B.E COMPUTER SCIENCE AND ENGINEERING

SEMESTER I

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16EN001	Communication skills	2/0/2	4	3	40/60	HS
2	16MA101	Linear Algebra, Calculus and its Applications	3/2/0	5	4	60/40	BS
3	16CH003	Environmental Science	3/0/0	3	3	60/40	HS
4	16CS201	Problem Solving Techniques and C Programming	3/0/2	5	4	40/60	ES
5	16CS301	Computer Science Essentials	3/0/0	3	3	60/40	PC
6	16CH105	Engineering Chemistry	3/0/2	5	4	40/60	BS
7	16ME204	Engineering Practices Laboratory	0/0/3	3	2	40/60	ES
			Total	28	23		

SEMESTER II

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16EN002	Technical Communication Skills	2/0/2	4	3	40/60	HS
2	16MA102	Integral Calculus and Laplace Transform	3/2/0	5	4	60/40	BS
3	16PH101	Engineering Physics	3/0/2	5	4	40/60	BS
4	16CS202	Linux and Advanced C Programming	3/0/2	5	4	40/60	ES
5	16CS302	Computer Science Essentials – II	3/0/0	4	3	60/40	PC
6	16ME205	Engineering Graphics Laboratory	0/0/3	3	2	40/60	ES
			Total	26	20		

SEMESTER III

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16MA105	Discrete Structures	3/2/0	5	4	60/40	BS
2	16CS303	Operating Systems	3/0/0	3	3	60/40	PC
3	16CS304	Data Structures	3/0/3	6	5	40/60	PC
4	16CS205	Digital Principles and Systems Design	3/0/3	6	4	40/60	ES
5	16CS206	Object Oriented Programming using Java	3/0/0	3	3	60/40	ES
6	16CS305	Operating Systems Laboratory	0/0/3	3	2	40/60	PC
7	16CS207	Java Programming Laboratory	0/0/3	3	2	40/60	ES
8	16CS7XX	Mandatory Course-I	2/0/0	2	1	0/100	MC
			Total	31	24		

SEMESTER IV

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16MA110	Probability and Statistics	3/2/0	5	4	60/40	BS
2	16CS306	Fundamentals of Open Source Software	3/0/3	6	5	40/60	PC
3	16CS307	Database Management Systems	3/0/0	3	3	60/40	PC
4	16CS308	Computer Architecture	3/0/0	4	3	60/40	PC
5	16CS309	Design and Analysis of algorithms	3/0/0	4	3	60/40	PC
6	16CS310	Database Management Systems Laboratory	0/0/3	3	2	40/60	PC
7	16CS311	Algorithms Laboratory	0/0/3	3	2	40/60	PC
8	16CS601	Mini Project-I	-	-	2	40/60	PW
9	16CS7XX	Mandatory Course-II	2/0/0	2	1	0/100	MC
			Total	**30**	**25**		

SEMESTER V

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16MA112	Fourier Series and Computational Methods	3/2/0	5	4	60/40	BS
2	16CS312	Theory of Computation	3/0/0	4	3	60/40	PC
3	16CS208	Microprocessors and Microcontrollers	3/0/0	3	3	60/40	ES
4	16CS313	Computer Networks	3/0/0	3	3	60/40	PC
5	16CS314	Artificial Intelligence	3/0/3	6	4	40/60	PC
6	16CS4XX	Professional Elective-I	3/0/0	3	3	60/40	PE
7	16CS209	Microprocessor Laboratory	0/0/3	3	2	40/60	ES
8	16CS315	Computer Networks Laboratory	0/0/3	3	2	40/60	PC
9	16CS7XX	Mandatory Course-III	2/0/0	2	1	0/100	MC
			Total	**32**	**25**		

SEMESTER VI

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16CS316	Compiler Design	3/0/0	4	3	60/40	PC
2	16CS317	Software Development	3/0/0	3	3	60/40	PC
3	16CS318	Data Analytics	3/0/0	4	3	60/40	PC
4	16CS319	Virtualization and Cloud	3/0/0	4	3	60/40	PC
5	16CS4XX	Professional Elective-II	3/0/0	3	3	60/40	PE
6	16XX50X	Open Elective	3/0/0	3	3	60/40	OE
7	16CS320	Compiler Design Laboratory	0/0/3	3	2	40/60	PC
8	16CS321	CASE tools Laboratory	0/0/3	3	2	40/60	PC
9	16CS322	Cloud and Data Analytics Laboratory	0/0/3	3	2	40/60	PC
10	16CS602	Mini Project-II	-	-	2	40/60	PW
11	16CS7XX	Mandatory Course-IV	2/0/0	2	1	0/100	MC

				Total	32	27		

SEMESTER VII							
S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16CS323	Internet of Things	3/0/0	3	3	60/40	PC
2	16CS324	Web Technology	3/0/0	3	3	60/40	PC
3	16CS4XX	Professional Elective-III	3/0/0	3	3	60/40	PE
4	16CS4XX	Professional Elective-IV	3/0/0	3	3	60/40	PE
5	16CS4XX	Professional Elective-V	3/0/0	3	3	60/40	PE
6	16CS4XX	Professional Elective-VI	3/0/0	3	3	60/40	PE
7	16CS325	Internet of Things (IoT) Laboratory	0/0/3	3	2	40/60	PC
8	16CS326	Web Technology Laboratory	0/0/3	3	2	40/60	PC
			Total	24	22		

SEMESTER VIII							
S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	16CS603	Project	0/0/24	24	12	40/60	PW
			Total	24	12		

HUMANITIES (9 credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	16EN001	Communication skills	2/0/2	4	3	HS
2.	16CH003	Environmental Science	3/0/0	3	3	HS
3.	16EN002	Technical Communication Skills	2/0/2	4	3	HS

BASIC SCIENCES (28 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	16MA101	Linear Algebra And Differential Calculus	3/2/0	5	4	BS
2.	16CH105	Engineering Chemistry	3/0/2	5	4	BS
3.	16MA102	Integral Calculus and Laplace Transform	3/2/0	5	4	BS
4.	16PH101	Engineering Physics	3/0/2	5	4	BS
5.	16MA105	Discrete Structures	3/2/0	5	4	BS
6.	16MA110	Probability and Statistics	3/2/0	5	4	BS
7.	16MA112	Fourier Series and Computational Methods	3/2/0	5	4	BS

ENGINEERING SCIENCES (26 Cre dits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	16CS201	Problem Solving Techniques and C Programming	3/0/2	5	4	ES
2.	16ME204	Engineering Practices Laboratory	0/0/3	3	2	ES
3.	16CS202	Linux and Advanced C Programming	3/0/2	5	4	ES
4.	16ME205	Engineering Graphics Laboratory	0/0/3	3	2	ES

5	16CS205	Digital Principles and Systems Design	3/0/3	6	4	ES
6.	16CS206	Object Oriented Programming using Java	3/0/0	3	3	ES
7.	16CS207	Java Programming Laboratory	0/0/3	3	2	ES
8.	16CS208	Microprocessors and Microcontrollers	3/0/0	3	3	ES
9.	16CS209	Microprocessor Laboratory	0/0/3	3	2	ES

PROFESSIONAL CORE (74 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	16CS301	Computer Science Essentials	3/0/0	4	3	PC
2.	16CS302	Computer Science Essentials – II	3/0/0	4	3	PC
3.	16CS303	Operating Systems	3/0/0	3	3	PC
4.	16CS304	Data Structures	3/0/3	6	5	PC
5.	16CS305	Operating Systems Laboratory	0/0/3	3	2	PC
6.	16CS306	Fundamentals of Open Source Software	3/0/3	6	5	PC
7.	16CS307	Database Management Systems	3/0/0	3	3	PC
8.	16CS308	Computer Architecture	3/0/0	4	3	PC
9.	16CS309	Design and Analysis of algorithms	3/0/0	4	3	PC
10.	16CS310	Database Management Systems Laboratory	0/0/3	3	2	PC
11.	16CS311	Algorithms Laboratory	0/0/3	3	2	PC
12.	16CS312	Theory of Computation	3/0/0	4	3	PC
13.	16CS313	Computer Networks	3/0/0	3	3	PC
14.	16CS314	Machine Learning	3/0/3	6	4	PC
15.	16CS315	Computer Networks Laboratory	0/0/3	3	2	PC
16.	16CS316	Compiler Design	3/0/0	4	3	PC
17.	16CS317	Software Development	3/0/0	3	3	PC
18.	16CS318	Data Analytics	3/0/0	4	3	PC
19.	16CS319	Cloud and Virtualization	3/0/0	4	3	PC
20.	16CS320	Compiler Design Laboratory	0/0/3	3	2	PC
21.	16CS321	CASE tools Laboratory	0/0/3	3	2	PC
22.	16CS322	Cloud and Big data Laboratory	0/0/3	3	2	PC
23.	16CS323	Internet of Things	3/0/0	3	3	PC
24.	16CS324	Web Technology	3/0/0	3	3	PC
25.	16CS325	Internet of Things (IoT) Laboratory	0/0/3	3	2	PC
26.	16CS326	Web Technology Laboratory	0/0/3	3	2	PC

ELECTIVE/AUDIT COURSES (18 + 3 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
PROFESSIONAL ELECTIVES						
Networking and Computing						
1.	16CS401	Wireless Networks	3/0/0	3	3	PE
2.	16CS402	Cryptography and Network Security	3/0/0	3	3	PE
3.	16CS403	Distributed Systems	3/0/0	3	3	PE
4.	16CS404	Mobile Application Development	3/0/0	3	3	PE
5.	16CS405	Mobile Computing	3/0/0	3	3	PE
6.	16CS406	Quantum Computing	3/0/0	3	3	PE
Programming Languages , Multimedia and Software Engineering						

1.	16CS407	Advanced Java Programming	3/0/0	3	3	PE
2.	16CS408	Python programming	3/0/0	3	3	PE
3.	16CS409	Computer Graphics and Multimedia	3/0/0	3	3	PE
4.	16CS410	Image Processing	3/0/0	3	3	PE
5.	16CS411	Open source web services	3/0/0	3	3	PE
6.	16CS412	Software Testing and Quality Assurance	3/0/0	3	3	PE
7.	16CS413	Building Enterprise Applications	3/0/0	3	3	PE
Intelligent Systems and latest trends						
1.	16CS414	Data Warehousing and Mining	3/0/0	3	3	PE
2.	16CS415	Design patterns and design thinking	3/0/0	3	3	PE
3.	16CS416	Data Science	3/0/0	3	3	PE
4.	16CS417	User Experience Design	3/0/0	3	3	PE
5.	16CS418	Machine Learning	3/0/0	3	3	PE
6.	16CS419	Game Theory and its Applications	3/0/0	3	3	PE
7.	16CS420	Business Intelligence	3/0/0	3	3	PE
8.	16CS421	Deep Learning	3/0/0	3	3	PE
OPEN ELECTIVES						
1.	16CS501	Internet Marketing and E-Commerce	3/0/0	3	3	OE
2.	16CS502	Green Computing	3/0/0	3	3	OE
3.	16CS503	Fundamentals of Database technologies	3/0/0	3	3	OE
4.	16CS504	Software Product Development and Management	3/0/0	3	3	OE
5.	16CS505	Java Fundamentals	3/0/0	3	3	OE

MANDATORY COURSES (4 credits)

S.No	Course Code	Course Title	Credit	Category
1.	16CS701	Life Skills and Ethics	1	MC
2.	16CS702	Quantitative aptitude and soft skills	1	MC
3.	16CS703	Foreign Language/Spoken Hindi	1	MC
4.	16CS704	MOOC Certification	1	MC

ONE CREDIT COURSES

S.No	Course Code	Course Title	Credits
1.	16CS801	SPSS	1
2.	16CS802	SQLite	1
3.	16CS803	Ruby on rails	1
4.	16CS804	CCNA	1
5.	16CS805	Angular JS	1
6.	16CS806	MATLAB Programming	1
7.	16CS807	Practical TCP/IP and Ethernet Networking for industry	1
8.	16CS808	Ethics in Cyber Security	1
9.	16CS809	Open source Testing	1
10.	16CS910	Hadoop	1
11.	16CS911	Robotics	1
12.	16CS912	Introduction to Operating Systems	1
13.	16CS913	Programming, data structures and algorithms using python	1
14.	16CS914	Introduction to Programming in C	1

15.	16CS915	Programming in C++	1
16.	16CS916	Social Networks	1
17.	16CS917	Introduction to Modern Application Development	1

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

S. No	Stream	Credits/Semester								Credits	%	AICTE Norms % (Min-Max)
		I	II	III	IV	V	VI	VII	VIII			
1.	Humanities (HS)	6	3							9	5	**5-10**
2.	Basic Sciences(BS)	8	8	4	4	4				28	15.56	**15-20**
3.	Engineering Sciences(ES)	6	6	9		5				26	14.44	**15-20**
4.	Professional Core(PC)	3	3	10	18	12	18	10		74	41.11	**30-40**
5.	Professional Electives(PE)					3	3	12		18	10	**10-15**
6.	Open Electives(OE)						3			3	1.67	**5-10**
7.	Project Work(PW)				2		2		12	16	8.89	**10-15**
8.	Industrial Practice (IP)									2	1.11	
9.	Mandatory Course (MC)			1	1	1	1			4	2.22	**-**
	Total	**23**	**20**	**24**	**25**	**25**	**27**	**22**	**12**	**180**	**100**	**176 Credits**

16EN001	COMMUNICATION SKILLS	2/0/2/3

Nature of Course: Theory

Pre Requisites: BEC Preliminary

Course Objectives

1. To equip the students with the LSRW skills
2. To develop communication skills and soft skills
3. To facilitate the students to use the Language in practical mode.
4. To prepare the students for all competitive program like BEC/ IELTS/ TOEFL.

COURSE OUTCOMES

Upon successful completion of the course, students shall have ability to

1. Gain comprehensive knowledge of LSRW Skills
2. Communicate effectively in Corporate Environment
3. Enhance fluency over language with self confidence
4. Use language with ease

Course Contents with Course Outcomes/Blooms Taxonomy/Assessment Methods

GENERAL INTRODUCTION: Getting to know people- Self introduction-Introducing others-Presenting about job - Presenting about working conditions- Presenting about company history and structure – Presenting about company activities-Instructions, Recommendations-Present simple, Adverb of frequency, Past Simple, Prepositions of time, Connectors of addition and contrast, Present Continuous, Parts of Speech, Gerunds and Infinitives. **WORD POWER :** Vocabulary practice- Business Vocabulary- Telephonic Conversation and Etiquette - Requests and obligation-Describing trends- Presenting about company performance- Reasons and consequences through reading practices- Describing products Dimensions, Process description - Presenting about product development - Synonyms-Antonyms-Jumbled sentences- Compare and contrast-Adjectives and adverbs, Present perfect and past simple, Reasons and Consequences, Comparatives and superlatives, Question formation, Sequencing words, Present continuous, Articles, Prepositions. **ESP / ENGLISH FOR ENGINEERS:** Presenting about business equipment- Letter Phrases- Writing Test Practice- Presenting about hotel facilities – Presenting about traffic and transport, Making Predictions-Report writing-Writing proposals. Tenses- Present-Past-Future-Forms of verbs, Prefixes-Suffixes, Word Techniques- Formation. **PRESENTATION SKILLS AND EVENT MANAGEMENT :** Presenting about conference arrangement- Presenting about a conference arrangement –Checking and confirming details-Presentation about a conference before, after, when, until, etc. Listening Test Practice-Presenting about production processes- Presenting about quality control-Itinerary- Paragraph Writing - Essay Writing- Check list Passive forms and If- Conditionals. **ENGLISH FOR CORPORATE :** Language use in call centers, insurance and changes in working practices(Future possibility/ Probability- Presenting about banking- Speaking Test Practice- Presenting about delivery services - Presenting about trading - Presenting about recruitment -Presenting about job applications (Indirect questions)- Reading, Writing and Listening Test-Prepositions of time, Tense review, indirect questions, Conditional 2 (hypothetical). **SELF- STUDY:** Job Application Letter- Resume Writing– Functional Grammar-Telephone Etiquette-Product Description.

LABORATORY COMPONENTS				
EXP NO.	NAME OF THE EXPERIMENT	TEXT BOOK	PAGES	LAB HOURS
1	Listening Comprehension	T2	117-130	3
2	Self Introduction	T2	91-100	3
3	Oral Presentation	T2	195-213	3
4	Telephonic Conversation	T2	165-187	3
5	Conference Arrangement	T2	117-130	3

Text Books

1. Wood, Ian, Paul Sanderson, Anne Williams with Marjorie Rosenberg, Pass Cambridge BEC Preliminary, Cengage learning. Second Edition. 2014.
2. RizviAshraf M , "Effective Technical Communication", McGraw Hill Education (India) Private Limited , 2016.
3. DrSumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015

Reference Books:

1. Whitby, Norman. Cambridge University Press- Students Book. 2013.
2. Jawahar, Jewelcy, Rathna P, English Work book, VRB Publications Pvt Ltd,2016.

Web References:

1. http://www.cambridgeindia.org.
2. http://www.cambridgeenglish.org/exams/business-certificates/business-vantage

Assessment Methods & Levels (based on Blooms'Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
CO001.1	Remember	Quiz	5
CO001.2	Understand	Role Play	5
CO001.3	Apply	E-mail Writing	5
CO001.4	Apply	Group Discussion	5

Blooms Taxonomy based Assessment Pattern:

Bloom's Category	Continuous Assessment Tests			End Semester Examination
	CIA1	CIA2	Term Examination	
Remember	20	20	20	20
Understand	40	40	40	40
Apply	40	40	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

16MA101	LINEAR ALGEBRA, CALCULUS AND ITS APPLICATIONS	3/2/0/4
Nature of Course	J (Problem analytical)	
Pre requisites	Basics of integration	

Course Objectives:	
1	To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2	To familiarize with functions of several variables which are needed in many branches of engineering.
3	To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form.
4	To acquire sound knowledge of techniques in solving ordinary differential equations by numerical methods.

Course Outcomes:

At the end of this course student would be able to

1.	Identify and solve algebraic Eigen value problems and find the extreme values of the given function.	[AP]
2.	Apply the knowledge of differential equation in order to solve the engineering problems like electric circuits and bending of beams.	[AP]
3.	Apply numerical method techniques to find the solution of ordinary differential equations.	[AP]

Course Contents:

MATRICES : Introduction with Applications- Characteristic equation – Eigen values and eigen vectors of a real matrix –Properties (excluding proof)–Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form –Reduction of quadratic form to canonical form by orthogonal transformation.

FUNCTIONS OF SEVERAL VARIABLES : Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion- Maxima and Minima of functions of two variables – constrained Maxima and Minima- Method of Lagrangian multipliers. **ORDINARY DIFFERENTIAL EQUATIONS:** Second and higher order linear differential equations with constant coefficients- Cauchy's linear differential equations –Transformation of differential equations with variable coefficients to constant coefficients - Legendre's linear differential equations - Method of variation of parameters. **APPLICATIONS OF SECOND ORDER DIFFERENTIAL EQUATIONS :** Modelling - Free oscillations – Undamped system – Damped system - Solution of specified differential equations connected with electric circuits and bending of beams (Differential equations and associated conditions need to be given). **NUMERICAL SOLUTION TO FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS :** Single step methods: Taylor series method - Euler's Method - Modified Euler's Method – Runge - Kutta Method of fourth order.

SELF STUDY:

	Multistep methods: Milne's Predictor and Corrector Method - Adam's Predictor and Corrector Method.

Text Books:

1	Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2014.
2	Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publications, Delhi, 2014.

Reference Books:

1	Venkataraman. M.K, "Engineering Mathematics, Volume I Revised Enlarged, Fourth Edition", The National Pub. Co., Chennai, Sep 2011.
2	Veerarajan. T, "Engineering Mathematics for first year", 3rd edition, McGraw-Hill Publishing Company Ltd., New Delhi, 2011.
3	Kandasamy.P , Thilagavathy.K, Gunavathy.K, " Numerical Methods" ,3rd edition, S Chand & Company Pvt. Ltd, 2013.

Web References:

1	http://www.nptel.ac.in/courses/111105035
2	http://www.nptel.ac.in/courses/122104017
3	http://nptel.ac.in/courses/122102009
4	http://nptel.ac.in/courses/111107063

Assessment Methods & Levels (based on Blooms'Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C101.1	Remember	Classroom or Online Quiz	2
C101 .2	Understand	Class Presentation/Power point presentation	4
C101.3	Apply	Group Assignment	6
C101.4 & C101.5	Apply	Group activities	8

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA1	CIA2	Term End Assessment	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CH003	ENVIRONMENTAL SCIENCE	3/0/0/3

Nature of Course	: Nil
Pre requisites	: Nil

Course Objectives:

1. To impart knowledge on chemistry aspects of environment and ecosystem.
2. To study the integrated themes on various aspects of biodiversity and natural resources.
3. To create an awareness on waste management.
4. To gain knowledge on global issues, acts and green approaches.

Course Outcomes:

Upon successful completion of the course, students shall have ability to

1. Be familiar with basic concepts of environmental science to understand the fundamental underlying mechanism.
2. Analyse the various aspects of biodiversity and natural resources.
3. Be familiar with the waste management process.
4. Applying the knowledge gained about the acts and green approaches in the field of engineering.

Course Contents:

ECOSYSTEM : Introduction – components of the environment- Environmental problems and sustainable development- Ecosystem – Types of ecosystem- Structure and functions of an ecosystem- Energy Flow in Ecosystem –Nitrogen Cycle- Carbon cycle –Phosphorous cycle- Food chain – Food web- Ecological pyramid. **BIO DIVERSITY AND ENERGY RESOURCES:** Biodiversity – biogeographical classification of India -Hotspots – threats and conservation of biodiversity. Renewable & non-renewable resources-Forest resource – deforestation – water resources-Biomass, tidal energy, solar energy-Wind energy, geothermal energy and nuclear energy. **WASTE MANAGEMENT:** Environment and society- Solid waste management, biomedical waste management,- Risk management and e- waste management- Current and new electronic waste recycling technology- Future perspectives of electronic scrap. **GLOBAL ISSUES AND GREEN APPROACHES :** Acid rain, Greenhouse Effect- Global Warming, Ozone layer depletion- Geo hazards-Disaster management- Green Chemistry-12 principles of green chemistry- Best practices in green chemistry for sustainable development with suitable examples.-Ecomark, EIA & EIS. **ENVIRONMENTAL ACTS AND APPLICATIONS:** Environmental protection act-Introduction- Air (Pollution and control) act, water (Pollution and control) act- Forest protection act, wild life protection act- Role of NGOs in Environmental protection- Role of IT in Environment and Human health. **SELF STUDY:** Green Consumerisation , Sustainability is a global challenge.

