	OVERVIEW & INSTRUCTIONS	9

Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.

UNIT II	ARITHMETIC OPERATIONS	7

ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

UNIT III	PROCESSOR AND CONTROL UNIT	11

Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

UNIT IV	PARALLELISM	9

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors

UNIT V	MEMORY AND I/O SYSTEMS	9

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Design arithmetic and logic unit.
2. Analyze pipelined control units.
3. Evaluate performance of memory systems.
4. Understand parallel processing architectures.
5. Recognize the memory technologies and hierarchy.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1									3	1	3
CO2	3	2	1	1									3	1	

CO3	3	2	1	1									3	1	
CO4	3	3	2	2									3	2	
CO5	3	3	2	1		1						1	3	2	
(1-Low, 2- Moderate, 3-High)															

TEXT BOOKS:	
1.	David A. Patterson and John L. Hennessey, "Computer organization and design", Fifth edition, Morgan Kauffman / Elsevier , 2014.
2.	*V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", Sixth edition, Mc Graw-Hill Inc, 2012*

REFERENCES:	
1.	*M. Morris Mano "Computer System Architecture", Third Edition, Pearson Education, 2017.*
2.	*William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education, 2006.*
3.	*Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005*
4.	*Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005*
5.	*John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.*

18SOE007	FUNDAMENTAL OF COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks.
- Be exposed to the required functionality at each layer and flow control and congestion control algorithms.

UNIT I FUNDAMENTALS & LINK LAYER **8**

Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance ; Link layer Services – Framing – Error Detection – Flow control.

UNIT II MEDIA ACCESS & INTERNETWORKING **10**

Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP).

UNIT III ROUTING **9**

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM).

UNIT IV TRANSPORT LAYER **9**

Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DEC bit, RED) – QoS – Application requirements

UNIT V APPLICATION LAYER **9**

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Identify the components required to build different types of networks.
2. Select the required functionality at each layer for given application.
3. Measure solution for each functionality at each layer.
4. Match the flow of information from one node to another node in the network.
5. Support traditional applications.

COURSE ARTICULATION MATRIX:

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

(L- Low, M- Moderate, H-High)

TEXT BOOKS:

1.	Larry L. Peterson, Bruce S. Davie, "Computer Networks: A systems approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
2.	Andrew S Tanenbaum and David J Wetherall, "Computer Networks", Prentice Hall of India/ Pearson Education, New Delhi, Fifth Edition, 2012.

REFERENCES:

1.	*James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.*
2.	*Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.*
3.	*Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.*
4.	*William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.*
5.	*Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.*

18SOE008	LINUX AND RTOS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the concepts linux Kernel and RTOS concept
- Use cases for tasks, semaphores, queues, event flags and timers
- Design concepts needed to build an embedded system using RTOS.

UNIT I	INTRODUCTION	9

Basic Operating System Concepts-Linux as Embedded Operating System-Comparison of Embedded OS Embedded OS Tools and Development-Discussion on Embedded OS Applications and Products

UNIT II	SYSTEM ARCHITECTURE OF A BASIC OS	9

Internals of Linux OS-System Calls, Linux Compiler options, MakeProcess, Multithreading and Synchronization, Serial port and Network programming with Embedded Linux Kernel module programming and Device drivers.

UNIT III	INTER PROCESS COMMUNICATION	9

Pipe and FIFOs, Shared memory, Sockets, Getting Linux on a device-Linux boot sequence, Building Kernel, Building Boot image

UNIT IV	EMBEDDED RTOS-INTRODUCTION	9

Embedded Software – Real-time Vs Non Real-time-Introduction to Real-time systems and Embedded Real-time Systems-Discussion of popular RTOS-Comparison of Embedded RTOSs , Design Goals for Real-time software-Discussion on Embedded Real-time applications, Considerations for real-time programming.

UNIT V	SYSTEM ARCHITECTURE OF RTLINUX	9

Introduction RTLinux-Thread Creation and Management- Thread Synchronization Mechanisms IPC – RTFIFO, Shared Memory-Interrupt Handling

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Identify Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.
2.	Make use of the UNIX/Linux system to accomplish typical personal, office, technical, and software development tasks. Monitor system performance and network activities.
3.	Utilize software development tools including libraries, preprocessors, compilers, linkers, and make files.
4.	Understand technical documentation, prepare simple readable user documentation and adhere to style guidelines .Collaborate in teams on system tasks.
5.	Build an embedded system using RTOS.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1 0	PO 1 1	PO 1 2	PS O 1	PS O 2	PS O 3
CO1	3	1	2								3		3	1	2

CO2	3	1	2								3		3	2	2
CO3	3	1	2								3		3		
CO4	3	1	3								3		2	1	2
CO5	3		3								3		2	1	2
(L- Low, M- Moderate, H-High)															

TEXT BOOKS:

1.	M. Tim Jones, "GNU/ Linux Application programming", Second edition, Cengage Learning, 2008
2.	Craig Hollabaugh, "Embedded Linux: Hardware, Software, and Interfacing", Addison Wesley , 2002

REFERENCES:

1.	*Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, Philippe Gerum, "Building Embedded Linux Systems: Concepts, techniques, tricks and traps", Second Edition, O'Reilly Media, 2008.*
2.	*David E. Simon, "An Embedded Software Primer", Pearson Education, 2002*
3.	*Michael Beck, Harald Bohme, Mirko Dziadzka, Ulrich Kunitz, Robert Magnus, Dirk Verworner, "Linux Kernel Internals", Second Edition, Addison Wesley, 1998*
4.	*Raj Kamal, "Embedded Systems: Architecture Programming and Design", Tata McGraw Hill Education, 2003*
5.	*K.V.K. Prasad, "Embedded / Real-Time Systems: Concepts, Design and Programming", Dreamtech Press, 2003.*

18SOE009	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the basics of algorithmic problem solving and simple Python programs.
- To develop Python programs with conditionals and loops, functions and call them.
- To use Python data structures –- lists, tuples, dictionaries, input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

UNIT II 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 III 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 IV 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 V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1.	Develop algorithmic solutions to simple computational problems.
2.	Solve operations on hand simple Python programs.
3.	Examine simple Python programs for solving problems.
4.	Modify a Python program into functions.

5.	Recommend compound data using Python lists, tuples, and dictionaries.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		3							3	3		
CO2	3		1		3							3	3		
CO3	3	3	1		3							3	3		
CO4	3	2	1		3							3	3		
CO5	3	2	1		3							3	3		

(L- Low, M- Moderate, H-High)

TEXT BOOKS:

1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/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.
3.	

REFERENCES:

1.	*Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.*
2.	*Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.*
3.	*Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.*
4.	*Dr.A.Kannan, Dr.L.Sairamesh, "Problem Solving and Python programming", Third Edition,United Global Publishers Pvt. Ltd., 2017.*
5.	*Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.*

18SOE010	DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Gaining factual knowledge (terminology, classifications, methods, trends)
- Learning fundamental principles, generalizations, or theories
- Learning to apply course material (to improve thinking, problem solving, and Decisions) and data collection, cleansing, and analytics.

UNIT I INTRODUCTION **8**

What is big data – Why big data matters – Big data and the Business case – Building the big data team – Big data sources – The Nuts and Bolts of big data – Security, compliance, auditing and protection- Evolution of big data – Best practices – Big data pipeline in depth – Big data visualization and privacy.

UNIT II PREDICTIVE ANALYTICS **10**

Data Collection - Sampling - Pre-processing - Linear Regression - Logistic Regression - Decision Trees - Neural Networks - Support Vector Machines - Ensemble Methods - Multiclass Classification Techniques - Evaluating Predictive Models.

UNIT III DESCRIPTIVE AND SURVIVAL ANALYTICS **9**

Association Rules - Sequence Rules - Segmentation - Survival Analysis Measurements - Kaplan Meier Analysis - Parametric Survival Analysis - Proportional Hazards Regression - Extensions of Survival Analysis Models - Evaluating Survival Analysis Models.

UNIT IV FRAMEWORK & TOOLS **9**

Statistically analyze and explore data using R - Map Reduce using Hadoop - Predict using RHadoop - Predict using Apache Mahout - Data visualization and optimization in R.

UNIT V APPLICATIONS **9**

Credit Risk Modelling – Fraud detection – Net Lift response modelling – Churn prediction – Recommender systems – Web analytics – Social media analytics – Business process analytics

TOTAL : 45 PERIODS

OUTCOMES: On completion of this course, students will be able to

1. Organize the components required to build different types of networks
2. Choose the required functionality at each layer for given application
3. Identify solution for each functionality at each layer
4. Examine the flow of information from one node to another node in the network
5. Understand the applications of data analytics.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										3	2	2
CO2	3	2	2										2	2	1
CO3	3	3	3										3		1
CO4	3	3	3										2		1
CO5	2	3	3										3	3	1

(L- Low, M- Moderate, H-High)

TEXT BOOKS:	
1.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Third Edition, Wiley, USA, 2014.
2.	Ohlhorst and Frank J, "Big Data Analytics: Turning Big Data into Big Money", Third Edition,Wiley, USA, 2012.
REFERENCES:	
1.	*Michael Minelli, Michele Chambers and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", John Wiley and Sons, New Delhi, 2013.*
2.	*Thomas A Runkler, "Data Analytics - Models and Algorithms for Intelligent Data Analysis, Springer Verlag", Germany, 2012.*
3.	*Sarah Stowell, "Instant R: An Introduction to R for Statistical Analysis", Jotunheim Publishing, Norway, 2012.*
4.	*Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.*
5.	*Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets" ,Cambridge University Press, 2012.*