TOTAL LECTURE HOURS: 45

Text Books:

1	AnubhaKaushik and C P Kaushik 'Environmental Science and Engineering' Third Edition, New age International (P) Limited, Publisher 2008. New Delhi.
2	Benny Joseph 'Environmental Science and Engineering' McGraw Hill 2015.
3	SashiChawla 'Text Book of Environmental Studies' 6th Edition, 2015

Reference Books:

1	William P. Cunningham Mary Ann Cunningham 'Environmental Science A Global Concern' McGraw-Hill Education
2	K. De 'Environmental Chemistry'. Wiley Eastern Ltd
3	G. Tyler Miller, JR. 'Environmental Science' 10th Edition, 2004

Web References:

1	http://nptel.ac.in/courses/105104099/
2	http://nptel.ac.in/courses/112104033/2

Bloom's Category	Continuous Assessment Tests			End Semester Examination
	CIA1	CIA2	Term End Assessment	End Semester Examination
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-

16CS201	PROBLEM SOLVING TECHNIQUES AND C PROGRAMMING	3/0/2/4

Nature of Course	: K (Problem Programming)
Pre requisites	: Nil

Course Objectives:

1 2 3 4	To understand problem solving concepts . To gain knowledge about the control structures in C To use arrays and pointers in C Programs To write functions in C .

Course Outcomes:

Upon completion of the course, students shall have ability to

1.	Apply problems solving techniques to real world problems.	[R]
2.	Design programs using fundamental C constructs.	[U]
3.	Use the concepts of pointers , arrays and structures in programs	[AP]
4.	Do modular programming with functions	[AP]

Course Contents:

COMPUTATIONAL THINKING AND PROBLEM SOLVING TECHNIQUES : Computational Thinking: Introduction to Computational Thinking –From abacus to machine – The first Software –First Modern Computer-Information and data   - Converting information into data - Data Capacity.Problem Solving Techniques**:** General problem Solving concepts-: Algorithm, Pseudo-code and Flowchart.Problem Solving with Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops. **Case Study:** Raptor and Scratch Tools. **INTRODUCTION TO C PROGRAMMING :**C Character Set – Identifiers and Keywords– Data Types- Constants-Variables and Arrays-Declarations-Operators and Expressions-Data input and output-Preparing and running a Complete C Program. **CONTROL STRUCTURES :**Branching: if-else; Looping: while-do while-for ; nested control structures -switch-break-continue-comma-goto. **ARRAYS AND POINTERS :** Arrays:Defining an array- Processing an array- Multi dimensional arrays-Strings: Defining a string-Null character-initialization of strings – reading and writing a string- processing the string -Pointers: fundamentals – Pointer Declaration& Usage. **FUNCTIONS AND STRUCTURES :**Defining a Function – Accessing a function – Function Prototypes-Passing arguments to a function – Recursion-Structures: Defining a structure – processing a structure. **SELF STUDY:**Unions

Lab Component		
1	Office Automation – Resume preparation , Spreadsheet processing	[E]
2	Draw Flowchart using Raptor Tool	[E]
	a. Simple Flow Chart	[E]
	b. Decision Making	[E]
	c. Looping[Pre test&Post test]	[E]
3	Create Animation / Gaming /Application using Scratch Tool	[E]
4	Program to process data types, format input and output.	[E]
5	Program to evaluate an expression	[E]

6	Program using decision making statements	[E]
7	Program using looping statements	[E]
8	Program using single and two dimensional arrays	[E]
9	Program for string manipulation	[E]
10	Program using call by value and call by reference.	[E]
11	Program using recursion	[E]
12	Program using structures	[E]

Text Books:

1	David Riley and Kenny Hunt, "Computational Thinking for the Modern Problem Solver", Chapman & Hall/CRC, 2014. [Unit I]
2	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011. [Unit I]
3	Byron, S. Gottfreid, "Programming with C", McGraw Hill, Schaum's outlines, 3rd Edition, 2014. [Unit II- V]

Reference Books:

1	Herbert Schildt, "The Complete Reference C", 4th edition ,MCGRAW HILL,2015
2	S.ThamaraiSelvi and R.Murugesan, "Programming in ANSI C", 6E, MCGRAW HILL, 2012.
3	K.R.Venugopal and SudeepR.Prasad , "Mastering C", MCGRAW HILL ,Second edition , 2015

Web References:

1	http://nptel.ac.in/courses/106105085/
2	http://nptel.ac.in/courses/106106127/
3	http://raptor.martincarlisle.com/
4	https://scratch.mit.edu/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	Rubric based CIA [40 Marks]	
Remember	30	30	20	-	-
Understand	70	50	30	-	-
Apply	-	20	50	70	70
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

16CS301	COMPUTER SCIENCE ESSENTIALS	3/0/0/3
Nature of Course	: C (Theory Concept)	
Pre requisites	: Nil	

Course Objectives:	
1	To study and understand the basics of computing
2	To get an overall understanding of the different facets of computer science
3	To know about the different domains in Computer Science
4	To gain insight on computer hardware and software

Course Outcomes:

Upon completion of the course, students shall have ability to

1.	Gain an overall understanding of the discipline	[R]
2.	Realize abstraction and organization of data	[U]
3.	Understand the fundamentals of networking and internet	[U]
4.	Know about basics of Computer Graphics and Artificial intelligence	[U]

Course Contents:

COMPUTER AND DATA : Introduction to Computer Science: Role of Algorithms- History of Computing- Science of Algorithms- Abstractions- Basics of data encoding and storage: Bits and their storage- Main memory- Mass Storage- Representing Information as Bit Patterns. **ARCHITECTURE AND OPERATING SYSTEM :** Machine Architecture: CPU Basics- Stored Program concepts- Machine Language Introduction with example- Program Execution with illustrative example-Operating Systems:History of OS- OS Architecture- Coordinating Machine Activities. **NETWORKING AND SOFTWARE ENGINEERING :**Networking and the Internet: Network Fundamentals- The Internet- The World Wide Web-Software Engineering: Introduction- Software Life Cycle. **DATA ORGANIZATION :**Data Abstractions: Basic data Structures- Related Concepts Database Systems: Database Fundamentals- Relational Model- Data Mining. **GRAPHICS AND ARTIFICIAL INTELLIGENCE:** Computer Graphics: Scope of Computer Graphics- Overview of 3D Graphics.Artificial Intelligence: Intelligence and Machines- Perception- Reasoning. **SELF STUDY** : An Introduction to topics of research in Computer Science

	TOTAL LECTURE HOURS: 45

Text Books:	
1	J. Glenn Brookshear- "Computer Science: An Overview"- Addison-Wesley- Eleventh Edition- 2012(Unit I- Chapter 0 &1, Unit II- Chapter 2&3, Unit III- Chapter 4&7, Unit IV- Chapter 8 &9, Unit V- Chapter 10&11).

Reference Books:	
1	Nell B. Dale, John Lewis, "Computer Science illuminated ",Jones and Bartlett Learning , 2013
2	Anita Goel , "Computer Fundamentals",Pearson Education , 2010
3	RobertSedgewick,Kevin Wayne ,"An introduction to Computer Science", Princeton University, 2012

Web References:	
1	http://web.stanford.edu/class/cs101/
2	http://www.bbc.co.uk/learning/subjects/information_technology.shtml
3	http://www.cambridgegcsecomputing.org

Assessment Methods & Levels (based on Blooms'Taxonomy) :

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA1 [6 marks]	**CIA2 [6 marks]**	**Term End Assessment [8 marks]**	
Remember	50	-	15	15
Understand	50	100	85	85
Apply	-	-	-	-
Analyse	-	-	-	-
Evaluate	-	-	-	-

16CH105	ENGINEERING CHEMISTRY	3/0/2/4

Nature of Course	: Nil
Pre requisites	: Nil

Course Objectives:

1	To impart knowledge on the role of chemistry in everyday life along with the water treatment techniques.
2	To acquire knowledge in applications of plastics in engineering field.
3	To know about the energy production and storage devices
4	To understand the principles of electrochemistry, corrosion science and the significance of various analytical techniques

Course Outcomes:

Upon successful completion of the course, students shall have ability to

1	Apply chemistry in everyday life and water treatment methods.	[R]
2	Use the knowledge of polymers, various energy sources and storage devices in engineering field.	[U]
3	Analyse the types of corrosion and various analytical techniques.	[A]

Course Contents:

CHEMISTRY IN EVERYDAY LIFE : Chemicals in medicines-analgesics, antiseptics, antacids, disinfectants-chemicals in food preservatives-artificial sweetening agents-Characteristics of water – hardness-types and estimation by EDTA method. Domestic water treatment-disinfection methods (Chlorination, Ozonation,UV treatment)- demineralisation process – desalination-reverse osmosis. **CHEMISTRY FOR ENGINEERING PLASTICS :** Introduction-monomers and polymers-classification of polymers Polymerisation- types -Mechanism of addition polymerization(free radical mechanism) Plastics- classification -preparation, properties and uses of PC, Teflon-classification -preparation, properties and uses of Nylon 6,6 and Nylon 6, moulding methods Rubber-vulcanisation of rubber-synthetic rubber (Butyl rubber and SBR). **ENERGY SOURCES AND STORAGE DEVICES :**Nuclear energy-fission and fusion reaction - nuclear reactor for power generation (block diagram only)- breeder reactor-Fuel cells-hydrogen oxygen fuel cells Batteries-alkaline batteries.-Lead acid, nickel cadmium and lithium batteries. **ELECTROCHEMISTRY AND CORROSION SCIENCES :**Electrochemical cells-single electrode potential- emf series- electrodes-Electrodes- Reference electrode-SHE-calomel electrode-Ion selective- glass electrode and measurement of pH.-Corrosion-chemical corrosion-electrochemical corrosion (mechanism)-galvanic corrosion-differential corrosion-Protective coatings-electroplating of gold-electroless plating of Nickel. **ANALYTICAL TECHNIQUES :**Laws of absorption- Instrumentation (Block diagram) and applications-UV-Visible spectroscopy-Flame photometry-Estimation of sodium by flame photometry. **SELF-STUDY:**Instrumentation (Block diagram) and applications-IR spectroscopy.Atomic absorption -Spectroscopy-Estimation of Nickel by atomic absorption spectroscopy.

Lab Component

1	Determination of Total, Temporary and permanent hardness of water by EDTA method	[E]
2	Determination of Alkalinity and TDS in water	[E]
3	Estimation of Dissolved oxygen by Winkler's method	[E]
4	Estimation of Chloride in Water sample	[E]
5	Estimation of ferrous ion by Potentiometric titration	[E]
6	Estimation of acids in a mixture by Conductometric titration	[E]
7	Estimation of strength of an acid by pH metry	[E]
8	Determination of inhibitor efficiency on the corrosion rate of steel in acid media by weight loss method	[E]
9	Electroplating of Nickel and determination of cathode efficiency	[E]

10	Determination of single electrode potential of an electrode - Zn and Cu	[E]
	Total Hours : 75	

Text Books:

1	Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2013.
2	P.C.Jain and Monica Jain, "Engineering Chemistry", 16th Edition, DhanpatRai
3	Sunita Rattan, A Text Book of Engineering Chemistry, SK Kataria Publishers, 2013

Reference Books:

1	J.C.Kuriakose and J.Rajaram "Chemistry in Engineering and Technology", Vol I&II, 6th Edition McGraw Hill Publishing Company (P), Ltd., New Delhi, 2009.
2	V.R.Gowarikar, "Polymer Science", New Age International Publishers Ltd., 2010.
3	Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012.

Web References:

1	nptel.ac.in/courses/105104102/hardness.htm
2	nptel.ac.in/courses/105104102/Lecture%204.htm
3	en.wikipedia.org/wiki/Colorimetry
4	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	**Continuous Assessment**				**End Semester Examination (Theory) [40 marks]**
	Theory			**Practical**	
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	**Rubric based CIA [40 Marks]**	
Remember	30	30	30	10	20
Understand	60	50	40	20	50
Apply	10	20	30	40	30
Analyse	-	-	-	30	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

16ME204	ENGINEERING PRACTICES LABORATORY	0/0/3/2

Nature of Course	:M (Practical application)
Co requisites	:Engineering Drawing/Graphics

Course Objectives:

1.	To gain hands on experience on Carpentry, Fitting, Sheet metal, Plumbing, Arc welding
2.	To provide exposure to the students with hands on experience on various wiring system and measurement system.
3.	To provide exposure to the students with hands on experience on various wiring system and measurement system.
4.	To provide exposure to the students with hands on experience on various Electronic Components

Course Outcomes:

Upon completion of the course, students shall have ability to

1	Prepare simple components like try, cylinder funnel etc.	[R,U,AP]
2	Prepare simple lap, butt and tee joints using arc welding equipments.	[C]
3	Prepare simple wooden joints using wood working tools.	[AP]
4	To provide exposure to the students with hands on experience on various wiring system and measurement system	[AP]
5	To provide exposure to the students with hands on experience on various Electronic Components.	[A]

Course Contents:

 MECHANICAL

1. Welding – Butt, Lap And Tee Joint
2. Sheet Metal – Rectangular Tray
3. Sheet Metal – Cylindrical Container
4. Demonstration on Turning and Drilling Practices, Foundry Operations and Forging Operations

 CIVIL

1. Plumbing: Basic Pipe Connections – Mixed Pipe Material Connection –Pipe Connections with Different Joining Components.
2. Wood Work, Joints by Sawing, Planning And Cutting.
3. Study of Pipe Connections Requirements for Pumps and Turbines and Joints in Roofs, Doors, Windows and Furniture.
4. Demonstration of Plumbing Requirements of High –Rise Buildings.

Electrical
1. Identify Different Types of Fuses, Fuse Carriers, MCB, ELCB, MCCB with Ratings and Usage for AC and DC Meters.
2. Wiring of Simple Circuit for Controlling Light Using Switches, Fuse and Indicator.
3. Wiring of Light Circuit using Two Way Switches (Staircase Wiring).
4. Measurement of Unknown Resistance Using DC Bridges.
5. Measurement of Electrical Parameters Using Transducers.
6. Identification of Electronic Components With Specification.
7. Testing of Cro and Electronic Components.
8. Generation of Signals.
9. Soldering Practice.
10. Single Phase Half Wave and Full Wave Rectifier using PN Junction Diode.

		Total Hours:	45

Reference Books:		
1.	SeropeKalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2015 (Second Indian Reprint).
2.	Suyambazhagan S, 'Engineering practices' PHI learning private limited, New Delhi, 2014.
3.	Jeyapoovan T., Saravanapandian M. &Pranitha S., 'Engineering Practices Lab Manual', VikasPuplishing House Pvt.Ltd, 2014.

Web References:	
1.	https://www.youtube.com/results?search_query=electrical+engineering+practices+lab
2.	https://www.youtube.com/watch?v=rLUyP6g1VNI&list=PL425060D3C78350E1

Assessment Methods & Levels (based on Bloom'sTaxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	10	10
Understand	10	10
Apply	40	40
Analyse	20	20
Evaluate	10	10
Create	10	10

16EN002   TECHNICAL COMMUNICATION SKILLS   2/0/2/3

Nature of Course: Theory

Pre Requisites: BEC Preliminary

Course Objectives

1. To develop the prominence of listening and reading practices using authentic business vocabulary.
2. To instil analytical thinking and logical reasoning to enhance LSRW skills in Business related situations.
3. To urge the need of effective communication in corporate sector with Business English.
4. To prepare students for competitive program like BEC, IELTS, TOEFL.

Course Outcomes

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

CO1:Remember LSRW skills and employ cross-cultural communication in business related situations.

CO2: Understand and gain proficiency with business vocabulary.

CO3: Apply Task- Based activity to enhance an effective communication.

CO4: Analyse and apply Business English in working environment.

Course Contents with Course Outcomes/Blooms Taxonomy/Assessment Methods

LISTENING -Taking and Leaving Voice mail messages –Identifying the information before listening-Inferring ideas- Listening to short monologues -Longer listening tasks -Recognise functions. **SPEAKING -**Expressing hypothetical Situations – Expressing obligation -Aspects of business – Giving examples- Giving reasons- Giving extra information- Presentation at a business meeting- Connecting ideas- Collaborative task – Short talk on a business topics- Film Reviews. **READING** - Science texts - Terms related about science and scientists - Scanning for specific information- Understanding cohesive features - Skimming the reading comprehensions - Interpret opinions and ideas expressed – Collocations - Identifying dependent preposition - Identifying the extra words. **WRITING -** Definitions, Extended Definitions -Letter writing (accepting and declining invitations)- Internal communication (notes/memo/E-mail writing to the head of the department, colleague, assistant , staff in the department etc) Report writing- Business proposal- circular- agenda and minutes- Appropriate linking words- Report Phrases - Asking for Information and Making Suggestions- Transcoding (Bar Chart, Flow Chart)- Letter for calling quotations, Replying for quotations- Placing an order and complaint letter. **PARTS OF SPEECH-** Tenses - Adjectives - Adverbs - Articles- Modal verbs, Active and Passive, Impersonal Passive voice, Homophones- Homonyms- Acronyms- Abbreviations- British and American words- Comparatives and Superlatives- Gerunds- infinitives – Participles - Modal Verbs - Relative Pronouns- Reported Speech - Indirect Questions- Spotting errors.

LABORATORY COMPONENTS				
EXP NO.	**NAME OF THE EXPERIMENT**	**TEXT BOOK**	**PAGES**	**LAB HOURS**
1	**MINI PRESENTATION**	T2	**117-130**	3
2	**LOGICAL REASONING AND ETHICS IN A GIVEN SITUATION**	T2	**91-100**	3
3	**TECHNICAL PRESENTATION**	T2	**195-213**	3
4	**GROUP DISCUSSION**	T2	**165-187**	3
5	**EXTEMPORE**	T2	**117-130**	3

Total Hours   45+15

Text Books

1. Whitby, Norman. Cambridge University Press- Students Book. 2013.

2. Rizvi Ashraf M , "Effective Technical Communication", McGraw Hill   Education (India)

Private Limited , 2016

3. Dr.Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited, 2015.

Reference Books:

1. Wood, Ian, Paul Sanderson, Anne Williams with Marjorie Rosenberg, Pass Cambridge BEC Vantage, Cengage learning. Second Edition. 2014.

2. Gunasekaran S, 'A Text and Workbook of Technical English II", United Global Publishers, June 2010.

3. Lewis, Norman, Word Power Made Easy, Pocket Books, New York, 1979.

Web References:

1. http://www.cambridgeindia.org

2. http://www.cambridgeenglish.org/exams/business-certificates/business-vantage

3.https://**steptest**.in

Online Resources:

 1.https://www.coursera.org/specializations/business-english

 2. http://www.academiccourses.com/Courses/English/Business-English

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO002.1	Remember	Extempore	**5**
CO002.2	Understand	Mini presentation	**5**
CO002.3	Apply	Technical presentation	**5**
CO002.4	Apply	Group Discussion	**5**

Blooms Taxonomy based Assessment Pattern:

Bloom's Category	Continuous Assessment Tests			End Semester Examination
	CIA1	**CIA2**	**Term Examination**	
Remember	30	20	20	20
Understand	30	30	30	30
Apply	40	50	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

16MA102   **INTEGRAL CALCULUS AND LAPLACE TRANSFORMS**   **3/2/0/4**

Nature of Course   J (Problem analytical)
Pre requisites   Basics of integration
Course Objectives:

1 To gain knowledge in improper integrals, Gamma and Beta functions which are needed in engineering applications
2 To develop logical thinking and analytical skills in evaluating multiple integrals
3 To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines
4 To apply numerical methods to evaluate integrals when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information
5 Solve the differential equations using Laplace transform technique

Course Outcomes:
Upon completion of the course, students shall have ability to

C102.1	Recall basic integration formulae, scalar and vector point function concepts	[R]
C102.2	Differentiate and integrate vector point functions	[U]
C102.3	Evaluate integrals using Beta and Gamma functions	[AP]
C102.4	Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure	[AP]
C102.5	Find the gradient, divergence and curl of vector point functions and related theorems useful for evaluation of engineering problems	[AP]
C102.6	Apply the Laplace transform technique to solve ordinary differential equations	[AP]

Course Contents:
Definite integrals-Evaluation of definite integrals using Bernoulli's formula-Beta and Gamma Integrals- Relation between Beta and Gamma Functions-Evaluation of Integrals using Beta and Gamma Functions-**Multiple integrals** - Double integration in Cartesian coordinates –Area as double integral –Change the order of integration-Triple integration in Cartesian co-ordinates – Volume as triple integral-**Vector calculus** - Vector differential operator- Gradient of a scalar point function - Directional derivatives –Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields –Simple problems– Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem(statements)– Simple applications involving cubes and rectangular parallelopipeds-**Numerical integration -** Trapezoidal rule – Simpson's 1/3 and 3/8 rules – Two and three point Gaussian Quadrature formulae –Trapezoidal rule and Simpson's rule to evaluate double integrals-**Laplace transform** –Conditions for existence – Transform of elementary functions – Basic properties (without proof) – Derivatives and integrals of Laplace transform -Transforms of derivatives and integrals - Periodic functions - **Inverse Laplace transform**-Partial fraction method - convolution theorem , Initial and Final value theorems (statements)– Problems - Solution of second order differential equations with constant coefficients.

Total Hours: 60

Text Books:

1 Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2014

2 Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publications, Delhi, 2014

3. N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 8th edition Laxmi publications ltd, 2011

Reference Books:

1. Veerarajan. T, "Engineering Mathematics for first year", 3rd edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011
2. Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012
3. Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers 2013

Web References:

1. http://nptel.ac.in/video.php?subjectId=122107037
2. http://nptel.ac.in/courses/122107036/
3. http://nptel.ac.in/video.php?subjectId=117102060

Online Resources:

1. https://www.coursera.org/learn/pre-calculus
2. https://www.coursera.org/learn/linearalgebra1
3. https://alison.com/courses/Advanced-Mathematics-1
4. https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x.
5. https://www.edx.org/course?search_query=laplace+transform

Assessment Methods & Levels (based on Blooms'Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C102.1	Remember	Classroom or Online Quiz	2
C102.2	Understand	Class Presentation/Power point presentation	4
C102.3, C102.4	Apply	Group Assignment	7
C102.5,C102.6	Apply	Group activities	7

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment		Term End Assessment	End Semester Examination
	CIA1	CIA2		
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Nature of Course   : E (Theory skill based)
Pre requisites   : Nil
Course Objectives:

1	To learn the basic concepts of physics needed for all branches of engineering
2	To understand the concepts and working principles of laser, fibre optics, quantum physics and crystal physics.
3	To identify suitable materials to be used in the engineering field.
4	To implement and visualize theoretical aspects in the laboratory
5	To familiarize the students to handle various instruments and equipment

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Recall the basic concepts of laser, fibre optics and quantum physics used in various engineering applications	[R]
C101.2	Understand the crystal structure of the various materials	[U]
C101.3	Understand the fundamental concepts of electrical and magnetic properties of materials.	[U]
C101.4	Interpret the behaviour of nanomaterials and shape memory alloys	[U]
C101.5	Apply the gained knowledge to solve the problems related to their field of study	[AP]

Course Contents:

Laser: Principle of absorption and emission - Types of laser: CO_2, Nd-YAG, semiconductor laser - Industrial applications - Holography. Fiber optics: Principle and propagation–numerical aperture and acceptance angle – classification of optical fibers - splicing - fiber optic communication system - light source - PIN detector. Fiber optic sensors: temperature and displacement.Quantum mechanics: Matter waves, de-Broglie wavelength, uncertainty principle – Schrödinger's wave equation – time independent and time dependent - physical significance - particle in a one dimensional potential box. Conducting materials: Classical free electron theory of metals - Electrical and thermal conductivity- Wiedemann-Franz law - Band theory of solids- Fermi distribution function –Effect of temperature on Fermi function. Semiconducting materials: Intrinsic and extrinsic semiconductors – carrier concentration derivation – Fermi level – variation of Fermi level with temperature in intrinsic – electrical conductivity for intrinsic semiconductor – Band gap determination – Hall effect. Magnetic materials: Origin of magnetic moment –ferro magnetic material – domain theory – hysteresis – soft and hard magnetic materials – Ferrites. Dielectric materials: properties- Electronic and ionic polarisation – frequency and temperature dependence – internal field-Claussius-Mosotti relation-dielectric loss –dielectric breakdown mechanisms - ferro electric materials – piezo electric materials - insulating materials - applications. Crystallography: Atomic packing factor for SC, BCC, FCC and HCP structures – miller indices. Advanced materials: Shape memory alloys-characteristics - properties of Ni-Ti alloy. Characterisation techniques: SEM, TEM and X-ray diffraction.

Nanomaterials: Properties – synthesis techniques: ball milling, chemical vapour deposition and sol-gel method. Carbon nanotubes: structure - properties and applications.

Lab Component

1	Laser and optical fiber parameters	[E]
2	Lattice constant using x-ray diffraction pattern	[E]
3	Specific resistance-Carey Foster's Bridge	[E]
4	Band gap of a semiconductor	[E]
5	Characteristics of a solar cell /Photo diode	[E]
6	Thermal conductivity of a bad conductor	[E]
7	Young's modulus	[E]
8	Rigidity modulus	[E]
9	Thickness of a thin material using air wedge	[E]
10	Coefficient of viscosity for a liquid	[E]

Total Hours: 75

Text Books:

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' DhanpatRai Publications (P) Ltd, New Delhi, 2014.
2. Rajendran, V 'Engineering Physics' McGraw Hill Publications ltd, New Delhi, 2014.

Reference Books:

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (9 th Edition) 2013.
2. M.N. Avadhanulu, P.G. Kshirshagar – A Text Book of Engineering Physics- S.Chand& Co Ltd, 2016.
3. P.K. Mittal – Applied Physics – I.K. International Publishing House pvt.Ltd.

Web References:

1. http://www.nanotech-now.com/Nanomat-Preso2.pdf
2. http://nptel.ac.in/courses/108106073
3. https://www.corning.com/in/en/products/communication-networks/.../fiber.html
4. https://physics.stanford.edu/node/201
5. *https://www.amazon.com/Semiconductor-Materials-Physical...References/.../0849389...*
6. *https://books.google.co.in/books?isbn=1482238888*
7. *https://www.generalplastics.com/polyurethane-foam-**dielectric-materials**-f...*
8. *https://www.asme.org/.../**nano**technology/**carbon-nanotube**-super-fabric*
9. *https://**web**.iit.edu/.../**web**/.../Academic%20**Resource**%20Center/.../**Miller**...*
10. *https://www.boundless.com/physics/.../the-**hall-effect**-559-10926/*

Online Resources:

1. https://www.coursera.org/learn/ap-physics-1
2. *www.cleanroom.byu.edu › Semiconductor Properties*
3. *https://www.urmc.rochester.edu › ... › Our Resource Laboratories*
4. *https://www.jic.ac.uk/**microscopy**/links.html*
5. *https://www.merlot.org/merlot/**materials**.htm*
6. *www.**fiberopticsonline**.com/*
7. *https://ocw.mit.edu/courses/physics/8-04-**quantum-physics**-i-spring-2013/*

16CS202   **LINUX AND ADVANCED C PROGRAMMING**   **3/0/2/4**

Nature of Course   : F (Theory Programming)
Pre requisites   : Problem Solving Techniques & C Programming
Course Objectives:
1   To understand the essential Linux command line operations and to manage user services with file access
2   To learn the fundamentals of shell scripting/programming
3   To apply pointers to arrays, strings and pass pointers to functions in C.
4   To gain knowledge about structures and pointer to structures.
5   To develop the ability to apply file I/O operations.
6   To acquire knowledge in pre-processor commands and bitwise operations in C.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Recall the programming structures	[R]
CO2	Understand and work in Linux command line interface	[U]
CO3	Write shell programs	[AP]
CO4	Apply pointer for effective memory access in C	[AP]
CO5	Employ structure and pointers to structures	[AP]
CO6	Illustrate file access.	[AP]
CO7	Demonstrate and apply the pre-processor commands and bitwise operations in C	[AP]

Course Contents:
Introduction to Linux- Linux kernel and architecture-Accessing shell based commands File System permission-Configuring and securing open ssh services- Installation of software in Linux-Shell -Types of shell-Shell scripting Pointers - pointers to array - Pointer and functions-Pointer to strings – Array of pointers –pointers to pointers-Dynamic memory allocation Structure - Type Definition -Structures and functions - return-Pointer to structures - Self -referential Structure-Bit Fields – union Files –Text versus Binary Streams – State of a File- File I/O operations – Error Handling During I/O Operations –Binary files- Random Access to Files -Bitwise Operators-Pre-processor Commands- Command Line Arguments
List of Experiments
1   Linux Bash commands- system, file, help, search- process, network and
    Miscellaneous commands
2   Shell Scripting
3   Pointers- Pointer to array – pointer arithmetic
4   Pointer and function
5   Pointer and string
6   Dynamic Memory Allocation- array of pointers
7   Structures-array of structures
8   Structure and functions
9   Pointers to structure - self-referential structures
10 Text and Binary File operations
11 MACROS
12 Bitwise operations

                                                           Total Hours: **75**

Text Books:
1. Mark B Sobel, "Practical Guide to Linux Commands Editor and Shell Programming", Pearson education,2013
2. Kenneth A. Reek,"Pointers on C,First Edition" ,Pearson education,2007.
3. YashavantKanetkar, "Understanding Pointer in C", 3E, BPB Publication, 2011.

Reference Books:
1. YashwantKanetkar, "Let us C", 12th Edition, BPB Publications, 2014
2. B Stephen G. Kochan "Programming in C",Fourthedition,Addison Wesley publishing,2014.
3. Behrouz A. Forouzan& Richard F. Gilberg, "A Structured Programming Approach Using C", 3E, Cengage Learning, 2008
4. E Balagurusamy, "Programming in ANSI C", 6E, TMH, 2012.,"Computer System Architecture", 3rdEdition, Pearson Education, 2007

Web References:
1. http://vic.gedris.org/Manual-ShellIntro/1.2/ShellIntro.pdf
2. https://knowstuffs.wordpress.com/2012/06/11/linux-kernel-and-architecture/
3. http://redhat.lsu.edu/manuls.php
4. https://www.tutorialspoint.com/cprogramming/cprogramming_tutorial.pdf
5. http://students.iitk.ac.in/programmingclub/course/#notes

Online Resources:
1. htps://alison.com/courses/Diploma-in- Programming-in- C
2. https://www.edx.org/course/programming-basics- iitbombayx-cs101- 1x-0?gclid=CIXj9JKQh9ACFdeGaAodIX4MMw
3. https://www.coursera.org/learn/intro-programming
4. https://onlinecourses.nptel.ac.in/iitk_cs_101/previewhttps://www.edx.org/course/signals-systems-part-2-iitbombayx-ee210-2x-2

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	**Continuous Assessment**				**End Semester Examination (Theory) [40 marks]**
	Theory			**Practical**	
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	**Rubric based CIA [40 Marks]**	
Remember	20	20	20	20	10
Understand	30	30	30	20	30
Apply	50	50	50	60	60
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

16CS302   **COMPUTER SCIENCE ESSENTIALS - II**   **3/0/0/3**

Nature of Course   : E (Theory Skill Based)

Course Objectives:

1. To understand the basic concepts of structure of computer hardware & networking.
2. To identify the existing configuration of the computers and peripherals.
3. To allow students to configure internetworking components.
4. To understand the storage area network management principles and protocols.
5. To enable the knowledge of Data protection in Storage area environment.

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Describe the relationship between hardware and Software.	[R]
CO2	Classify and explain the functions of different computer hardware components.	[U]
CO3	Understand the various methods to implement Storage Area Network.	[U]
CO4	Apply configuration procedure to implement Local Area Network and internetworking components.	[AP]
CO5	Analyze the various storage management principles and protocols.	[AN]

Course Contents:

PC components - Processor Specifications- Processor features - Processor manufacturing - BIOS Basics - UEFI Technology- RAM types and Performance- Memory modules- Memory Banks- Solid State Drive (SSD), Comparison of SSD and HDD.(Technical quiz)   Motherboard Connectors System Bus types, Functions and Features- Resolving resource conflicts   - input/output devices- **Network architecture overview**- Hardware elements of network- Putting network together- Internet connectivity: Trends- Broadband Internet access types- Internetworking components – IP addressing – subnet mask- server configuration-Router configuration –**Introduction to storage system management**-Storage system environment– Direct attached storage: Types of DAS-Benefits and limitations-Disk drive interfaces-Storage area Network: Evolution-Components-types-Network attached storage :General purpose servers Vs NAS Device-NAS File I/O-components of NAS - Data protection: software RAID – Hardware RAID- components-RAID levels.

                                            Total Hours: **45**

Text Books:

1. Scott Mueller "Upgrading and Repairing PCs", 22 nd Edition, QUE, Pearson Education, New Delhi, 2015.
2. G Somasundaram, AlokShrivastava,"Information Storage and Management", EMC Education services,Wiley India, 2009 .
3. Mike Meyers, Scott Jernigan, "A+ Guide to Managing and Troubleshooting PCs", Tata McGraw Hill, 2010.

Reference Books:

1. Gary B.Shelly, Misty E.Vermaat, "Discovering Computers", Cengage Learning, 2012
2. Ron Gilster, "PC Hardware – a beginner's guide" – Tata McGraw Hill, 2002
3. Govindaraju B. "IBM PC and Clones: Hardware, Trouble Shooting and Maintenance", 2nd Edition, Tata McGraw Hill Pub. Co., New Delhi, 2002

Web References:

    1 http://www.brainbell.com/tutors/A+/Hardware/Preventive_Maintenance.htm

    2 http://www.technologystudent.com/elec1/dig1.htm

Online Resources:

    1 http://www.worldwidelearn.com/online-training/pc-hardware-courses.htm

    2 https://www.edx.org/course/clep-information-systems-computer-upvalenciax-sc101-2x

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Remember	Quiz	**2**
CO2	Understand	Quiz	**3**
CO3	Understand	Group Assignment	**5**
CO4	Apply	Problem solving	**5**
CO5	Analyse	Technical Presentation	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	40	30	30	30
Understand	60	50	40	40
Apply	-	20	20	20
Analyse	-	-	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

16ME205   **ENGINEERING GRAPHICS LABORATORY**   **0/0/3/2**

Nature of Course   :M (Practical application)
Co requisites   :Basic drawing and Computer Knowledge
Course Objectives:
1. To know the method of constructing the conic curves used in Engineering Applications.
2. To develop an understanding of Isometric to Orthographic Views and vice versa.
3. To learn the basic projection of straight lines and plane surfaces.
4. To develop the imagination of solids inclined to one reference planes.
5. To know the sectioning of solids and development of surfaces used in various fields.

Course Outcomes:

Upon completion of the course, students shall have ability to

C202.1	Recall the basic concepts of engineering drawing.	[R]
C202.2	Recall the basic syntax and commands of CAD software.	[R]
C202.3	Interpret the parameters of engineering drawing.	[U]
C202.4	Sketch the 2D geometries in the drafting software.	[AP]
C202.5	Examine the isometric projection and convert it into orthographic projection (Vice versa).	[A]

Course Contents:
1. Construction of Conic Curves (Ellipse, Parabola and Hyperbola)
2. Construction of Special Curves (Cycloid and Involutes)
3. Isometric to Orthographic projections – Manual sketches
4. Isometric to Orthographic projections – Software sketches
5. Projection of lines - Inclined to both HP and VP
6. Projection of Plane surfaces (Hexagon, Pentagon and circle) – Inclined to both HP and VP
7. Projection of Solids (Prism and Pyramid) – Inclined to HP
8. Projection of Solids (Cone and Cylinder) – Inclined to VP
9. Sectioning of Solids (Prism and Pyramid) with Section plane Inclined to HP
10. Sectioning of Solids (Cone and Cylinder) with Section plane Inclined to VP
11. Development of Surfaces (Prism,Pyramid,Cone and Cylinder)
12. Introduction to Perspective projection

Total Hours: 45

Reference Books:
1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2014.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2011.
3. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2013.

Web References:
1. http://nptel.ac.in/courses/112102101/
2. www.solidworks.com

Assessment Methods & Levels (based on Bloom'sTaxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	30	30
Understand	30	30
Apply	20	20
Analyse	20	20
Evaluate	0	0
Create	0	0

16MA105   **DISCRETE STRUCTURES**   **3/2/0/4**
(CSE & IT)

Nature of Course   J(Problem analytical)
Course Objectives:

1   To study the concepts needed to test the logic of a program

2   To understand and identify different types of patterns on many levels in engineering fields

3   To learn the working of class of functions which transform a finite set into another finite set which relates to input and output functions in computer science

4   To know the fundamental concepts of Group theory

Course Outcomes :
Upon completion of the course, students shall have ability to

CO1	To recall the basic concepts of sets, groups and truth table	[R]
CO2	To find the validity of arguments	[U]
CO3	Use the concepts of Discrete Mathematics in software development and hardware design	[AP]
CO4	Demonstrate and understand the fundamental concepts of a mathematical function and all of its properties.	[AP]
CO5	Apply operator-algebraic techniques to reformulate and solve group theoretic problems.	[AP]

Propositional calculus- Propositions – Logical connectives – Compound propositions – Conditional and bi-conditional propositions – Truth tables – Tautologies and contradictions –Contrapositive – Logical equivalences and implications – Normal forms – Principal conjunctive and disjunctive normal forms– Rules of inference – Arguments - Validity of arguments -**Predicate calculus**- Predicates – Statement function – Variables – Free and bound variables – Quantifiers– Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments -**Set theory**- Basic concepts – Subset – Algebra of sets – The power set – Ordered pairs and Cartesian product – Relations on sets–Types of relations and their properties– Relational matrix and the graph of a relation – Equivalence relations – Partial ordering – Poset – Hasse diagram- **Functions**- Definitions of functions – Classification of functions –Types of functions - Examples –Composition of functions–Inverse function–Binary and n-ary operations– Characteristic function of a set – Hashing functions – Recursive functions –Permutation functions- **Group theory**-Binary operation-Semi group-Monoid-Group-Subgroup-Abelian group-Group homomorphism and isomorphism-Normal subgroup-Quotient group-Lagrangian theorem-Hamming distance-Group coding and decoding

                                                         Total Hours   75

Text Books:
1.   Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011
2.   Kenneth H.Rosen,"Discrete Mathematics and its Applications", Seventh Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2011
3.   Veerarajan T, " Discrete Mathematics with Graph theory and Combinatorics", Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2010

Reference Books:

1.   Ralph. P. Grimaldi,"Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, New Delhi, 2007

2. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", sixth edition , Pearson Education Pvt Ltd., New Delhi, 2010

3. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2008.

Web References:
1 http://www.nptel.ac.in/courses/111105035
2 http://www.nptel.ac.in/courses/122104017
3 http://nptel.ac.in/courses/122102009
4 http://freevideolectures.com/Course/2267/Mathematics-I/22

Online Resources:
1 www.edx.org/Probability
2 https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/
3 https://onlinecourses.nptel.ac.in/noc15_ec07/

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Class room or online Quiz	2
CO2& CO3	Understand Apply	Class presentation/Powerpoint Presentation	6
CO4	Apply	Group Activities	6
CO5	Apply	Group Assignment	6

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination**
	CIA1	**CIA2**	**Term End Assessment**	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS303   **OPERATING SYSTEMS**   3/0/0/3

Nature of Course : G (Theory analytical)
Course Objectives:
1. To understand the structure and functions of OS
2. To learn about Processes, Threads and Scheduling algorithms
3. To understand the principles of concurrency and Deadlocks
4. To learn various memory management schemes
5. To study I/O management and File systems

Course Outcomes
Upon successful completion of this course, the student will be able to

CO1	Identify and reproduce the basic concepts of Modern operating systems	[R]
CO2	Understand the various operating system mechanisms and operations.	[U]
CO3	Understand Process management concepts including scheduling, synchronization deadlocksand multithreading in real world problems	[U]
CO4	Apply concepts of memory management including virtualMemory and Page Replacement to the issues that occur in Real time applications	[AP]
CO5	Solve issues relatedto file system interface, implementation, disk management, protection and security mechanisms	[AP]

Course Contents

Introduction of basics of Modern Operating Systems: Multitasking, Multiuser, parallel, distributed & Real–time O.S, POST, GUI, Types of servers **Concurrency:** Managing multiple tasks and sharing resources: Processes and threads, context switching, synchronization, Scheduling and Deadlock. Memory Management; linking, dynamic memory allocation, dynamic address translation, virtual memory, Quantum base memory and demand paging. **File systems**: disk management and scheduling, directories, protection, and crash recovery Virtual machines and security in OS. Server OS, Network OS and Mobile OS**.**

Total Hours   45

Text Books:
1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts" 9th Edition, John Wiley, 2013
2. D.M.Dhamdhere, "Operating systems- A Concept based Approach" 2nd Edition, Tata Mc – Graw Hill, 2010.

Reference Books:
1. Andrew S. Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson Education/PHI 2014.
2. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
3. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.
4. Tanenbaum,"Modern Operating Systems," 3/e, Pearson Edition, 2007.

Web References:
1. nptel.ac.in/courses/Webcourse.../Operating%20Systems
2. http://geeksforgeeks.org/Operating Systems/

Online Resources
1. https://www.coursera.org/learn/embedded-operating-system

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Remember	Quiz	**5**
CO2	Understand	Writing Skills	**5**
CO3	Understand	Class Presentation	**4**
CO4	Apply	Group Assignment	**3**
CO5	Apply	Surprise Test	**3**
Summative assessment based on Continuous and End Semester Examination			

Bloom's Category	Continuous Assessment Tests			Semester End Examination [60 Marks]
	CIA1 [6 Marks]	CIA2 [6 Marks]	Term Examination [8 Marks]	
Remember	20	20	20	20
Understand	40	20	20	20
Apply	40	60	60	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

16CS304   **DATA STRUCTURES**   **3/0/3/5**
Nature of Course   :K (Problem Programming)
Pre requisites   :Advanced C programming
Course Objectives:

1 To stress the importance of Algorithms and Data structures in becoming a more productive programmer.
2 To understand the Algorithms and Data structures used for solving a problem are much more important than knowing the exact code for it in some programming language.
3 To provide an insight into the intrinsic nature of the problem as well as possible solution techniques, independent of programming language, programming paradigms, computer hardware or any other implementation technique.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Remember the concepts of arrays, pointers, and structures	[R]
CO2	Apply the linear data structures to solve various problems	[AP]
CO3	Implement the complex data structures such as trees	[AP]
CO4	Able to compare, implement and know when to apply sorting and searching algorithm	[AN]
CO5	Understand and apply the concepts of graphs in different scenarios	[AP]
CO6	Develop efficient algorithms for different applications	[C]

Course Contents:

FUNDAMENTALS OF DATA STRUCTURES: Importance of Algorithms and Data Structures, Classification of Data Structures, Introduction to Time and Space Complexity , Asymptotic Notations, Introduction to Array and Pointer implementation, Structures, Recursion. **LISTS, STACKS AND QUEUES:** Abstract Data Type (ADT), The List ADT-Singly, Doubly, Circular Linked List, Stack ADT- Stack operations and its applications, Queue ADT-Queue, Circular Queue, Priority Queue, Applications. **TREES AND HASHING:** Binary Trees, Expression Trees, Tree Traversals, Binary Search Trees, AVL Trees, Hashing, Binary Heap. **SORTING AND SEARCHING:** Sorting-Selection, Insertion, Bubble, Quick, Merge sort, Searching-Linear, Binary. **GRAPHS:**   Graph Traversal, Topological Sort, Shortest Path Algorithms: Dijkstra's Algorithm, Minimum Spanning Tree: Prim's and Kruskal's Algorithm, Applications of graph, Bi-Connectivity.

                                                                                      Total Hours: 75

Lab Component
1. Arrays, Pointers and Structures
2. List ADT
3. Stack ADT
4. Queue ADT
5. Binary Search tree
6. Tree traversal
7. Searching
8. Sorting
9. Minimum Spanning Tree
10. Dijsktra's Algorithm

Text Books:
1 Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein,"Introduction to Algorithms" , Paper Back 2010, Third edition, MIT Press, 2010(Reprint)

2   M. A. Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, 2007

Reference Books:

1   V. Aho, J.E. Hopcroft and J. D. Ullman," Data Strucures and Algorithms", Pearson India, Ist Edition, 2002.
2   Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, "Data Structures using C", Pearson Education Asia, 2009.
3   Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", Thomson Brooks / COLE, 2004.
4   J. Tremblay, P. Soresan, "An introduction to data structures with Applications", McGraw-Hill, 2nd edition, 2007.

Web References:

1   http://www.amazon.in/Data-Structures-Algorithms-Made Easy/dp/0615459811/ref=sr_1_1?ie=UTF8&qid=1474906913&sr=8-1&keywords=karumanchi-C++edition
2   http://www.amazon.in/Data-Structures-Algorithms-Made-Easy/dp/1466304162/ref=sr_1_2?ie=UTF8&qid=1474906913&sr=8-2&keywords=karumanchi-java edition
3   http://nptel.ac.in/courses//106103069/
4   http://web.stanford.edu/class/cs97si/

Online Resources:

1   https://www.coursera.org/learn/data-structures
2   https://www.coursera.org/specializations/data-structures- algorithms
3   http://nptel.ac.in/courses//data-structures

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA1 [6 marks]	CIA2 [6 marks]	Term End Assessment [8 marks]	Rubric based CIA [40 Marks]	
Remember	30	20	20	-	10
Understand	20	0	10	20	10
Apply	50	40	40	20	40
Analyse	0	40	30	30	40
Evaluate	0	0	0	-	0
Create	0	0	0	30	0

16CS205   DIGITAL PRINCIPLES AND SYSTEMS DESIGN   3/0/3/4

Nature of Course: G (Theory analytical)
Pre Requisites: Engineering Physics
Course Objectives:
1. To introduce the principles of digital logic and minimize the logic expression
2. To enable the students to understand the operation of various combinational logic circuits
3. To enable the students to understand the principles of flip flops and to realise one flip flop from another
4. To prepare the students to apply flip flop concepts in designing registers and counters
5. To allow students to design synchronous and asynchronous sequential circuits

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Examine the structures for various number systems , their conversions and use of various logic gates with different input patterns.	[R]
CO2	Understand the various methods to simplify Boolean Functions	[U]
CO3	Explain the conceptual design of Programmable Logic Devices	[U]
CO4	Demonstrate the functionality of various flip flops and the conversion between them	[AP]
CO5	Use the flip flops to design and construct the various types of shift registers and Counters	[AP]
CO6	Analyse and design different combinational logic circuits	[AN]
CO7	Analyse and design different Sequential logic circuits	[AN]
CO8	Construct and test simple logic circuits	[C]

Course Contents:
Introduction: Number Systems- Binary codes – Binary Arithmetic - Boolean algebra - Boolean functions – K Maps **Logic Gates:** Synthesis of Logic Circuits using NAND/NOR gates (Two Level/Multilevel Implementation*).* **Combinational Logic:** Analysis and Design Procedures, Circuits for Arithmetic Operations, Multiplexer, Demultiplexer, Decoder, Encoders, and their use in logic synthesis, Hazards in combinational circuits. **Synchronous Sequential Logic:** Latches, Flip flops, Analysis and Synthesis of clocked sequential circuits, State table reduction..**Registers and Counters:** Registers, Shift Registers, Ripple Counters, Synchronous Counters, Special Counters. **Memory:** RAM-ROM -Memory Decoding. **Programmable Logic Devices:** Programmable Read Only Memory, Programmable Logic Array, Programmable Array Logic .

                                                       Total Hours: 75

Lab Component
1.Realization of Boolean Functions using Logic Gates
2.Analysis and Synthesis of Combinational Logic Circuits
   a)   Code Converter
   b)   Parity Generator and Checker
   c)   Two bit magnitude comparator
   d)   Arithmetic Circuits
   e)   Multiplexer
3.Analysis and Synthesis of Shift Register
4. Analysis and Synthesis of Asynchronous/ Synchronous Counter
5.Testing/Tracing Logic Circuits
6.Schematic Review of Logic Circuits
7.Mini Project

Text Books:
1. M. Morris Mano, Michael D.Ciletti., "Digital Design",5thEdition, Pearson education,2013
2. C. H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2014

Reference Books:
1. Donald D.Givone, "Digital Principles and Design", 7th Edition, McGraw-Hill, 2010.
2. Donald P leach, Albert Paul Malvino, GoutamSaha,"Digital Principles and Application", 8th Edition., McGraw Hill education (India) Private Limited, 2015

Web References:
1. http://nptel.ac.in/course.php?disciplineId=117

Online Resources:
1. http://www.nesoacademy.org/electronics-engineering/digital-electronics/digital
2. http://www.digital.iitkgp.ernet.in/dec/index.php

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	**Continuous Assessment**				**End Semester Examination (Theory) [40 marks]**
	Theory			**Practical**	
	CIA1 [6 marks]	**CIA2 [6 marks]**	**Term End Assessment [8 marks]**	**Rubric based CIA [40 Marks]**	
Remember	20	-	10	-	10
Understand	30	20	20	-	10
Apply	50	40	40	30	40
Analyse	-	40	30	20	40
Evaluate	-	-	-	20	-
Create	-	-	-	30	-

16CS206   **OBJECT ORIENTED PROGRAMMING USING JAVA**   3/0/0/3

Nature of Course   : F (Theory Programming)
Pre requisites   : Problem Solving Techniques and C Programming
Course Objectives:

1 To understand Object Oriented programming concepts like Data Abstraction Encapsulation
2 To analyze different types of constructor, Inheritance and polymorphism
3 To understand and apply package, Interface and Applet concepts
4 To know the fundamental concepts of collection framework and multithreading in solving real world problems

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Identify and reproduce the features of Object Oriented programming paradigm.	[R]
CO2	Interpret the fundamental concepts of collection framework algorithms and its uses.	[U]
CO3	Understand the basis of Package, multithreading, and interface concepts	[U]
CO4	Use I/O functionality to code basic file operations and experiment with exceptions handling.	[AP]
CO5	Apply the concepts of Applets, AWT and Event handling mechanism to solve a given problems.	[AP]
CO6	Analyze the usage of different kinds of inheritance and constructor in real world scenario	[AN]

Course Contents:

Introduction to Object Oriented Programming: Object oriented programming features - Merits and demerits of object oriented methodology – Overview of object oriented programming languages-C++.**JAVA:** Introduction to java programming – Features of java-Classes and objects - Arrays -Methods-Constructor-Access Specifier - Nested Classes-Inner Classes -Command line arguments**. Inheritance, packages and Interface**: Inheritance types-Method overriding - Abstract Classes- Packages-Interfaces-Strings. **Exceptions and I/O handling:** Exception handling fundamentals-I/O basics – Reading console input – Writing console output-Files- **Applets, AWT and Event Handling:** Applet classes-AWT-event handling –multithreaded programming- Collection framework-JDBC Connectivity

                                          Total Hours: **45**

Text Books:
1 Herbert Schildt." The Complete Reference C++" , 5th Edition, MH, 2012.
2 Herbert Schildt, "Java : The Complete Reference", 9th edition, TMH, 2014.
Reference Books:
1 Scott Mayers, Effective Modern C++ ", O'Reilly Media , 1st Edition ,2014
2 Paul Deitel, Harvey Deitel, "Java How To Program", 10th Edition, Prentice Hall Publications,2014.
3 Y. Daniel Liang ,"Introduction to Java Programming", 9th Edition , Prentice Hall Publications ,2015

Web References:

1 http://www.nptel.ac.in
2 http://www.javaworld.com

Online Resources:

1 https://www.coursera.org/learn/c-plus-plus-a
2 https://www.coursera.org/learn/c-plus-plus-b
3 https://www.coursera.org/learn/object-oriented-java
4 https://www.coursera.org/specializations/java-object-oriented

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Online Quiz	**2**
CO2	Understand	Online Quiz	**3**
CO3	Understand	Technical presentation	**3**
CO4	Apply	Group Assignment	**4**
CO5	Apply	Problem Solving	**4**
CO6	Analyze	Test	**4**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60]
	CIA1 [6]	CIA2 [6]	Term End Assessment [8]	
Remember	20	10	10	10
Understand	30	30	20	20
Apply	30	40	40	40
Analyse	20	20	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

16CS305   **OPERATING SYSTEMS LABORATORY**   **0/0/3/2**

Nature of Course: M (Practical Application)

Co Requisites   : Operating Systems

Course Objectives:

1. To design, simulate and debug various functionalities of operating System such as system calls, Process Synchronization Process Scheduling
2. To apply and analyse Deadlock, Memory Management and Disk Scheduling Techniques for real world problems
3. To analyse behaviour of simulation models using GDB debugger

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Demonstrate the use of basic unix commands and shell programming	[AP]
CO2	Apply synchronization techniques to processes	[AP]
CO3	Write programs for disk scheduling, Memory management and File organization Techniques	[AP]
CO4	Practice simple applications using operating system functionalities and debug using GDB debugger.	[AP]
CO5	Analyse the efficiency of CPU Scheduling algorithms	[AN]
CO6	Analyse the efficiency of Deadlock Prevention and avoidance mechanisms.	[AN]

List of Experiments

1. Analysis and Synthesis of Basic Linux Commands
2. Programs using Shell Programming
3. Implementation of Unix System Calls
4. Simulation and Analysis of Non Pre emptive and Pre emptive CPU Scheduling Algorithms
5. i. Simulation of Producer – Consumer Problem using Semaphores
   ii. Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
6. Simulation of Banker's Algorithm for Deadlock Avoidance
7. Analysis and Simulation of Memory Allocation and Management Techniques
8. Implementation of Page Replacement Techniques
9. Simulation of Disk Scheduling Algorithms
10. Implementation of File organization Techniques
11. Design an efficient Traffic Control System to avoid traffic congestion in Metro Cities. Use Process Synchronization, Scheduling, Deadlock and Memory Management concepts to implement the system. Use GDB tool to debug the system designed

                                                          Total Hours   30

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts" 9th Edition, John Wiley, 2013
2. D.M.Dhamdhere, "Operating systems- A Concept based Approach", 2nd Edition, Tata Mc – Graw Hill, 2010.

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson Education/PHI 2014.
2. Gary Nutt, "Operating Systems", 3rd Edition, Pearson Education, 2004.

3. Harvey M. Deital, "Operating Systems", 3rd Edition, Pearson Education, 2004.
4. Tanenbaum,"Modern Operating Systems," , 3rd Edition, Pearson Edition, 2007.

Web References:
1. nptel.ac.in/courses/Web course./Operating%20Systems
2. http://geeksforgeeks.org/Operating Systems/

Online Resources:
1. https://www.udacity.com/course/introduction-to-operatingsystems

Assessment Methods & Levels (based on Bloom'sTaxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment[60 marks] (in %)**	**End Semester Examination [40 marks] (in %)**
Remember	-	-
Understand	-	-
Apply	70	60
Analyse	30	40
Evaluate	-	-
Create	-	-

16CS207   **JAVA PROGRAMMING LABORATORY**   **0/0/3/2**

Nature of Course: K (Problem Programming)
Co Requisites   :   Object Oriented Programming using JAVA
Course Objectives:
1.   To Analyze different kinds of constructor, Inheritance and polymorphism
2.   To know the fundamental concepts of Applet and Multithreading concepts.
3.   To understand the database connectivity concepts using JDBC

Course Outcomes
Upon completion of the course, students shall have ability to

CO1	Understand the usage of Applet and event handling mechanism	[U]
CO2	Demonstrate the use of object oriented concepts in real world problems	[AP]
CO3	Apply the concepts of inheritance, constructor, exception handling	[AP]
CO4	Construct java programs to solve the given problems using basic programming Constructs	[C]
CO5	Develop and debug java programs using Package, multithreading,Exceptions and interface concepts	[C]

List Of Experiments
1.   Implementation of Election Contest using class and object.
2.   Implementation of Toll Booth using Constructors
3.   Develop staff management system for demonstrating the concept of Hierarchial Inheritance.
4.   Implementation of Single and Multilvel Inheritance for library management systems
5.   Implementation of String Operations
6.   Implementation of exception handling mechanism using try and catch block
7.   Design Java Package for numbers. Develop two different classes that belongs to two package, one to check whether the given string is palindrome or not and the other to check whether the given number is odd or even and access these package using one main file
8.   Develop Applet Programming for loading graphic components
9.   Implementation of Action and Mouse events
10. Implementation of tourism information system using JDBC.
11. Implementation of Multi-threading for generation of Prime numbers and Fibonacci Series.

                                                               Total Hours   45
Reference Books:
1.   Herbert Schildt, "Java : The Complete Reference", 9th edition, TMH, 2014
2.   Paul Deitel, Harvey Deitel, "Java How To Program", 10th Edition, Prentice Hall Publications,2014.
3.   Y. Daniel Liang ,"Introduction to Java Programming",9th Edition , Prentice Hall Publications ,2015
Web References:
1.   http://www.nptel.ac.in
2.   http://www.javaworld.com

Online Resources:
1.   https://www.coursera.org/learn/object-oriented-java
2.   https://www.coursera.org/specializations/java-object-oriented

Assessment Methods & Levels (based on Bloom's Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment[60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	-	-
Understand	20	20
Apply	50	50
Analyse	-	-
Evaluate	-	-
Create	30	30

16MA110   **PROBABILITY AND STATISTICS**   **3/2/0/4**

Nature of Course: G (Theory analytical)

Pre Requisites: Linear Algebra and Differential Calculus
Integral Calculus and Computational Methods

Course Objectives:
1. To study the basic probability concepts.
2. To understand and have a well – founded knowledge of standard distributions which can describe real life phenomena.
3. To understand the skills in handling situations involving more than one random variable.
4. To learn the concept of testing of hypothesis

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Apply the probability concepts in solving engineering problems	[U],[AP]
CO2	Use distribution in cluster analysis of similar binary variables.	[U],[AP]
CO3	Use two dimensional random variables to model experiments with two simultaneous outcomes.	[R],[U], [AP]
CO4	Analyze standard score from a given set of data.	[U],[AP]
CO5	Use testing of hypothesis to derive the inference for engineering problems.	[U],[AP]

Course Contents with Course Outcomes/Blooms Taxonomy/Assessment Methods

Probability- Probability concepts-Addition and Multiplication law of probability – Conditional probability - Total probability theorem - Bayes theorem**- Random Variables**- One dimensional random variable - Probability mass function - Probability density function – Discrete and continuous random variables– **Standard distributions**-Discrete distributions - Binomial – Poisson – Geometric – Continuous distributions - Uniform – Exponential - Normal distributions – MGF- Simple problems-**Two dimensional random variables**-Joint distributions - Marginal and conditional distributions – Covariance – Correlation- Regression- Multiple correlation-

Testing of hypothesis- Test statistics for small samples -t-test-F-test, χ^2-test -z- Test statistics for large samples

Total Hours   75

Text Books:
1. Kreyszig. E, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, Singapore, 2014.
2. Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.

Reference Books:
1. Venkataraman. M.K, "Engineering Mathematics", Volume I & II Revised Enlarged 4th Edition", The National Pub. Co., Chennai, 2006.
2. Veerarajan. T, "Engineering Mathematics for first year", 5th edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011.
3. Kandasamy.P ,Thilagavathy.K, Gunavathy.K, "Numerical Methods" , 3rd edition, S Chand & Company Pvt. Ltd, 2013

Web References:
1. http://www.nptel.ac.in/courses/111105035

2. http://www.nptel.ac.in/courses/122104017

3. http://nptel.ac.in/courses/122102009

4. http://freevideolectures.com/Course/2267/Mathematics-I/22

Online Resources:

1. www.edx.org/Probability

2.https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/

3. https://onlinecourses.nptel.ac.in/noc15_ec07/

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Class room or online Quiz	2
CO2& CO3	Understand Apply	Class presentation/Powerpoint Presentation	6
CO4	Apply	Group Activities	6
CO5	Apply	Group Assignment	6

Summative assessment based on Continuous and End Semester Examination

Bloom's Category	Continuous Assessment Tests			Semester End Examination
	CIA1	CIA2	Term Examination	
Remember	20	0	10	10
Understand	30	20	20	10
Apply	50	40	40	40
Analyse	0	40	30	40
Evaluate	0	0	0	0
Create	0	0	0	0

16CS306   **FUNDAMENTALS OF OPEN SOURCE SOFTWARE**   3/0/3/5

Nature of Course: F (Theory Programming)

Course Objectives:
1. To realize the basics of open source software
2. To know the significance of open source software licensing strategies and its tools.
3. To be aware of web basic concepts.
4. To be clear about the concepts in scripting languages
5. To realize the importance of Python and R

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Describe the necessity of open source software.	[R]
CO2	Discuss the efficiency of operating systems.	[U]
CO3	Understand the concepts of web basics.	[U]
CO4	Apply the functionalities scripting languages	[AP]
CO5	Write programs using Python and R	[AP]
CO6	Create an application using R	[C]

Course Contents

Introduction: History and evolution of FOSS - Design Logic, Source Code, Binary Code - Examples of OSS products – Applications, OSS Tools. Classification of FOSS and Licensing: Free Software - Proprietary Software - Other existing Software models -Open Standards - Open Content - Benefits and Shortcoming - Strengths and weakness -Comparison of FOSS and Proprietary software – Licensing : Types of licensing - Commercial License versus Open Source License – OSS Licensing –Types of licenses - licensing strategies. **Web Basics:** web Browsers - Web Servers - Types of Web Pages & its Processing in WWW - HTTP, HTTPS - HTTP Transaction - FTP & its Types. Scripting: HTML, Shell, Awk. **Introduction to Python -R Programming** History and Overview – R Nuts and Bolts- Getting Data In and Out of R- Interfaces to the Outside World- Subsetting R Objects- Vectorized Operations- Dates and Times- Managing Data Frames with the dplyr package-Control Structures- Functions- Scoping Rules of R- Loop Functions- Debugging- Profiling R Code

List of Experiments
1. Cron Scheduling
   - List , edit and remove cron tab entries
   - Prompt before deleting cron tab
   - Schedule a Job for Specific Time
   - Special Strings for Common Schedule & Multiple commands
2. HTML Script
   - Designing a web page using basic commands, tables, forms.
3. Awk Scripts

4. Simple Python programs
   - Addition of 3 numbers using text boxes
   - Multiplication table
   - Factorial of a number
5. R Programming
   - R Nuts and Bolts
   - Reading and Writing data
   - List, Matrix operations
   - Control structures, Functions, Loops
   - Debugging

Total Hours   **75**

Text Books:
1. Kenneth Wong and PhetSayo , "Free and Open Source Software A general Introduction" IOSN APDIP, 2004
2. Wesley J. Chun, "Core Python Programming", Pearson Education , 2012
3. Roger D Peng., "R Programming for Data Science", Lean Publication, 2015

Reference Books:
1. Colin Gillespie, Robin Lovelace, "Efficient R Programming: A Practical Guide to Smarter Programming", O' Reilly Publications, 2016

Web References:
1. https://opensource.com/resources/what-open-source
2. http://freevideolectures.com/blog/2015/05/free-courses-learn-scripting-language/

Online Resources:
1. https://www.coursera.org/learn/interactive-python-1
2. https://www.coursera.org/courses?query=R

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	**Continuous Assessment**			**Rubric Based CIA [40 Marks]**	**End Semester Examination [40 Marks]**
	CIA1 [6 Marks]	**CIA2 [6 Marks]**	**Term End Assessment [8 Marks]**		
Remember	30	30	20	-	-
Understand	70	50	20	-	-
Apply	-	20	60	80	80
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	20	20

16CS307   **DATABASE MANAGEMENT SYSTEMS**   3/0/0/3

Nature of Course   :G (Theory analytical)
Course Objectives:
1. To learn the fundamentals of data models to conceptualize and depict a database system using ER diagram.
2. To understand the relational database implementation using SQL with effective relational database design concepts.
3. To learn the database design procedure for large enterprise database design.
4. To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure
5. To understand the internal storage structures using different file and indexing techniques which will help in physical DB design along with Query optimization techniques.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.	[U]
CO2	Understand the basic issues of transaction processing and concurrency control.	[U]
CO3	Demonstrate with understanding of SQL Programming language and normalization theory.	[AP]
CO4	Practice the query evaluation techniques, query optimization and familiar with basic database storage structures and access techniques.	[AP]
CO5	Analyze and derive an information model expressed in the form of an entity relation diagram and transform into a relational database schema.	[AN]

Course Contents :
Introduction & Data Modelling: Introduction– Characteristics of databases –File systems vs Database systems- Evolution of DBMS – Users of database systems- Three level DBMS Architecture and Data Abstraction- Database system architecture –Designing an enterprise database system- Introductions to data models – Benefits of data model – Phases of data modelling- Entity–Relationship model – E-R Diagrams – Extended E-R Diagram – Evaluating data model quality - The relational Model – Schema – Keys- Relational Algebra – Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations. **Relational Database Design And Querying:** Introduction – Undesirable Properties of Relations – Functional Dependency- Single Valued Dependency Single valued Normalization (1NF, 2NF 3NF & BCNF)- Desirable properties of Decompositions – De-normalization- Client Server database Implementation- SQL fundamentals – Views - Integrity – Procedures, Functions, Cursor and Triggers- Advanced SQL features –Embedded SQL – Dynamic SQL- Transaction Concepts – Transaction model – ACID Properties – Serializability –Transactions as SQL statements. **Storage Techniques And Query Processing:** Introduction – Overview of physical storage media- File structures – Index and Index types – B+ Tree- Hashing – Static Hashing – Dynamic Hashing- Introduction to Query Processing – Issues in query optimization – Steps in query processing - **Database Implementation And Latest Trends:** Distributed database Implementation- Concurrent transactions - Concurrency control – Lock based protocols-

Recovery System – Failure classification.

<div align="right">

Total Hours: 45

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Text Books:
1. Gupta G K, "Database Management Systems", Tata McGraw Hill Education Private Limited, New Delhi, 2011.
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.

Reference Books:
1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 4th Edition , Pearson / Addision wesley, 2007
2. Raghu Ramakrishnan, Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2006
3. Peter rob, Carlos Coronel, "Database Systems – Design, Implementation and Management", 9th Edition, Thomson Learning, 2009.

Web References:
1. http://nptel.ac.in/video.php?subjectId=106106093
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/
3. www.tutorialspoint.com/dbms/

Online Resources:
1. https://www.udemy.com/database-management-system/
2. http://www.nptelvideos.in/2012/11/database-management-system.html
3. https://lagunita.stanford.edu/courses/Engineering/db/2014_1/about
4. http://nptel.ac.in/courses/106106093/
5. https://alison.com/courses/IT-Management-Software-and-Databases
6. https://mva.microsoft.com/en-us/training-courses/database-fundamentals-8243?I=TEBiexJy_5904984
7. http://www.sqlcourse.com/
8. https://www.coursera.org/learn/database-management
9. https://university.mongodb.com/
10. https://www.edx.org/school/mongodbx
11. http://www.edureka.co/mongodb
12. http://www.joyofdata.de/blog/free-and-certified-mongodb-online-courses-mooc/
13. https://www.lynda.com/NoSQL-training-tutorials/1473-0.html
14. https://www.udemy.com/learn-nosql-database-design-from-scratch/
15. https://www.class-central.com/tag/nosql

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Understand	Online Quiz	3
CO2	Understand	Technical Presentation	3

CO3	Apply	Group Assignment	5
CO4	Apply	Group Assignment	5
CO5	Analyse	Surprise Test	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	80	40	40	40
Apply	20	60	40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS308   **COMPUTER ARCHITECTURE**   **3/0/0/3**

Nature of Course   : C (Theory Concept)
Pre requisites   : Computer Hardware, Networks & Storage Management
Course Objectives:
  1   To study the concepts of the basic structure and operation of a digital computer.
  2   To learn the working of different types of arithmetic operations.
  3   To understand the different types of control and the concept of pipelining.
  4   To learn the working of different types of memories.
  5   To understand the different types of communication with I/O devices and standard I/O
      interfaces

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Recognize the design of the various units of digital computers that store and process information via instructions.	[R]
CO2	Review the functionality of all components and connectivity to the Central Processing Unit.	[U]
CO3	Interpret the logic design of fixed-point add, subtract, multiply and divide hardware and instantiating the concepts of fast adders, high speed multiplier, booth multiplier and carry save addition techniques.	[U]
CO4	Distinguish the hazards of pipeling technique and use in high performance processors.	[U]
CO5	Illustrate various memory components and memory mapping techniques including Cache and virtual memory for increasing the memory bandwidth and high performance.	[AP]
CO6	Choose different ways of communication with I/O devices using various interconnection networks including bus structures.	[AP]
CO7	Infer the processor concepts by introducing multi-core, cluster , shared and distributed architecture concepts	[AN]

Course Contents:

Course Contents with Course Outcomes/Blooms Taxonomy/Assessment Methods
Architecture: Functional units, Basic operational concepts, Bus structures, Memory locations and addresses ,Instruction and instruction sequencing, Addressing modes and Assembly language
Arithmetic Unit: Addition and subtraction of signed numbers – Design of Fast adders – Multiplication of signed numbers, Fast multiplication, Integer division, Floating point numbers and operations.**Processing:** Execution of a Complete Instruction, Hardwired Control and Micro Programmed Control. **Pipelining:** Basic Concepts, Data Hazards, Instruction Hazards, Influence On Instruction Sets , Data Path And Control Consideration and Superscalar Operation. Intel Pentium Processor Architecture & Working, Sun Ultra Sparc, Sandiego Super Computer Center**) Memory:** Basic concepts ,Semiconductor RAMs , ROMs ,Cache memories , Performance consideration, Virtual memory and Memory Management requirements**. Multicore Architecture**: Secondary storage Multicore Processors, Centralized and Distributed shared-memory architecture, Cluster computers, Accessing I/O devices, Interrupts,Direct Memory AccessHP Moonshot)

                                                                                      Total Hours: 45

Text Books:

1. Carl Hamachar, Zvonco Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill, 6th Edition 2012.
2. John P. Hayes, Computer Architecture and Organization, McGraw-Hill 3rd edition, 2013

Reference Books:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier, 4th edition 2012.
2. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley Asia 2nd Edition
3. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India, 8th edition , 2012
4. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann, 5th edition 2011
5. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill, 1st edition 2013
6. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House
7. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill reprint 2011

Web References:

1. http://www.hp.com/hpinfo/newsroom/press_kits/2013/hpmoonshot2013/DS_Moonshot_System.pdf
2. https://www.hpe.com/h20195/v2/getpdf.aspx/c04168328.pdf?ver=11
3. http://documents.opto22.com/casestudies/2183_Case_Study_San_Diego_Supercomputer_Center.pdf

Online Resources:

1. https://www.coursera.org/learn/making-architecture
2. https://www.coursera.org/learn/comparch
3. http://nptel.ac.in/video.php?subjectId=106102062
4. http://nptel.ac.in/courses/106102062/

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Online Quiz	**2**
CO2	Understand	Online Quiz	**2**
CO3	Understand	Problem Solving	**3**
CO4	Understand	Class Presentation	**3**
CO5	Apply	Group Assignment	**3**
CO6	Apply	Case Study	**4**
CO7	Analyse	Technical Writing	**3**
Summative assessment based on Continuous and End Semester Examination			

| Bloom's Level | Continuous Assessment | | | End Semester Examination [60 marks] |
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	20	20	10	10
Understand	80	40	40	40
Apply	-	40	30	30
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS309   **DESIGN AND ANALYSIS OF ALGORITHMS**   **3/0/0/3**

Nature of Course   : G (Theory analytical)
Pre requisites   :Problem Solving Techniques and C Programming
                              Data Structures

Course Objectives:
1. To introduce general techniques for analyzing computer algorithms
2. To learn different algorithm design techniques
3. To understand the limitations of Algorithm power

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1:	Recognize general principles and good algorithm design techniques for developing efficient algorithms	[R]
CO2:	Estimate the time and space complexities of algorithms	[U]
CO3:	Apply mathematical preliminaries to the analysis and design stages of different types of algorithms	[AP]
CO4:	Write efficient algorithms	[AP]
CO5:	Compare the time and space complexities of different types of algorithms	[AN]

Course Contents:
Algorithm Analysis: Importance - role of algorithms in computing - Algorithm efficiency - Mathematical analysis for Recursive and Non-recursive algorithms - Empirical analysis of algorithm. **Brute Force Approach:** Selection Sort - Bubble Sort - Sequential Search - String Matching. **Decrease And Conquer Technique:** Insertion sort - Topological sort. **Divide And Conquer Technique:** Merge sort - Quick sort - Binary search - Strassen's Matrix Multiplication.**Dynamic Programming:** Knapsack Problem and Memory functions - Optimal Binary Search Trees - Warshall's and Floyd's Algorithms. **Greedy Technique:** Prims Algorithms - Kruskal's Algorithm - Dijkstra's Algorithm - Huffman Trees and Codes. **Solvability:** Lower-Bound Arguments - Decision Trees - P, NP and NP-Complete Problems. **Backtracking:** n - Queens Problem - Hamiltonian Circuit Problem - Subset Sum Problem. **Branch and Bound Technique:** Assignment Problem - Knapsack Problem - Travelling Salesman Problem. **Approximation Algorithms:** Vertex-cover problem - Travelling Salesman Problem

                                            Total Hours: **45**

Text Books:
1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2012.
2. Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009.

Reference Books:
1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2012.
2. Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009.
3. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms," 2nd Edition, Galgotia Publications, 2008.

4   Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rd Edition, 2008.

Web References:

1   https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

Online Resources:

1   https://www.coursera.org/learn/introduction-to-algorithms
2   https://onlinecourses.nptel.ac.in/noc16_cs04/preview
3   https://www.edx.org/course/algorithms-iitbombayx-cs213-3x

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Online Quiz	**4**
CO2	Understand	Technical presentation	**4**
CO3	Apply	Group Assignment	**4**
CO4	Apply	Group Assignment	**4**
CO5	Analyse	Surprise Test	**4**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA1	CIA2	Term End Assessment	
Remember	10	10	10	10
Understand	20	20	20	20
Apply	40	40	40	40
Analyse	30	30	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

16CS310   **DATABASE MANAGEMENT SYSTEMS LABORATORY**   **0/0/3/2**

Nature of Course   : M (Practical application)
Course Objectives:

1 To learn the fundamentals of data models to conceptualize and depict a database system using ER diagram.
2 To understand the relational database implantation using SQL with effective relational database design concepts
3 To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
4 To understand the internal storage structures using different file and indexing techniques which will help in physical DB design along with Query optimization techniques

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Understand the basics of NoSQL Databases and cloud storage.	[U]
CO2	Sketch ER diagrams for real world applications.	[AP]
CO3	Apply concurrency control and recovery mechanisms for practical problems.	[AP]
CO4	Select suitable SQL commands to manage the database	[AN]
CO5	Design effective Databases for enterprise applications.	[C]

Course Contents :
1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views
7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
8. Application Development using front end tools
9. Document Database creation using MongoDB
10. Study of Cloud Storage

                                            Total Hours: 45

Reference Books:
1 Gupta G K, "Database Management Systems", Tata McGraw Hill Education Private Limited, New Delhi, 2011.
2 Peter rob, Carlos Coronel, "Database Systems – Design, Implementation and Management", 9th Edition, Thomson Learning, 2009.
3 Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition , Pearson/ Addision wesley, 2007.

Web References:
1 http://nptel.ac.in/video.php?subjectId=106106093
2 http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment[60 marks] (in %)**	**End Semester Examination [40 marks] (in %)**
Remember	-	-
Understand	20	20
Apply	40	40
Analyse	20	20
Evaluate	-	-
Create	20	20

16CS311   **ALGORITHMS LABORATORY**   **0/0/3/2**

Nature of Course   : L (Problem experimental)

Course Objectives:

        1   To implement and analyze various design techniques of algorithms

        2   To implement efficient algorithms

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Apply different problem solving techniques to find a solution to a problem	[AP]
CO2	Analyze time and space complexities of algorithms	[AN]
CO3	Compare the time and space complexities of different algorithms designed to solve a problem	[E]
CO4	Propose an efficient algorithm for a problem	[C]

Course Contents:

1. Implement recursive and non-recursive algorithms for an application and analyze the same
2. Implement and analyze Sorting, Searching and String matching algorithms using Brute Force approach
3. Design algorithms using Divide and Conquer technique for different real-world scenarios
4. Use different algorithms find the valuable set of items in a Knapsack. Analyze the same
5. Implement and analyze an algorithm to find the shortest path between every pair of cities using Dynamic Programming
6. Using different algorithms based on Greedy technique, implement and analyze a real world application as the one given below
   Scenario:
   For a large local area network with a lot of switches, implement an algorithm to find the minimum number of packets that need to be relayed across the network and avoid multiple copies of the same packet from arriving via different paths
7. Use suitable algorithms to deal with the following Scenario and analyze the same
   Scenario:
   A vendor car has capacity 'K' kg. There are some bundles having respective weights c_l, c_2, ...,c_n kg which are to be transported by that vendor car. The problem is to pick up those bundles and load them in the car so that the car capacity is maximum utilized, if not fully.
8. Implement an algorithm for the Huffman-tree construction. Analyze the time efficiency class of the algorithm for constructing a Huffman tree as a function of the alphabet's size
9. Implement a suitable Backtracking algorithm to find a tour
   Scenario:
   A person has to travel from island 'A' to another island 'B' crossing 'n' bridges and return to 'A'. A person can plan a walk in such a way that he will cross each of these bridges once but not more than once.
10. Implement a suitable Branch and Bound algorithm to find the shortest tour
    Scenario:
    A robot is involved in cutting the metal surface with laser. The sequence of movements for the robot arm should be minimal.
11. Incorporating the problem solving techniques, develop a mini project

                                                     Total Hours: **45**

Reference Books:

        1   Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson

Publications, 3rd Edition, 2012.

2 Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009.

3 Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms," 2nd Edition, Galgotia Publications, 2008.

4 Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rd Edition, 2008.

5 Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2012.

Web References:

1 https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

Online Resources:

1 https://www.coursera.org/learn/introduction-to-algorithms

2 https://onlinecourses.nptel.ac.in/noc16_cs04/preview

3 https://www.edx.org/course/algorithms-iitbombayx-cs213-3x

Assessment Methods & Levels (based on Bloom's Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	-	-
Understand	-	-
Apply	40	40
Analyse	30	30
Evaluate	20	20
Create	10	10

16MA112   **FOURIER SERIES AND COMPUTATIONAL METHODS**   **3/2/0/4**
                                   (CSE & IT)

Nature of Course   J(Problem analytical)
Pre requisites   Linear Algebra and Differential Calculus
                              Integral Calculus and Laplace Transform

Course Objectives:
1   To study the concept of mathematical formulation of certain practical problems in terms of partial differential equations and solving them for physical interpretation
2   To understand the concept of Fourier series and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data
3   To understand the basics of Z – transform and its applicability to discretely varying functions
4   To study the concept of finding the roots of nonlinear (algebraic and transcendental) equations and solutions of large system of linear equations and Eigen values of the matrix
5   To find numerical solution to partial differential equations

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Recall concepts of partial differential equations, properties of definite integrals and summation of series	[R]
CO2	Formulate certain problems in terms of difference equations and solve them using Z-transform technique	[U]
CO3	Find Fourier series solution to the engineering problems involving partial differential equations	[AP]
CO4	Apply numerical methods to solve algebraic, transcendental and simultaneous equations	[AP]
CO5	Use numerical methods to solve partial differential equations by finite difference method	[AP]

Course Contents:
Partial Differential Equations - Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions- Lagrange's linear equations –Linear homogeneous partial differential equations of second and higher order with constant coefficients- **Fourier series** - Dirichlet's conditions- General Fourier Series – Odd and Even Functions- Half range sine series and cosine series –Parseval's Identity- Harmonic analysis - **Z- Transforms -** Definition - Z-transform of Standard functions-Properties (excluding proof) – **Inverse Z- transform-** Convolution theorem(Statement)- Formation of difference equations- Solution of difference equations using Z-transform Techniques- **Numerical solution to algebraic and transcendental equations**-Regula-Falsi method - Newton-Raphson method –Gauss Elimination method -Gauss Jordan method –Gauss Jacobi method - Gauss Seidel method – Inverse of a matrix by Gauss Jordan method –Eigen value of a matrix by power method-**Numerical solution to PDE**- Finite difference technique-Laplace Equation-Liebmann's Iteration Process-Parabolic Equation –Bender-Schmidt's Difference Equation-Crank-Nicolson's Difference Equation-Hyperbolic Equation

Total Hours: 75

Text Books:
1   Kreyszig. E, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, Singapore, 2014.
2   Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.
3   Grewal B.S., Numerical methods in Engineering and Science. 10th edition, Khanna Publishers, 2014

Reference Books:
1   Veerarajan. T, "Transforms and Partial differential equations", 2rd edition, Tata McGraw-Hill Publishing Company Ltd., reprint,2015
2   Glyn James, ―Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012

3 Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers 2013

Web References:
1 http://nptel.ac.in/courses/122107036/
2 http://nptel.ac.in/video.php?subjectId=122107037
3 http://nptel.ac.in/video.php?subjectId=117102060

Online Resources:
1 https://www.coursera.org/learn/integration-calculus
2 https://alison.com/courses/Strand-5-Higher-Level-Functions-and-Calculus/reviews/649/

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Remember	Class room or online Quiz	2
CO2	Understand	Class presentation/Powerpoint Presentation	4
CO3	Apply	Group Activities	6
CO4& C05	Apply	Group Assignment	8

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination**
	CIA1	CIA2	Term End Assessment	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS312   **THEORY OF COMPUTATION**   **3/0/0/3**

Nature of Course: J (Problem Analytical)

Course Objectives:
1. To have a knowledge of regular languages and context free languages.
2. To have an understanding of finite state and pushdown automata.
3. To make a study of the programming capabilities of Turing machines.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	To know about Regular languages	[U]
CO2	To design Finite automata for different Problems	[AP]
CO3	To apply pumping lemma to Regular languages and Context Free languages	[AP]
CO4	To know about context free languages	[U]
CO5	To design Push down automata and write CFG for different problems	[AP]
CO6	To Know about the properties of Regular languages and Context free languages	[U]

Course Contents

FINITE AUTOMATA: Mathematical preliminaries and notations – Central concepts of automata theory – Finite automata -Deterministic Finite Automata - Nondeterministic Finite Automata – Equivalence of DFA and NFA –Finite Automata with Epsilon transitions - Application of FA. **REGULAR EXPRESSIONS**: Regular languages: Regular Expressions – Finite Automata and Regular Expressions –Applications of Regular Expressions - Regular Grammars. **REGULAR LANGUAGES:** Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata. **CONTEXT FREE GRAMMAR**: Context Free languages: Context Free Grammars – Parse Trees - Ambiguity in Grammars and languages– Applications of Context Free Grammars – Pushdown automata (PDA) – Languages of a PDA -Equivalence of PDA's and CFG's **CONTEXT FREE LANGUAGES:**
Properties of Context Free Languages: Normal Forms (CNF, GNF) for Context Free Grammars - Pumping lemma for CFL's - Closure properties of CFL – **TURING MACHINES:** Turing Machines- Simple examples.

                                        Total Hours   45

Text Books:
1.   J.E.Hopcroft, R.Motwani and J.D Ullman,"Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2011.
2.   J.Martin, "Introduction to Languages and the Theory of Computation", 3rd Edition, TMH, 2007.

Reference Books:
1.   H.R.Lewis and C.H.Papadimitriou,"Elements of the theory of Computation", 2nd Edition, Pearson Education/PHI, 2003
2.   Micheal Sipser, ―Theory and Computatio, 7th Edition, Thomson Course Technology, 2008

Web References:
1.   http://nptel.iitm.ac.in

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Quiz	**2**

CO2	Apply	Assignment	**2**
CO3	Apply	Assignment	**3**
CO4	Understand	Quiz	**3**
CO5	Apply	Team Design	**5**
CO6	Understand	Assignment	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	60	60	60	60
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS208   **MICROPROCESSORS & MICROCONTROLLERS**   **3/0/0/3**

Nature of Course   :G(Theory Concept)
Pre requisites   : Digital Principles and System Design
Course Objectives:

1. To understand the architecture and Instruction set of 8086 and 8051
2. To develop the programming abilities to work on 8086 microprocessor and microcontrollers
3. To know about different peripheral devices and their interfacing to 8051 & ARM Processor
4. To understand the architecture and programming of ARM Processor
5. To apply and understand the principles and working of Arduino Processor.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Understand the operations of microprocessor architecture 8086 and write the assembly language programming	[U]
CO2	Understand the concepts of microcontroller 8051 and apply the programming concepts in microcontroller.	[AP]
CO3	Design 8051 microcontroller and to interface the controller with the external circuits.	[AP]
CO4	Understand the concepts of ARM architecture and interfacing with external circuit.	[U]
CO5	Apply the concepts in developing real time applications using Arduino processor	[AP]

Course Contents:

Organization and architectural features of 8086 microprocessor: The instruction set, Addressing modes; Interrupts, Assembly language programming of 8086. **Microcontroller**: Architecture of 8051, Special Function Registers (SFRs), I/O Pins Ports and Circuits, Instruction set, Interrupts, Assembly language programming. **8051 interfacing** - LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation. **ARM Processor**- The ARM architecture, ARM Bus architecture,ARM7 Processor Fundamentals, ARM Instruction Set, Memory Mapping, The Thumb Instruction Set, Interfacing of sensors, transducers, actuators, A/D and D/A Converters with ARM. **IOT Processors**- Arduino platform Getting started with Arduino,basic programming LCD Display, Arduino Ethernet programming.

                                                        Total Hours: **45**

Text Books:

1. A.K.Ray&K.M.Bhurchandi, "Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing", Third edition, TMH, 2012 Reprint.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, "The 8051 microcontroller and embedded systems", Pearson Education,2006
3. Andrew N.Sloss, Dominic Symes and Chris Wright " ARM System Developer"s Guide : Designing and Optimizing System Software" , First edition, Morgan Kaufmann Publishers, 2004.
4. Simon Monk "Programming Arduino getting started with sketches", The McGraw-Hill, 2012.
5. Douglas V Hall, "Microprocessor and Interfacing", MHI, 2005.

Reference Books:
1. Yu-cheng Liu, Glenn A.Gibson, "Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design", PHI 2003
2. Steve Furber , "ARM System –On –Chip architecture", Addision Wesley, 2000.

Web References:
1. https://www.coursera.org/learn/raspberry-pi-interface/home/welcome
2. http://nptel.ac.in/courses/108107029/
3. http://www.eeherald.com/section/design-guide/esmod.html
4. https://www.edx.org/course/embedded-systems-shape-world-utaustinx-ut-6-03x
5. https://www.udemy.com/mcu_msp430/
6. http://www.multisoftvirtualacademy.com/8051-microcontroller-online-training.php

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Quiz	5
CO2	Apply	Tutorial	5
CO3	Understand	Mini Project	5
CO4	Apply	Coding- Tutorial	5

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	25	0	20	20
Understand	25	30	20	20
Apply	50	50	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	20	20	20

Nature of Course   : C (Theory Concept)
Course Objectives:
   1   To study the concepts of data communications and functions of different layers of ISO/OSI reference architecture
   2   To understand the error detection and correction methods and types of LAN
   3   To study the concepts of sub netting and routing mechanisms.
   4   To understand the different types of protocols and network components.
   5   To study the application protocols and network security

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Understand the fundamentals of data communications and functions of layered architecture.	[U]
CO2	Practice the error detection and correction methods and understand the different network technologies	[AN], [U]
CO3	Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and routing technologies	[AN]
CO4	Understand the transport layer principles and reliable data transfer	[U]
CO5	Understand the application layer protocols and also the use of cryptography and network security	[U]

Course Contents:
Data communications and physical layer: Introduction, history and development of computer networks, networks topologies, ISO/OSI model and protocols. Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B). MAC Layer: Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA. **Data Link Layer:** Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, LAN: Design, specifications of popular technologies, switching, Ethernet, Gigabit Ethernet, Token Ring, Token Bus, Bluetooth, Wi-Fi, Wi-Max, FDDI, PPP, bridging and SDN. **Network layer:** Internet Protocol, IPv6, ARP, DHCP, ICMP, Distance vector routing, Link state routing, Classless Inter-domain routing, RIP, OSPF, BGP, Subnetting, , Network Address Translation. **Transport layer:** UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, Design issues in protocols at different layers, Socket Programming. **Application Layers:** DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW, symmetric and asymmetric key cryptography, Sharing of symmetric keys – Diffie-Hellman key Exchange, Public Key Infrastructure, Public Key Authentication Protocols, Firewalls.

                                                                                              Total Hours: 45

Text Books:
   1   AS Tanenbaum, DJ Wetherall, "Computer Networks", 5th Edition, Prentice-Hall, 2010.
   2   Behrouz A. Forouzan, "Data communication and Networking", 4th Edition, Tata McGraw-Hill, 2007.

Reference Books:
   1   Peterson & Davie, "Computer Networks, A Systems Approach", 3rd Edition, Harcourt, 2013
   2   William Stallings, "Data and Computer Communications", 8th Edition, PHI, 2006

3 Bertsekas and Gallagher "Data Networks, PHI, 2000

4 JF Kurose, KW Ross, "Computer Networking: A Top-Down Approach", 5th Edition, Addison-Wesley, 2009.

5 W Stallings, Cryptography and Network Security, Principles and Practice, 5th Ed., Prentice-Hall, 2010

Web References:

1 https://www.udacity.com/course/computer-networking--ud436

2 http://www.learnerstv.com/Free-Computer-Science-Video-lectures-ltv578-Page1.htm

3 http://freevideolectures.com/Course/3162/Computer-Networking-Tutorial

Online Resources:

1 http://nptel.ac.in/courses/106105082/

2 https://www.free-online-training-courses.com/networking/

3 https://www.youtube.com/watch?v=1eGxPlInj4M

4 http://www.omnisecu.com/basic-networking/index.php

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Understand	Online Quiz	**3**
CO2	Understand, Analyse	Group Assignment	**4**
CO3	Analyse	Case Study	**5**
CO4	Understand	Class Presentation	**4**
CO5	Understand	Class Presentation	**4**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	50	50	60	60
Apply	-	-	-	-
Analyse	50	50	40	40
Evaluate	-	-	-	-
Create	-	-	-	-

16CS314   **ARTIFICIAL INTELLIGENCE**   **3/0/3/4**

Nature of Course   : G (Theory analytical)
Pre requisites   : Discrete Structures
Course Objectives:
1. To understand fundamental concepts in Artificial Intelligence.
2. To understand the problem solving techniques and knowledge representation.
3. To design intelligent components or programs to meet desired needs.
4. To implement, and evaluate a computer-based intelligent systems.

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Recognize the various types and working units of an expert systems	[R]
CO2	Interpret the logic behind the building of knowledge base and knowledge representation.	[U]
CO3	Apply suitable learning methodology while designing systems based on their applications.	[AP]
CO4	Choose various machine learning techniques and to use in various intelligent system designs.	[AN]
CO5	Design problem solving intelligent agents	[C]

Course Contents:

Agents: Intelligent Agents, Agents and environments, The nature of environments, structure of agents, Problem Solving, problem solving agents, example problems, searching for solutions, uninformed search strategies. **Searching techniques:** Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces. Constraint satisfaction problems (CSP), Backtracking search, Adversarial Search, Optimal decisions in games, Alpha – Beta Pruning, games that include an element of chance. **Knowledge Representation:** Introduction to Logical Agents, First order logic, Syntax and semantics for first order logic, Knowledge engineering in first order logic, Inference in First order logic , prepositional versus first order logic , unification and lifting , forward chaining, backward chaining **Learning:** Learning from observations ,forms of learning ,Inductive learning , Learning decision trees ,Ensemble learning , Knowledge in learning ,Logical formulation of learning. Statistical learning, Learning with complete data, Learning with hidden variable, Instance based learning, Artificial Neural networks, Kernel Machines, Information retrieval, Information Extraction.

Lab Component

1.	Depth First search.	[AP]
2.	Best First Search.	[AP]
3.	Travelling sales person problem	[AP]
4.	8-queens problem	[AP]
5.	Genetic Algorithm or Simulated annealing algorithm	[AP]
6.	Simple Expert system using decision tree	[C]
7.	Expert system using supervised learning	[C]

                                                                Total Hours: 75

Text Books:
1 Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2013.
2 Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.

Reference Books:
1 Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.
2 George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 2002.

Web References:
1 http://nptel.ac.in/courses/106106126/
2 http://nptel.ac.in/video.php?subjectId=106105079

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	**Continuous Assessment**				**End Semester Examination (Theory) [40 marks]**
	Theory			**Practical**	
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	**Rubric based CIA [40 Marks]**	
Remember	20	10	10	-	10
Understand	60	30	20	20	20
Apply	20	30	30	20	30
Analyse	-	30	40	30	40
Create	-	-	-	30	-

16CS209   **MICROPROCESSOR LABORATORY**   **0/0/3/2**

Nature of Course   : L (Problem experimental)
Course Objectives:
   1   To understand the basic programming of Microprocessors and Micro Controllers.
   2   To solve various real time problems using Micro controllers and Micro – processors.

Course Outcomes:
Upon completion of the course, students shall have ability to
   CO1   Write the assembly language programming using 8086 Microprocessor.   [AP]
   CO2   Able to program using 8051 microcontroller and Interface 8051 with other devices.   [AP]
   CO3   Program using ARM and to do interfacing with external circuit.   [AP]
   CO4   Solve real time problems using Arduino Processor.   [C]

Course Contents:
   1.   Assembly Language programs using 8086.
   2.   Assembly Language programs using 8051.
   3.   Stepper motor control using 8086 Microprocessor.
   4.   Sensor Interfacing using 8051 Micro controller.
   5.   Interfacing 8051 with ADC.
   6.   Basic Programming with Arduino Kit
   7.   Design of a Traffic light controller with Arduino.
   8.   Design a Simple chat Server using Arduino.
   9.   Basic programming using ARM Processor.
   10. Interfacing with seven segment display using ARM.

                                                            Total Hours: 45

Reference Books:
   1   A.K.Ray&K.M.Bhurchandi, "Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing", Third edition, TMH, 2012 Reprint.
   2   Mohamed Ali Mazidi, Janice GillispieMazidi, "The 8051 microcontroller and embedded systems", Pearson Education,2006.
   3   Andrew N.Sloss, Dominic Symes and Chris Wright " ARM System Developer"s Guide : Designing and Optimizing System Software" , First edition, Morgan Kaufmann Publishers, 2004.
   4   Simon Monk "Programming Arduino getting started with sketches", The McGraw-Hill, 2012.
   5   Yu-cheng Liu, Glenn A.Gibson, "Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design", PHI 2003
   6   Steve Furber , "ARM System –On –Chip architecture", Addision Wesley, 2000.

Web References:
   1   https://www.coursera.org/learn/raspberry-pi-interface/home/welcome
Online Resources:
   1   http://nptel.ac.in/courses/108107029/

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [60 marks] (in %)**	**End Semester Examination [40 marks] (in %)**
Remember	-	-
Understand	-	-
Apply	80	80
Analyse	-	-
Evaluate	-	-
Create	20	20

16CS315   **COMPUTER NETWORKS LAB**   **0/0/3/2**

Nature of Course   : L (Problem experimental)
Course Objectives:
    1 To learn socket programming
    2 To study and learn the network simulation tools
    3 Hands-on Experience on various networking protocols and tools

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Implement various networking protocols using sockets	[AP]
CO2	Analyse the performance of the protocols and algorithms in different layers	[AN]
CO3	Ability to implement algorithms in simulation tools	[E]
CO4	Analyse the network performance using tools and apply the solutions to the problems incurred	[AP]

Course Contents:

1. Study of system administration and network administration
2. Study of socket programming and client server model using UDP and TCP
3. Implementation of Sliding window protocol and stop and wait protocol
4. Write a code simulating PING and TRACEROUTE commands
5. Applications using TCP Sockets like
    a. File transfer
    c. Remote command execution
    d. Chat
    e. Concurrent server

6. Create a socket for HTTP for webpage upload and download
7. Implementation of Subnetting
8. Applications
    a. DNS
    b. SNMP
9. Study of Network Simulator(NS)
10. Study of Wire Shark Tool for SDN and Hypervisor for Network Virtualization.
11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
    i. Link State routing ii. Flooding iii. Distance vector

                                    Total Hours: 45

Reference Books:
    1 Craig Hunt, " TCP/IP Network Administration ", O'Reilly Media, 3rd Edition 2002
    2 Kenneth L. Calvert, Michael J. Donahoo, "TCP/IP Sockets in Java: Practical Guide for Programmers" , Imprint: Morgan Kaufmann 2008
    3 Elliotte Rusty Harold, "Java Network Programming, Developing Networked Applications", O'Reilly Media, 2013
    4 Esmond Pitt, "Fundamental Networking in Java", Springer.
    5 James F. Kurose, Keith W. Ross, "Computer Networking: A Top-down Approach, Pearson Education, Limited, 6th edition,2012

Web References:	
1	Spoken-tutorial.org

Online Resources:

1	https://www.coursera.org/learn/object-oriented-java
2	http://nptel.iitm.ac.in

Assessment Methods & Levels (based on Bloom's Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	-	-
Understand	10	10
Apply	40	40
Analyse	30	30
Evaluate	20	20
Create	-	-

Nature of Course   : D (Theory-Design)
Pre requisites   : Theory of Computation
Course Objectives:
1. To understand, design and construct a lexical analyzer and parser.
2. To employ code generation schemes.
3. To perform optimization of codes and gain knowledge about runtime environments.
4. To use Lex and YACC tools.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Design a lexical analyzer to identify the tokens in a program	[AP]
CO2	Construct a parser through the application of grammar.	[AP]
CO3	Understand intermediate code generation and symbol table organization techniques	[U]
CO4	Design a compiler for a small language with code generation and optimization strategies.	[AP]

Course Contents:
Introduction to compilers : Phases of a compiler; Cousins of the Compiler; Grouping of Phases; Compiler construction tools **Lexical Analysis :** Role of Lexical Analyzer ; Input Buffering; Specification of Tokens; Recognition of Tokens A language for Specifying Lexical Analyzer; Finite Automata - From a regular expression to an NFA and DFA. **Syntax analysis :** Role of the parser; Writing Grammars; Context-Free Grammars; Top Down parsing ; Recursive Descent Parsing ; Predictive Parsing ; Bottom-up parsing ; Shift Reduce Parsing ; LR Parsers; SLR Parser; Canonical LR Parser ; LALR Parser; YACC- parser generators. **Intermediate code generation:** Syntax- Directed definitions; Construction of Syntax Trees; Intermediate languages ; Declarations ; Assignment Statements; Boolean Expressions; Case Statements ; Back patching; **Type Checking:** Type system; Type checker; Type expression ;Type conversion. **Code generation :** Issues in the design of code generator ; The target machine ; Runtime Storage management; Basic Blocks and Flow Graphs ; A simple Code generator ; DAG representation of Basic Blocks; peephole optimization. **Code optimization:** Principal Sources of Optimization; Optimization of basic Blocks; Loops in flow graph.

                                              Total Hours: 60

Text Books:
1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, Monica S. Lam,"Compilers Principles, Techniques and Tools" , 2nd Edition, Pearson Education Asia, 2008.

Reference Books:
1. Allen I. Holub," Compiler Design in C", Prentice Hall of India, 2003.
2. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", 1st Edition,Benjamin Cummings, 2010.
3. J.P. Bennet ,"Introduction to Compiler Techniques", 2nd Edition, Tata McGraw- Hill, 2003.
4. HenkAlblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
5. Kenneth C. Louden,"Compiler Construction: Principles and Practice",2nd Edition,Thompson Learning, 2003.

Web References:
1. gatecse.in/category/compiler-design/
2. www.tutorialspoint.com/compiler_design

Online Resources:
1 http://nptel.ac.in/syllabus/syllabus.php?subjectId=106108113
2 nptel.ac.in/courses/106104123/

Assessment Methods & Levels (based on Bloom'sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Apply	Tutorial	**5**
CO2	Apply	Quiz	**5**
CO3	Understand	Case Study	**5**
CO4	Apply	Group assignment	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	40	20	40	40
Apply	60	80	60	60
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS317   **SOFTWARE DEVELOPMENT**   **3/0/0/3**

Nature of Course   :G (Theory)
Pre requisites   : Object Oriented Programming using Java
Course Objectives:

1   To discuss the essence of agile development methods.

2   Carry out all stages of an agile software process in a team, to produce working software.

3   Provide practical knowledge of how to manage a project using Scrum framework.

4   Use testdriven development to ensure software quality.

5   Should be able to demonstrate a more advanced capability to apply lean and agile development techniques to solve complex problems.

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Understand the background and driving forces for taking an Agile approach to software development.	[U]
CO2	Understand the business value of adopting Agile approaches.	[U]
CO3	Understand the Agile development practices.	[U]
CO4	Drive development with unit tests using Test Driven Development.	[AP]
CO5	Apply design principles and refactoring to achieve Agility.	[AP]
CO6	Deploy automated build tools, version control and continuous integration	[AP]
CO7	Perform testing activities within an Agile project.	[U]

Course Contents :

Fundamentals of Agile: 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

Agile Scrum Framework: 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

Agile Testing: 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.

Agile Software Design and Development: 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.

Industry Trends: 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 Hours: **45**

Text Books:

1. Ken Schawber, Mike Beedle," Agile Software Development with Scrum", Pearson Education.
2. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams" , Addison Wesley.

Reference Books:

1. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall.
2. Alistair Cockburn, "Agile Software Development: The Cooperative Game",Addison Wesley
3. Mike Cohn , "User Stories Applied: For Agile Software", Addison Wesley

Web References:

1. www.it-ebooks.info/tag/agile

2. http://martinfowler.com/agile.htmlwww.tutorialspoint.com/dbms/

Online Resources:

1. www.umsl.edu/~sauterv/analysis/Fall2013Papers/Buric/-5-references.html
2. https://www.codeproject.com › Development Lifecycle › Design and Architecture
3. https://www .agilemethodology.org
4. https://www.versionone.com › Agile 101
5. https://www .scrummethodology.com

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Online Quiz	3
CO2	Understand	Technical Presentation	3
CO3	Apply	Group Assignment	3
CO4,CO5	Apply	Group Assignment	4
CO6	Apply	Case study	4
CO7	Understand	Online Quiz	3

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	-	-	-	-
Understand	80	40	40	40
Apply	20	60	40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS318   **DATA ANALYTICS**   **3/0/0/3**

Nature of Course   : G (Theory analytical)

Course Objectives:

- To introduce different kinds and sources of Big data
- To provide an insight to different data analytics techniques
- To explore mining hidden structures in big data
- To study and evaluate dimensionality reduction for big data

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Explore kinds of big data and statistical analysis techniques on big data	[R]
CO2	Understand the concepts behind data preparation and dimensionality reduction techniques	[U]
CO3	Understand techniques for mining similar items, frequent itemsets and data streams	[U]
CO4	Explore big data analytics frameworks such as Hadoop Ecosystem and Spark architecture and apply for few case studies	[AP]

Course Contents:

Introduction to big Data: Sources of Big data, Characterstics, Challenges and applications and case studies. **Statistical analysis and modelling**: Mean, Covariance, Correlation , Sampling distributions, random variables and probabilities - Probability Theory – Bayes Theorem **Graphical models:** Bayesian Learning. **Data Preparation**, Dimensionality reduction techniques : Principal Componenet Analysis , Singular Value Decomposition. **Hadoop Ecosystem for Big Data** – Hadoop Architecture, HDFS -Algorithms using Map Reduce Framework –– Hbase – Hive- MongoDB. Scalable Machine Learning, Mahout for Machine Learning , **Introduction to Spark Architecture**- Analyzing big data- Case studies. **Finding similar items:** distance measures, Locality sensitive hashing- applications. **Mining frequent itemsets:** Market –basket model, A-priori algorithm, Limited pass algorithms. **Mining data streams:** sampling, filtering, counting distinct elements, counting frequent items in a stream Case study: recommendation systems

                                                Total Hours: **45**

Text Books:

1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.

2. Mic hael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013

Reference Books:

1. Bart Baesens , "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2014

2. Bill Franks, "Taming the Big Data Tidal Wave: Finding pportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012

Online Courses
1. https://www.edx.org/course/subject/data-analysis- statistics
2. https://www.coursera.org/browse/data-science/data- analysis?languages=en
3. http://online-learning.harvard.edu/course/big- data-analytics

Web References
1. https://bigdatauniversity.com/
2. http://www.statistics.com/data-analytics- courses
3. www.ibm.com/Data Analytics/

Assessment Methods & Levels (based on Bloom'sTaxonomy)			

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Remember	Quiz	**5**
CO2	Understand	Writing Skills	**5**
CO3	Understand	Class Presentation	**5**
CO4	Apply	Group Assignment	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	20	20	20	20
Understand	80	60	40	40
Apply	-	20	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Nature of Course   : C(Theory Concept)

Course Objectives:
1   To understand the basic concepts of virtualization and cloud infrastructure.
2   To allow students to design and configure virtual data centre environment.
3   To identify the various cloud models, services and solutions.
4   To learn about procedure to implement virtual data centre environment.
5   To enable the knowledge of Next generation Data center technologies and Cloud API's .

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Describe the characteristics of virtualization and cloud infrastructure.	[R]
CO2	Classify and explain the functions of virtual data centers and cloud computing.	[U]
CO3	Design cloud infrastructure management services and security policies.	[AP]
CO4	Apply configuration procedure to implement virtual data centre environment.	[AP]
CO5	Integrate the Next generation Data center technologies and Cloud API's .	[AN]

Course Contents:
Journey to the Cloud:Drivers for cloud computing, cloud definition and characteristics, building cloud infrastructure –a phased approach from Classic data center to virtual data center to Cloud, virtualization and its benefits.**Introduction to Data Centers:** Key elements of data center - application, DBMS, compute, storage and network, server clustering, RAID technology, intelligent storage system. **Virtualized Data Center (VDC) – Compute:** Compute virtualization benefits, hypervisor types, virtual machine (VM) and its resources, VM resource management, physical to virtual conversion – process, benefits and considerations. **Virtualized Data Center – Storage:** Storage virtualization benefits, storage for VMs, block and file level storage virtualization, virtual provisioning – benefits and best practices, storage tiering.**Virtualized Data Center – Networking:** Network virtualization benefits, VDC network infrastructure components, VLANs, and Network traffic management techniques.**Virtualized Data Center – Desktop and Application:** Desktop, application, and user state virtualization – benefits, tools, and deployment methods. **Cloud Computing Primer:** Cloud computing characteristics, cloud deployment models – private, public, hybrid and community cloud, cloud services – SaaS, PaaS, and IaaS, cloud economics and challenges. **Public Cloud Services:** Amazon Web Services (AWS): cloud computing with AWS, Amazon Elastic Compute Cloud (Amazon EC2), Amazon Simple Storage Service (Amazon S3), big data on AWS; Google's cloud solutions.
Advance Topics in Cloud Computing: Introduction to big data analytics, using MapReduce/Hadoop for analyzing unstructured data, Hadoop ecosystem of tools.

                                                                          Total Hours: 45

Text Books:
1   Cloud Infrastructure and Services Participant Guide Volume 1 & 2 (EMC Education

Services,Oct 2011)

2. M. Haines, S. Kaplan, D. Epping and B. Lin," Cloud Computing with VMware vCloud Director" (Short Topics in System Administration) (Kindle eBook, 2011, ISBN 978-1-931971-83-6)

3. S.R. Smoot and N. K. Tan," Private Cloud Computing: Consolidation, Virtualization, and Service-Oriented Infrastructure" (Elsevier, 2012, ISBN: 978-0-12-384919-9)

4. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, "Mastering in Cloud", MHI, 2013

Reference Books:

1. J. Rhoton, R Haukioja,"Cloud Computing Architected: Solution Design Handbook" (Recursive Press, 2011, ISBN 978-0-9563556-1-4)

2. T. Petrocelli,"Data Protection and Information Lifecycle Management"(Prentice Hall, 2006, ISBN 0131927574)

Web References:

1. http://www.brainbell.com/tutors/A+/Hardware/Preventive_Maintenance.htm

2. http://www.technologystudent.com/elec1/dig1.htm

Online Resources:

1. https://www.edx.org/course/introduction-cloud-infrastructure-linuxfoundationx-lfs151-x

2. https://www.edx.org/course/clep-information-systems-computer-upvalenciax-sc101-2x

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Quiz	**2**
CO2	Understand	Quiz	**3**
CO3	Understand	Group Assignment	**5**
CO4	Apply	Problem solving	**5**
CO5	Analyse	Technical Presentation	**5**

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	40	30	30	30
Understand	60	50	40	40
Apply	-	20	20	20
Analyse	-	-	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

16CS320   **COMPILER DESIGN LABORATORY**   **0/0/3/2**

Nature of Course   :L (Programming)
Course Objectives:
1   To learn the concept of token separation.

2   To study the working of LEX and YACC tools.

3   To understand the construction of various types of parsers.

4.   To understand the various phases of compilers.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Implement a lexical analyzer which generates tokens for C statements using C and LEX tool	[AP]
CO2	Implement syntax Analyzers using C and YACC tool	[AP]
CO3	Construct Symbol table using C Language	[AP]
CO4	Implement Front end and Back end of a compiler for simple C statements	[AP]

Course Contents:
1. Implementation of lexical analyzer using C.
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. Implementation of a parser using LEX and YACC.
5. Implementation of symbol table
6. Implementation of Predictive parsing.
7. Implementation of Shift Reduce Parsing Algorithm.
8. Implementation of LR parsing.
9. Implement the front end of a compiler that generates the 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 the back end of the compiler which takes the 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. Implementation of the code optimizer phase of a compiler that eliminates dead code and common sub-expressions.

Total Hours: 45

Reference Books:
1   Alfred Aho, Ravi Sethi, Jeffrey D Ullman, Monica S. Lam,"Compilers Principles, Techniques and Tools" , 2nd Edition, Pearson Education Asia, 2008.
2   C. N. Fischer and R. J. LeBlanc," Crafting a compiler with C", 1st Edition, Benjamin Cummings, 2008.

Web References:
1   www.geeksforgeeks.org/gate-corner/
2   gatecse.in/category/compiler-design/

Online Resources:
1   http://nptel.ac.in/syllabus/syllabus.php?subjectId=106108113

Assessment Methods & Levels (based on Bloom'sTaxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment[40 marks] (in %)**	**End Semester Examination [60 marks] (in %)**
Remember	-	-
Understand	20	20
Apply	80	80
Analyse	-	-
Evaluate	-	-
Create	-	-

16CS321   **CASE TOOLS LABORATORY**   **0/0/3/2**

Nature of Course   : M (Practical application)

Course Objectives:

1   To understand and apply the principles of agile software development
2   To use CASE tools for software development
3   To model a system using different diagram
4   To test any application

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Understand the Agile development practices.	[AP]
CO2	Deploy automated build tools, version control and continuous integration.	[C]
CO3	Perform testing activities within an Agile project.	[AN]
CO4	Drive development with unit tests using Test Driven Development.	[AP]

Course Contents :

1.   Understand a given business scenario and identify product backlog, user stories and sprint tasks
2.   Define user stories for a given feature
3.   Fill user stories, sprint schedule and sprint tasks in an Agile tool such as AgileFant
4.   Write unit tests aligned to xUnit framework for TDD
5.   Refactor a given design for next sprint requirements
6.   Execute continuous integration using a tool such as Jenkins

Total Hours: 45

Reference Books:

1   Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson
2   Lisa Crispin, Janet Gregory, **"**Agile Testing: A Practical Guide for Testers and Agile Teams**",**Publisher: Addison Wesley

Web References:

1   www.it-ebooks.info/tag/agile
2   http://martinfowler.com/agile.html
3   www.tutorialspoint.com/dbms/

Assessment Methods & Levels (based on Bloom'sTaxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment[60 marks] (in %)**	**End Semester Examination [40 marks] (in %)**
Remember	-	-
Understand	20	20
Apply	40	40
Analyse	20	20
Evaluate	-	-
Create	20	20

16CS322   **CLOUD AND DATA ANALYTICS LABORATORY**   **0/0/3/2**

Nature of Course   : L (Problem experimental)
Course Objectives:
1 To familiarize big data concepts and how it is applied for business
2 To deploy modern tools for big data analysis

Course Outcomes:
Upon completion of the course, students shall have ability to
CO1 To provide an overview of knowledge used in manipulating, storing, and analyzing big data.   [E]
CO2 Analyse the fundamentals and operating mechanisms of Hadoop   [AN]
CO3 To apply the learning specific problems in various domains   [AP]

Course Contents:
1. Deploy the Hadoop tool and use its function for analysing data
2. Deploy Oracle NoSQL database and process unstructured data
3. Demonstrate the functions of HIVE tool
4. Process a market based sample data set using HBase
5. Implement Simple consumer functions using R programming
6.Make Intelligent Business Decisions using Association Rule mining using R programming

7. Forecast the consumer behaviour using Simple linear regression with Hadoop

8. Cluster the customers based on buying behaviour using HIVE/Hadoop

9. Case Studies of web click stream data
 eg.how many times the particular link in particular site has been referred
10. Case Studies on student selecting higher education
 eg.how many students in engineering or opting for higher studies
11.Case studies on tweets classification in social media
eg.the nature of tweets positive,negative or neutral based on pattern of words

                                                            Total Hours: 30
Softwares Required:

Oracle NoSQL database,R for windows/Linux,Hadoop,Oracle Big data Connectors,R Studio,
Oracle R Enterprise

Reference Books:
1 Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013..
2 Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012.
3 Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", 1st Edition, Wiley and SAS Business Series, 2012.
4 Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012

Web References:

1 http://www.coreservlets.com/hadoop-tutorial/
2 http://www.javatpoint.com/hive
3 https://www.tutorialspoint.com/hbase/
4 http://www.javatpoint.com/nosql-databases

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	-	-
Understand	-	-
Apply	40	40
Analyse	40	40
Evaluate	20	20
Create	-	-

Nature of Course   : D (Theory Application)
Pre requisites   : Microprocessors & Microcontrollers
Course Objectives:
1 To understand the fundamentals of Internet of Things.
2 To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
3 To apply the concept of Internet of Things in the real world scenario

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Attain the fundamental knowledge of Internet of Things	[U]
CO2	To build IoT systems using Raspberry Pi,Arduino,Galileo	[AP]
CO3	To design and develop a real world IoT systems	[AP]

Course Contents:

FUNDAMENTALS OF IOT   **-** Introduction – Characteristics - Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M. **IOT DESIGN METHODOLOGY -** IoT systems management – IoT Design Methodology – Specifications Integration and Application Development - **BUILDING IOT WITH RASPBERRY PI -** Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services -   **BUILDING   IOT WITH GALILEO/ARDUINO -** Intel Galileo Gen2 with Arduino - Interfaces - Arduino IDE – Programming APIs and Hacks Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT **CASE STUDIES and ADVANCED TOPICS -** Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT.

Total Hours: 45

References:

1.   Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands - on approach", Universities Press, 2015.

2.   Cuno Pfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011.

3.   Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.

4.   Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.

5.   A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", VPT publisher, 2014.

6.   A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.

Web References:

1 www.ptc.com › Internet of Things (IoT)
2 http://wwwusers.di.uniroma1.it/~spenza/files/labIoT2015/Lab-IoT-1.pdf

Online Resources:

1 http://www.iotlab.eu/
2 http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/

Assessment Methods & Levels (based on Blooms'Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Understand	Online Quiz	3
CO2	Apply	Group Assignment	2
CO3	Apply	Mini Project	15

Summative assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment | | | End Semester Examination [60 marks] |
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	50	40	40	40
Apply	50	60	60	60
Analyse				-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS324 **WEB TECHNOLOGY** 3/0/0/3

Nature of Course   :F (Theory Programming)
Pre requisites   : FUNDAMENTALS OF OPEN SOURCE SOFTWARE
Course Objectives:
1   To understand the communication between web browsers and servers as well as how information is displayed by browser using HTML and CSS.
2   To learn the basics of Networking using Java.
3   To learn about Data representation in web using XML.
4   To illustrate how the web technologies interact with each other using JSP and Servlets.

Course Outcomes:

Upon completion of the course, students shall have ability to
CO1   Explain the history of the internet and related internet concepts.   [R]
CO2   Understand, analyse and create interactive web pages using HTML and Cascading Styles sheets.   [U]
CO3   Understand the networking concepts using Java programming.   [U]
CO4   To acquire knowledge of XML fundamentals and usage of XML technology.   [U]
CO5   To design and develop web based systems using technologies like JSP, Servlet.   [AP]

Course Contents:
Web Essentials: History of Web and Internet – HTTP Request and Response Message – Introduction to Client – Server Computing: Web Client – Web Servers. Mark-up Languages: Traditional HTML and XHTML: History – Basic HTML Syntax and Semantics – Some Fundamental HTML Elements – Lists – Tables – Forms – HTML5 Document Structure Changes. Style Sheets: CSS3 Emerging Features – Case Study. **Java Network Programming:** Looking up Internet Address – Socket programming – Client/Server programs – E – mail client – SMTP – POP3 programs – web page retrieval. **Web Data Representation:** XML – Documents and Vocabularies – Namespaces. JavaScript and XML: Ajax - DOM based XML processing Event – oriented Parsing: SAX – Transforming XML Documents – Displaying XML Documents in Browsers. **Java Servlets** - Architecture – Overview – A Servlet – Generating Dynamic Content – Life Cycle – Handling HTTP GET and POST Requests – Parameter Data – Sessions – Cookies – URL Rewriting - Other Capabilities – Multi – Tier Application (JDBC) – Case Study – Related Technologies. **JSP:** Introduction to Java Server Page (JSP) – JSP and Servlets - JSP Applications – Basic JSP - JavaBeans Classes and JSP - Model – View – Controller Paradigm – Case Study

Total Hours: 45

Text Books:
1   Thomas a Powell, 'HTML & CSS: The Complete Reference', 5th Edition, Tata Mcgraw Hill Education Private Limited, 2010.
2   Elliotte Rusty Harold, 'Java Network Programming', 4th Edition , O'Reilly Publishers, 2014.
3   Deitel Deitel Goldberg, 'Internet and World Wide Web – How to program', 4th Edition, Prentice Hall Publishers, 2009.

Reference Books:

1. Herbert Schildt, 'The Complete Reference – Java2', Tata McGraw – Hill, 9th Edition, 2015.
2. Black Book, 'Java Server Programming', Dreamtech Press, 2008.

Web References:

1. http://www.w3schools.com/
2. http://www.webbasedprogramming.com.
3. https://xwss.java.net/

Assessment Methods & Levels (based on Bloom'sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Quiz	**5**
CO2	Understand	Coding	**3**
CO3	Understand	Class Presentation	**2**
CO4	Understand	Tutorial	**5**
CO5	Apply	Group Project	**5**

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS325   **INTERNET OF THINGS LABORATORY**   **0/0/3/2**

Nature of Course   : L (Problem Experimental)
Course Objectives
1. To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
2. To apply the concept of Internet of Things in the real world scenario

Course Outcomes

Upon successful completion of this course, the student will be able to:
CO1   Attain the fundamental knowledge of Internet of Things   [AP]
CO2   To build IoT systems using raspberry pi/arduino/Galileo   [C]
CO3   To design and develop a real world IoT systems   [C]

COURSE CONTENTS:

1.   Design and development of CO_2 Emission identification
2.   Design and development of Automatic Irrigation system
3.   Design and Development of Theft Identification alert system
4.   Design and Development of health abnormal alert system

Reference Books:
1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands - on approach", Universities Press, 2015.
2. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
3. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
4. A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", VPT publisher, 2014.
5. Cuno Pfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011.
6. A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.

Web References:
1. https://learn.sparkfun.com/tutorials/iot-hobby-kit-experiment-guide
2. https://www.iot-experiments.com

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [60 marks] (in %)**	**End Semester Examination [40 marks] (in %)**
Remember	-	-
Understand	-	-
Apply	40	40
Analyse	-	-
Evaluate	-	-
Create	60	60

16CS326   **WEB TECHNOLOGY LABORATORY**   **0/0/3/2**

Nature of Course   :L (Problem experimental)

Course Objectives:
1. To create simple static Web pages using HTML and CSS.
2. To understand the working of network using Java Network Programming
3. To understand the XML, DOM and XML
4. To create dynamic web pages using server side scripting like servlets and JSP.

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Understand various web technologies	[U]
CO2	Understand hierarchy of objects in HTML and XML and create effective websites	[U]
CO3	Create fully functional website using Model - View – Controller (MVC) architecture	[C]

Course Contents:

1. Create a web page of an online Book store using HTML.

2. Create a web page with all types of Cascading style sheets.

3. Client/Server programs using Java.

4. Programs using XML – Schema – XSLT/XSL and AJAX

5. Write programs in Java using Servlets:

- To invoke servlets from HTML forms

6. Create three-tier applications using JSP and Databases

- for conducting on-line examination.

- for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.

7. Develop a fully functional website (Online book store).

                                          Total Hours: **45**

Reference Books:
1. Thomas a Powell, 'HTML & CSS: The Complete Reference', 5th Edition, Tata Mcgraw Hill Education Private Limited, 2010.
2. Elliotte Rusty Harold, 'Java Network Programming', 4th Edition , O'Reilly Publishers, 2014.
3. Deitel Deitel Goldberg, 'Internet and World Wide Web – How to program', 4th Edition, Prentice Hall Publishers, 2009.
4. Herbert Schildt, 'The Complete Reference – Java2', Tata McGraw – Hill, 9th Edition, 2015.
5. Black Book, 'Java Server Programming', Dreamtech Press, 2008.

Web References:
1. http://www.w3schools.com/
2. http://www.webbasedprogramming.com.
3. https://xwss.java.net/

Assessment Methods & Levels (based on Bloom'sTaxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment[60 marks] (in %)**	**End Semester Examination [40 marks] (in %)**
Remember	-	-
Understand	20	20
Apply	-	-
Analyse	-	-
Evaluate	-	-
Create	80	80

Nature of Course   :C (Theory Concept)

Course Objectives:

1. To study about Wireless networks, protocol stack and standards.
2. To study about fundamentals of 3G Services, its protocols and applications.
3. To study about evolution of 4G Networks, its architecture and applications

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Categorize the latest 3G / 4G and WiMax networks and its architecture.	[U]
CO2	Implement wireless network environment for any application using latest wireless protocols and standards.	[AP]
CO3	Implement different type of applications for smart phones and mobile devices with latest network strategies.	[AP]

Course Contents:

WIRELESS LAN-Introduction,WLAN technologies: Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security , IEEE802.16,WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX. **MOBILE NETWORK LAYER-**Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6,Network layer in the internet, Mobile IP session initiation protocol , mobile ad,hoc network: Routing, Destination Sequence distance vector, Dynamic source routing. **MOBILE TRANSPORT LAYER -**TCP enhancements for wireless protocols , Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility , Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP , TCP over 3G wireless networks**. WIRELESS WIDE AREA NETWORK-**Overview of UTMS Terrestrial Radio access network,UMTS Core network Architecture: 3G,MSC, 3G,SGSN, 3G,GGSN, SMS,GMSC/SMS,IWMSC, Firewall, DNS/DHCP,High speed Downlink packet access (HSDPA), LTE network architecture and protocol. **4G NETWORKS -**4G vision – 4G features and challenges , Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM,MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

                                                               Total Hours: **45**

Text Books:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.
2. Vijay Garg , "Wireless Communications and networking", First Edition, Elsevier 2007.

Reference Books:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.
2.   Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.
3.   Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition,Pearson Education, 2013

Web References:

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=117999903
2. http://nptel.ac.in/courses/106105081/23

Online Resources:

1. https://www.tutorialspoint.com/wireless_communication

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Remember	Quiz	**5**
CO2	Understand	Case Study	**5**
CO3	Understand	Class Preparation	**10**

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	
Create	-	-	-	-

16CS402   **CRYPTOGRAPHY AND NETWORK SECURITY**   **3/0/0/3**

Nature of Course   : G(Theory Analytical)
Course Objectives:
1   To understand the different types of modern cryptographic techniques.
2   To study the concepts of public key encryption and number theory.
3   To learn authentication standards and applications.
4   To learn the network security and applications.
5   To study the concept of main security threats and techniques to diminish these threats in Communication networks.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks	[AP]
CO2	Encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms	[R]
CO3	illustrate the number theory & generate the public key	[U]
CO4	Analyze existing authentication and key agreement protocols, identify the weaknesses of these protocols.	[A]
CO5	Download and install an e-mail and file security software, PGP, and efficiently use the code to encrypt and sign messages.	[AP]
CO6	Develop SSL or Firewall based solutions against security threats, employ access control techniques to the existing computer platforms	[AP]

Course Contents:

Course Contents with Course Outcomes/Blooms Taxonomy/Assessment Methods
Encryption techniques: Security goals-OSI Security Architecture(attacks,Services,Mechanisms)-
Symmetric ciphers: Classical Encryption techniques- Block Cipher Principles - Data Encryption Standard- Triple DES- Advanced Encryption Standard- Block cipher modes of operations
Asymmetric ciphers: Fermat's theorem-Testing of primality- Chinese remainder theorem- Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography-public-key cryptography and RSA **Message Authentication Codes:** Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions,MD5 message Digest algorithm - Secure Hash Algorithm (SHA)-RIPEMD – HMAC- Digital Signatures standards **Key Management and distribution:** Symmetric key distribution-Public key distribution-X.509 Certificates-Public key Infrastructure **Electronic Mail Security**: PGP – S/MIME **IP Security:** Architecture-Authentication header-Encapsulating security payloads **Web Security:** SSL,TLS,SET **System Security:** Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls

Total Hours: 45

Text Books:
1   William Stallings, "Cryptography and Network Security – Principles and Practices", 5th edition,Prentice Hall of India,2011.
2   Behrouz A.Forouzon,"Cryptography and network security", 2nd edition, Tata McGraw-Hill, 2010.
3   AtulKahate, "Cryptography and Network Security", 2nd edition, Tata McGraw-Hill, 2009.

Reference Books:

1 Bruce Schneier, "Applied Cryptography", 2nd edition, John Wiley & Sons Inc, 2007.
2 Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 4th Edition, Pearson Education, 2007.

Web References:

1 http://www.iitg.ac.in/icdcn2006/isg.pdf
2 http://www.tutorialspoint.com/cryptography/
3 http://www1.se.cuhk.edu.hk/~eclt5740/

Online Resources:

1 http://nptel.ac.in/courses/106105031/
2 http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3 http://freevideolectures.com/Course/3027/Cryptography-and-Network-Security
4 https://www.coursera.org/learn/crypto

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Apply	Assignment	**4**
CO2	Remember	Problem Solving	**4**
CO3	Understand	Problem Solving	**4**
CO4	Analyse	Technical presentation	**4**
CO5	Apply	Case study	**2**
CO6	Apply	Technical Writing	**2**
Summative assessment based on Continuous and End Semester Examination			

Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	20	20	10	10
Understand	80	40	40	40
Apply	-	40	30	30
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS403 **DISTRIBUTED SYSTEMS** **3/0/0/3**

Nature of Course: D (Theory application)

Course Objectives:
- To understand the basics of networking and the protocols used in distributed environment.
- To evaluate the impact of memory on parallel/distributed algorithm formulations and validate their performance.
- To gain knowledge of how to design and implement distributed algorithms

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Analyse various issues in the design and implementation of distributed computing systems	[A]
CO2	Categorize the various system models, communication between client and server	[U]
CO3	Apply the knowledge of deadlock methods and its algorithms	[AP]
CO4	Understand the significance of distributed file system with real time applications	[U]

Course Contents

Introduction Distributed Computing Models, Software Concepts, Hardware Concepts, The Client-Server model, Issues in design of a distributed operating system. **Communication** Introduction to Message Passing, Advantages and features of message passing, Message format, Message Buffering, Remote Procedure Call, Extended RPC Models, Remote Object Invocation, Message Oriented Communication. **Processes And Synchronization** Threads, code migration, clock synchronization, logical clocks, global state, Election algorithms, mutual exclusion, Distributed transaction. **Distributed Deadlock Detection** System model, Resources vs. communication deadlocks, deadlock prevention, avoidance, detection and resolution, Centralized deadlock detection, distributed deadlock detection, path pushing and edge chasing algorithm **Distributed Shared Memory** Introduction, General architecture of distributed shared memory, Design and implementation, Issues of DSM, Granularity, structure of shared memory space, consistency models, thrashing, advantages of DSM **Distributed File System** Introduction, Desirable features of good distributed file system, file models, file accessing, sharing, caching methods, file replication, fault tolerance, Case Study: CORBA(CORBA RMI and Services)

Total Hours   45

Text Books:
1. Andrew Tanenbaum, Maarten Van Steen, "Distributed System- Principals Paradigm", Maarten van Steen Publication,2016
2. Singhal and Shivratri, "Advanced Concept in Operating Systems", McGraw Hill,2015

Reference Books:
1. Sunita Mahajan, Seema Shah, " Distributed Computing", Oxford, 2nd edition,2013
2. Pradeep K. Sinha "Distributed Operating Systems", Prentice Hall of India Private,2012
3. George Coulouris, Tim Kindberg, Jean Dollimore, Distributed Systems: Concepts and Design, Academic Internet Publishers, 2006

Web References:
1. http://www.nptel.ac.in/courses/106106107/

Online Resources:
1. https://www.wiziq.com/tutorials/distributed-computing

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
C01	Analyse	Case Study	**5**
C02	Understand	Technical Presentation	**5**
C03	Apply	Group Assignment	**5**
C04	Understand	Online Quiz	**5**

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination**
	CIA1	**CIA2**	**Term End Assessment**	
Remember	10	25	40	40
Understand	30	15	40	40
Apply	0	10	10	10
Analyse	10	0	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

16CS404   **MOBILE APPLICATION DEVELOPMENT**   **3/0/0/3**

Nature of Course   : K (Problem Programming)
Course Objectives:
1. Understand system requirements for mobile applications.
2. Generate suitable design using specific mobile development frameworks.
3. Implement the design using specific mobile development frameworks.
4. Deploy the mobile applications in marketplace for distribution.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Demonstrate knowledge on basics of mobile application.	[R]
CO2	Understand the framework of mobile application and design simple interfaces.	[U]
CO3	Create an application using multimedia components.	[AP]
CO4	Develop and deploy application with server side connectivity.	[AP]

Course Contents:
Introduction: Introduction to mobile application - Market values for mobile applications-System requirements for mobile application – Mobile application development architecture. **Designing Applications using Android:**Developing user interfaces -Layout -Input Controls and Events- Menus - Dialogs, Notifications and Toasts**Multimedia&Services:**Lifecycle of a Service - Managing Services –GPS – location API – Playing audio, video.**Technology I Android**-Introduction –Establishing the development environment –Android architecture –Activities and views –Interacting with UI –Persisting data using SQLite –Packaging and deployment .**Technology II–IOS**-Introduction to Objective C –IOS features –UI implementation–Touch frameworks –Data persistence using Core Data and SQLite.

Total Hours: 45

Text Books:
1   Jeff McW herter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2   David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

Reference Books:
1   James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012
2   Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012.

Web References:
1   http://developer.android.com/develop/index.htm
2   https://www.tutorialspoint.com/android/
Online Resources:
1   http://www.androidhive.info/
2   https://www.codeschool.com/learn/ios

Assessment Methods & Levels (based on Bloom'sTaxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	**Bloom's Level**	**Assessment Component**		**Marks**
C01	Remember	Quiz		**5**
C02	Understand	Assignment		**5**
C03	Apply	Coding		**5**
C04	Apply	Mini Project		**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Nature of Course   :G (Theory analytical)

Course Objectives:

1   To learn the concepts of telecommunication networks.
2   To study the basic concepts of Mobile IP.
3   To understand session initiation protocol.
4   To understand mobile middleware and mobile operating system

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	To understand the fundamentals of mobile communication	[U]
CO2	Summarize the significance of different layers in mobile system	[U]
CO3	To interpret the mobile middleware	[U]
CO4	To develop mobile content applications.	[AP]

Course Contents :

TELECOMMUNICATION NETWORKS Telecommunication systems – Spread spectrum techniques - GSM – GPRS – DECT – 3G Wireless Systems-UMTS core Network Architecture – Satellite Networks **-** Basics – Parameters and Configurations. **MOBILE NETWORK LAYER** Introduction to Mobile IP – Components of mobile IP network - Agent Discovery – Registration –tunneling – security - Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics - Capacity Allocation – FAMA and DAMA **TRANSPORT AND APPLICATION LAYERS** Traditional TCP – Classical TCP improvements – Introduction to SIP, SIP Architecture, Applications, Services. **MOBILE MIDDLEWARE** Mobile middleware - Middleware for Application development – Adaptation – Mobile Agents - Service Discovery Middleware – Services - Garbage Collection – Eventing - Security. **MOBILE OPERATING SYSTEMS** Android OS – Architecture – Security - ios - Palm OS - Windows CE - Symbion OS -   Linux for Mobile Devices.

                                                  Total Hours: **45**

Text Books:

1   Jochen Schiller, "Mobile Communications", PHI/Pearson Education, 2nd Edition, 2008.
2   Frank Adelstein, Sandeep K S Gupta, Golden G Richard, Loren Schwiebert,"Fundamentals of Mobile and Pervasive Computing",Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2005.
3   Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, 2007.

Reference Books:

1   Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", PHI/Pearson Education, 2003.
2   Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober,"Principles of Mobile Computing", Springer, New York, 2003.
3   Hazysztof Wesolowshi, "Mobile Communication Systems", John Wiley and Sons Ltd, 2002.

Web References:

1   comp.ist.utl.pt/ec-cm/acetatos_aulas/C01-Introduction.ppt
2   www.cs.uml.edu/~glchen/cs414-564/…/C02-Wireless_Transmission.ppt
3   an.kaist.ac.kr/courses/2006/cs492/schiller_PPT/C03-Media_Access.ppt
4   http://www.mi.fuberlin.de/inf/groups/agtech/teaching/resources/Mobile_Communications/cours3e_Material/CO4Wirelss_TeleCommunication-Systems2.ppt.
5   http://www.mi.fuberlin.de/inf/groups/agtech/teaching/resources/Mobile_Communications/course_Material/C05-Satellite_Systems1.ppt.

6   kur2003.if.itb.ac.id/file/C07-Wireless_LANs.ppt

7   http://www.mi.fuberlin.de/inf/groups/agtech/teaching/resources/Mobile_Communications/course_Material/C08-Network_Protocols.pdf

8   http://www.mi.fuberlin.de/inf/groups/agtech/teaching/resources/Mobile_Communications/course_Material/C09-Transport_Protocols.pdf

9   http://www.mi.fuberlin.de/inf/groups/agtech/teaching/resources/Mobile_Communications/course_Material/C10-Support_for_Mobility.pdf

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Understand	Online Quiz	5
CO2	Understand	Technical Presentation	5
CO3	Apply	Group Assignment	5
CO4	Analyse	Surprise Test	5

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	80	40	40	40
Apply	20	60	40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Nature of Course   :G (Theory analytical)

Course Objectives:

1   Understand the building blocks of a quantum computer.
2   Understand the principles, quantum information and limitation of quantum operations formalizing.
3   Gain knowledge about the quantum error and its correction.

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Explain the basic concepts of quantum computing.	[U]
CO2	Explain the quantum model of computation and how it relates to quantum mechanics	[U]
CO3	Explore the quantum computing algorithms and operations.	[U]
CO4	Describe the quantum computational complexity and physical realization	[AP]

Course Contents :

FOUNDATION: Overview of traditional computing - Church-Turing thesis - circuit model of computation- reversible computation - quantum physics - quantum physics and computation – Dirac notation and Hilbert Spaces - dual vectors - operators - the spectral theorem - functions of operators - tensor products - Schmidt decomposition theorem.**QUBITS AND QUANTUM MODEL OF COMPUTATION**: State of a quantum system - time evolution of a closed system - composite systems - measurement - mixed states and general quantum operations - quantum circuit model -quantum gates - universal sets of quantum gates - unitary transformations – quantumcircuits.**QUANTUM ALGORITHMS-I:**Superdense coding - quantum teleportation - applications of teleportation - probabilisticversus quantum algorithms - phase kick-back - the Deutsch algorithm - the Deutsch- Jozsa algorithm - Simon's algorithm - Quantum phase estimation and quantum Fourier Transform - eigenvalue estimation. **QUANTUM ALGORITHMS-II:**Order-finding problem - eigenvalue estimation approach to order finding - Shor's algorithm for order finding - finding discrete logarithms - hidden subgroups - Grover's quantum search algorithm - amplitude amplification - quantum amplitude estimation - quantum counting - searching without knowing the success probability. **QUANTUM COMPUTATIONAL COMPLEXITY AND ERROR CORRECTION:**Computational complexity - black-box model - lower bounds for searching - general black-box lower bounds - polynomial method - block sensitivity - adversary methods - classical error correction - classical three-bit code - fault tolerance- quantum error correction - three- and nine-qubit quantum codes - fault-tolerant quantum computation-Physical realization of quantum computers.

                                                                    Total Hours: **45**

Text Books:

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

Reference Books:

1   V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing Company, 2007.
2   M. A. Nielsen & I.Chuang, "Quantum Computation and Quantum Information",Cambridge University Press (2000).

Web References:

1 http://nptel.ac.in/courses/115101092/
2 https://ocw.mit.edu/courses/mathematics/18-435j-quantum-computation-fall-2003/
3 https://www.edx.org/course/quantum-mechanics-quantum-computation-uc-berkeleyx-cs-191x

Online Resources:

1 https://www.udemy.com/a-gentle-introduction-to-quantum-mechanics/
2 www.nptelvideos.com/physics/quantum_physics.php
3 https://quantum.class.stanford.edu/
4 https://quantum.class.stanford.edu/
5 https://courses.cs.washington.edu/courses/cse599d/06wi/
6 https://uwaterloo.ca/institute-for-quantum-computing/programs/.../current-courses
7 https://www.findamasters.com/search/courses.aspx?Keywords=quantum+computing
8 https://www.coursetalk.com/providers/coursera/courses/quantum-mechanics-and-quantum-computation

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Understand	Online Quiz	5
CO2	Understand	Technical Essay Writing	5
CO3	Understand	Group Assignment	5
CO4	Apply	Group Assignment	5
Summative assessment based on Continuous and End Semester Examination			

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	80	40	60	60
Apply	20	60	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS407   **ADVANCED JAVA PROGRAMMING**   **3/0/0/3**
Nature of Course   : K (Problem Programming)
Course Objectives:

1 To understand the basic concepts of core principles of the Java Language

2 To gain knowledge to develop standalone applications.

3 To discuss basic principles of HTML, Java Script and XML

4 To gain knowledge to develop dynamic Web applications like servlet,jsp.

5 To introduce tools, technologies and framework hence Hibernate and Spring are introduced to enhance web development skills.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Gain the basic knowledge on Object Oriented concepts	[R]
CO2	Ability to develop the application based on the java concepts	[AP]
CO3	Ability to solve the real world problems using concepts like swings, JDBC	[AP]
CO4	Analyze and design web-based information systems to meet certain business needs using HTML5, CSS, JavaScript	[AP]
CO5	Able to Design and develop interactive, client-side, server-side executable web applications using eclipse.	[A]
CO6	Explore the features of various platforms and frameworks like hibernate, Spring ,struts used in web applications development	[A]

Course Contents:

Core Java - Overview of Java - Java modifiers-Wrapper classes-Argument passing in class & object- Returning a value- Objects as arguments-Returning objects- Passing an array-constructors – this keyword- Inheritance- Use of super in calling parent class constructor-java.lang.Object and its methods – Passing arguments in super(): super(int), super(String) - super(String,String)-Packages-User defined exception-Collections-Swings-Event Handling-JDBC-JDBC Drivers-JDBC configuration(connection) - Statement – Callable Statement-prepared statements- Scrollable and updatable result sets - Query execution- **HTML5, XML, Java Script -** HTML common tags – List – Tables – Images – Forms – Frames -HTML5- Form design-CSS- Introduction to Java Scripts-storing data (data types) - Objects- Properties-Events-Decision making-Looping-Functions-Array-Conversions-Processing HTML forms and validation using JavaScript- XML- DTD, XSD-XSLT-Well-formed XML, valid XML-Creating XML using XSD- DOM and SAX - **Servlets and JSP** - Overview of servlet-Servlet configuration-Servlet Architecture-Servlet life cycle-Servlet Request and Response- Generic Servlet ,Http Servlet- web.xml and its need -Servlet configuration- Session Tracking-servlet CRUD- Introduction to JSP – Problem with servlet -Life cycle of JSP- scripting Elements (Expression tag, scriptlets tag and declarations tag)-JSP Directive Elements-page directive - JSP objects- Action Elements **–** Sharing data Between JSP pages Application Development using eclipse-**Hibernate, Spring and struts-** Hibernate Introduction-features-Architecture-Mapping and Configuration Files in Hibernate - Hibernate O/R Mappings –Hibernate query language-Simple examples using hibernate- Spring Introduction- Architecture-IOC container- Dependency Injection Bean – Getting started with Spring MVC framework- Simple examples using Spring-STRUTS – Introduction, Struts framework core components – Installing and setting up struts – Getting started with struts.

                                                        Total Hours: **45**

Text Books:

1	Herbert Schildt, "Java The Complete Reference", 8th Edition, McGraw-Hill Osborne Media, 2015.
2	Kathy Sierra, "SCJP/ OCJP Sun Certified Programmer for Java 6 Study Guide", Dreamtech press, Kogent Learning Solutions Inc. 2011.
3	Bryan Basham, Kathy Sierra, Bert Bates, "Head First Servlets and JSP", O' Reilly Media, 2011
4	Paul Deitel, "Internet & World Wide Web: How to Program", Prentice Hall, 5th Edition, 2011.
5	Gavin King, Christian Bauer, "Java Persistence with Hibernate", Dreamtech press, Kogent Learning Solutions Inc. 2008.
6	Craig Walls, "Spring in Action", Manning, Dreamtech press, 2014

Reference Books:

1. Cay S. Horstmann and Gary Cornell, "Core Java™, Volume I – Fundamentals" 9th Edition, Prentice Hall, 2012.
2. Cay S. Horstmann and Gary Cornell, "Core Java, Vol. 2: Advanced Features", 9th Edition, Prentice Hall, 2013.
3. Robert W. Sebesta, "Programming the World Wide Web", Addison-Wesley, 7thEdition, 2012.
4. UttamK.Roy, "Web Technologies", Oxford University Press, 1st Edition, 2011.
5. Jon Duckett, "Beginning HTML,XHTML,CSS & JavaScript",wiley India pvt.Ltd 2010

Web References:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/
2. https://www.udemy.com/java-tutorial/
3. http://www.studytonight.com/servlet/introduction-to-web.php
4. http://www.javatpoint.com/hibernate-tutorial
5. http://www.java4s.com/hibernate/
6. http://www.oracle.com/technetwork/java/javaee/jsp/index.html
7. http://www.oracle.com/technetwork/java/javaee/ejb/index.html

8. http://www.javatpoint.com/servlet-tutorial

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Quiz	**3**
CO2	Apply	Coding	**3**
CO3	Apply	Class Presentation	**2**
CO4	Apply	Group Presentation	**2**
CO5	Analyze	Group Project	**5**
CO6	Analyze	Group Project	**5**
Summative assessment based on Continuous and End Semester Examination			

Bloom's Level	**Continuous Assessment**			**End Semester Examination (Theory) [40 marks]**
	Theory			
Remember	**CIA1 [6 marks]**	**CIA2 [6 marks]**	**Term End Assessment [8 marks]**	-s
Understand	20	30	-	-
Apply	80	70	80	60
Analyse			20	-
Evaluate	-	-	-	-
Create	-	-	-	40

16CS408   **PYTHON PROGRAMMING**   **3/0/0/3**

Nature of Course   : C (Theory Concept)
Course Objectives:

1. To understand why Python is a useful scripting language for developers.
2. To learn how to design and program Python applications.
3. To learn how to design object-oriented programs with Python classes.
4. To learn how to use class inheritance in Python for reusability.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Recognize and construct common programming idioms: variables, loop, branch, subroutine, and input/output.	[R]
CO2	Describe the principles of object-oriented programming and the interplay of algorithm in well-written modular code	[R]
CO3	Be able to design, code, and test Python programs	[U]
CO4	Solve problems requiring the writing of well-documented programs in the Python language, including use of the logical constructs of that language	[AP]
CO5	Demonstrate significant experience with the Python program development environment	[AP]

Course Contents:

Introduction-Why and How is Python Different- Python Concepts - Dynamic vs Static Types-Interpreted vs Compiled-Prototyping-Procedural vs Object-Oriented. **Comparison**: C ,C++,Java ,C# ,Python of Programming-**Types and Operators:** Python Syntax-Indentation, Multiple Line Spanning-Python Object Types- Python Numbers -**Strings-**Basic string operations, Indexing and slicing strings, String Formatting, Combining and Separating Strings-**Lists**-List usage - Adding List Elements-Mutability-Methods. **Dictionaries:** Making a dictionary-Basic operations-Dictionary details-Operation. **Functions. Tuples-** Why Use Tuples-Sequence Unpacking -Methods **.Files**-File Operations -Files and Streams -Creating a File -Reading From a File- Iterating Through Files-Seeking-Serialization **Statements, Exceptions, oops, Database.**

Total Hours: 45

Text Books:

1. Brian Heinold,"Introduction to Programming Using Python",Mount St. Mary's University, 2013.
2. Michael Dawson ,"Python Programming for the Absolute Beginner", 3rd Edition, 2010.
3. Allen Downey, Green Tea Press Needham, "Think Python, How to Think Like a Computer Scientist", Massachusetts.

Reference Books:

    1 John Paul Mueller, "Beginning programming with Python for Dummies", John Wiley & Sons

Web References:

    1 https://www.python.org/

    2 https://en.wikipedia.org/wiki/Python_(programming_language)

    3 http://www.tutorialspoint.com/python/

Online Resources:

    1 https://www.coursera.org/python

    2 https://www.edx.org/python

Assessment Methods & Levels (based on Blooms 'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Online Quiz	**4**
CO2	Remember	Online Quiz	**4**
CO3	Understand	Class Presentation	**4**
CO4	Apply	Mini Project	**4**
CO5	Apply	Group Assignment	**4**

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	20	20	30	20
Understand	80	40	40	40
Apply	-	40	30	40
Analyse	-	-		
Evaluate	-	-	-	-
Create	-	-	-	-

16CS409   **COMPUTER GRAPHICS AND MULTIMEDIA**   3/0/0/3

Nature of Course : C (Theory Concept)

Course Objectives:
1. To study the Graphics Techniques and Algorithms
2. To understand Computational Development of Graphics with Mathematics
3. To provide in depth knowledge of Display Systems, Image Synthesis, Shape Modelling of 3D Application
4. To study and understand the basic concepts related to Multimedia including Data Standard, Algorithms and Technologies

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Understand the importance of computer graphics API programming	[U]
CO2	To draw the basic primitives of an object and their algorithms	[R]
CO3	To understand and perform 2D and 3D transformations	[AP]
CO4	To gain knowledge of using interactive animation using multimedia tools	[A]
CO5	Gain the knowledge of different media streams in multimedia transmissions	[A]

Course Contents:

Introduction to Computer Graphics and scan conversion: Overview of computer graphics-Computer Display Technologies, Graphics Software, Output Primitives: - Points & lines, Line drawing algorithms, Circle generation algorithm, Ellipse generating algorithm. **2D & 3D Transformation:** Basic transformations. 3D Transformation, Clipping operations. **Object Modelling & Surface Determination:** 3D Object Representations,3D viewing, Projections, Visible Surface Identification Methods. Introduction to OpenGL programming and Animations. **Multimedia System Design: -**Introduction to Multimedia-Multimedia Applications-Multimedia Architecture-Technologies for Multimedia Data- File Format Standards-Multimedia Input Output Technologies-Multimedia Storage and Retrieval Technologies. **Compression Techniques and Authoring Systems**: Lossless and Lossy Compression- Inter-Frame and Intra-Frame Compression Text Compression, Image Compression, Video Compression. Multimedia Authoring Systems and User Interfaces.

Total Hours: 45

Text Books:
1. Donald Hearn and M.Pauline Baker," Computer Graphics in C version", 2nd Edition, Pearson education,1996

2. Multimedia Systems Design-prabhat K. Andleigh, Kiran Thakrar-PHI edition,2003

3. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Edition.)" – TMH,2000

4. Donald D.Hearn,M.Pauline Baker-Computer graphics with openGL,Pearson(3rd Edition),2010

Reference Books:
1 Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Edition.) – Pearson Education,2013

2   Elsom Cook – "Principles of Interactive Multimedia" – McGraw Hill,2001

3   W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" Tata Mc Graw Hill,1979

Web References:

1   http://en.wikipedia.org/wiki/Computer_graphics

2   http://nptel.ac.in/video.php?subjectId=106106090

3   http://graphics.ucsd.edu/courses/cse167_f06/CSE167_05.ppt

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Class Presentation	**5**
CO2	Reasoning	Online Quiz	**5**
CO3	Apply	Assignment	**5**
CO4,CO5	Analyse	Problem Solving	**5**

Summative assessment based on Continuous and End Semester Examination

| **Bloom's Level** | **Continuous Assessment** | | | **End Semester Examination [60 marks]** |
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	20	20	10	10
Understand	80	60	40	40
Apply	-		40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS410   **IMAGE PROCESSING**   **3/0/0/3**

Nature of Course   :G (Theory analytical)

Course Objectives:

1	Fundamentals of digital image processing and transformation techniques.
2	Performing image enhancement using frequency and spatial domain techniques.
3	Different kinds of redundancy and image compression techniques.
4	Segmentation methods used in image processing.
5	Degradation, restoration and representation of images

Course Outcomes:
Upon completion of this course the student will be able to

CO1	Analyze and apply image transforms like FFT, DCT, Walsh, Hadamard, Haar, Slant, Hotelling transforms for images.	[A]
CO2	Enhance the quality of images using frequency and spatial domain techniques.	[AP]
CO3	Apply Lossy and lossless image compression techniques for digital images.	[AP]
CO4	Perform edge detection and segmentation	[AP]
CO5	Identify the degrading, modeling and restoring the image	[AP]
CO6	Represent image using chain codes, linear signature, shape number, Fourier, moments, regional, texture, relational descriptors	[AP]

Course Contents :

FUNDAMENTALS OF DIGITAL IMAGE PROCESSING – Building blocks of Digital Image Processing systems – Image Acquisition, Storage, Processing, Display and Communication Interface, Digital Image Representation – Sampling and Quantization – Some Basic Relationships between pixels – Neighbors and Connectivity, Distance Measures, Image Transform – Fourier Transform – Discrete Fourier Transform – Some properties of Fourier Transform – Fast Fourier transform – FFT Algorithm, Inverse FFT, DCT – Properties, Walsh Transform, Hadamard Transform, Haar Transform, Slant Transform, Hotelling Transform.

IMAGE ENHANCEMENT Spatial and frequency domain approaches – Frequency domain Techniques – Spatial domain Techniques, Spatial Filtering, Frequency domain – Gray Level to Color Transform.

IMAGE COMPRESSION: Coding Redundancy, Inter pixel redundancy, Psycho Visual redundancy, Image compression models, The source Encoder and Decoder, The channel Encoder and Decoder, Information Theory, Classification, Huffman coding, Lossy compression Techniques, Threshold coding, Vector quantization, Image compression standard (JPEG)

IMAGE SEGMENTATION: Detection of isolated points, Line detection, Edge detection, Edge linking and Boundary detection, Region oriented segmentation, Segmentation using threshold, Accumulative difference image.

IMAGE RESTORATION, REPRESENTATION AND DESCRIPTION

Degradation model, Degradation model for continuous functions, Discrete Degradation Model,

Estimation of Degradation function by experimentation and modeling, Inverse filtering approach, LMS filter, Interactive Restoration, Constrained Least Square Restoration, Boundary Representation using chain codes, Linear Signature, Shape number, Fourier descriptors, Moments Region representation, Regional descriptor, Texture, Relational Descriptors

Total Hours: 45

Text Books:
1 Annadurai S., Shanmugalakshmi R., "Fundamentals of Digital Image Processing",Pearson Education (Singapore) Pvt. Ltd., 2007
2 Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008

Reference Books:
1 S. Sridhar, "Digital Image Processing", OXFORD University press, 2011
2 Madhuri A Joshi , " Digital Image Processing:an algorithm approach",PHI ,2006
3 Peter rob, Carlos Coronel, "Database Systems – Design, Implementation and Management", 9th Edition, Thomson Learning, 2009.

Web References:
1 www.nptelvideos.in
2 nptel.ac.in/courses/106105032
3 www.cs.iit.edu/~agam/cs512/lect-notes/opencv-intro
4 http://freevideolectures.com/Course/2316/Digital-Image-Processing-IIT-Kharagpur/29
5 opencv-srf.blogspot.com

Online Resources:
1 https://www.slideshare.net/.../introduction-to-matlab-with-image-processing-5495912
2 electronicsforu.com › Engineering Projects For You › Software Projects For You
3 https://www.youtube.com/watch?v=TG3OWTd5j2w
4 opencv-python-tutroals.readthedocs.io/...tutorials/
5 docs.opencv.org › OpenCV Tutorials
6 students.iitk.ac.in/eclub/assets/tutorials/OPENCV%20TUTORIAL.pdf
7 https://www.youtube.com/watch?v=ak9HyMImDog
8 www.micc.unifi.it/lisanti/downloads/OpenCV-PPM-Histogram.pdf
9 https://www.cs.umd.edu/class/fall2016/cmsc426/matlab/matlab_imageprocessing.pdf
10 https://www.coursera.org
11 http://www.mathworks.in
12 http://www.imageprocessingplace.com
13 http://siptoolbox.sourceforge.net

Assessment Methods & Levels (based on Blooms'Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Analyze	Programming Assignment	5
CO2&CO3	Apply	Research paper Presentation	5
CO4&CO5	Apply	Case study	5

| CO6 | Apply | Online Quiz | | 5 |

Summative assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment | | | End Semester Examination [60 marks] |
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	80	40	40	40
Apply	20	60	40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS411   OPEN SOURCE WEB SERVICES   3/0/0/3

Nature of Course   : G (Theory analytical)

Course Objectives:
1   To understand the details of web services technologies like WSDL,UDDI, SOAP
2   To learn how to implement and deploy web service client and server
3   To explore interoperability between different frameworks

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1   Understand the Basic details of WSDL, UDDI, SOAP   [U]

CO2   Implement WS client and server with interoperable systems   [AP]

Course Contents :

Evolution and Emergence of Web Services – Evolution of distributed computing, Core distributed computing technologies — client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services — The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services. Web Services Architecture — Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication models, basic steps of implementing web services. Restful web services – Introduction, Creating Restful web services, Environmental setup, Resources, Messages, Addressing, Methods, Statelessness, Caching, Security. **Fundamentals of SOAP** — SOAP Message Structure, SOAP encoding, Encoding of different data types, SOAP message exchange models, SOAP communication and messaging, Java and Axis, limitations of SOAP. **Describing Web Services** — WSDL — WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL. **Discovering Web Services** — Service discovery, role of service discovery in a SQA, service discovery mechanisms, UDDI — UDDI registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, Publishing API, Publishing, searching and deleting information in a UDDI Registry, limitations of UDD1. Web Services Security — XML security frame work, Goals of Cryptography,Digital signature, Digital Certificate, XML Encryption. **CLOUD COMPUTING** - Vision of Cloud computing – Cloud Definition – Characteristics and Benefits – Virtualization – Cloud computing Architecture – Cloud Reference Model, Types of Clouds – Cloud Platforms in Industry

Total Hours: 45

Text Books:
1   R. Nagappan, R. Skoczylas, R.P. Sriganesh,"Developing Java Web Services ",Wiley India.

2   Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013

Reference Books:

1. James McGovern, Sameer Tyagi etal,"Java Web Service Architecture",Elsevier.
2. S. Graham and others, Building Web Services with Java, 2nd Edition, Pearson Edn.
3. D.A. Chappell & T. Jewell, Java Web Services, O'Reilly,SPD.
4. G. Alonso, F. Casati and others, Web Services, Springer.
5. Heather Williamson, "XML, The Complete Reference", McGraw Hill Education, 2012.
6. Frank. P. Coyle, "XML, Web Services And The Data Revolution", Pearson Education, 2002.

Web References:

1. http://nptel.ac.in/courses/106105084/16
2. https://www.tutorialspoint.com/soap
3. http://smdfarooq.weebly.com/uploads/4/9/5/4/49543715/unit_1_farooq.pdf

Online Resources:

1. https://www.w3schools.com/xml/xml_services.asp
2. www.journaldev.com › Java › Java EE
3. docs.oracle.com/javaee/6/tutorial/doc/gijti.html
4. www.guru99.com/web-services-tutorial.html
5. www.mkyong.com/tutorials/jax-ws-tutorials/
6. www.ibm.com › Learn › SOA and web services
7. www.java4s.com/web-services/

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Online Quiz	10
CO2	Apply	Technical Presentation	10

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	-	-	-	-
Understand	80	40	40	40
Apply	20	60	40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS412   **SOFTWARE TESTING AND QUALITY ASSURANCE**   3/0/0/3

Nature of Course   :C (Theory Concept)
Course Objectives:
1 To understand the different phases of testing
2 To gain knowledge about the different types of testing.
3 To know about test documentation
4 To understand the significance of quality assurance

Course Outcomes:
Upon completion of the course, students shall have ability to
CO1	Understand the concepts of testing and its types.	[R]
CO2	Know the techniques involved in Black box testing and White box testing.	[U]
CO3	Familiarize the concepts of various higher order testing.	[U]
CO4	Learn about the various software quality management techniques.	[U]

Course Contents:
Overview of Software Testing: Basics of Software Testing, Testing Principles, Goals, Testing Life Cycle, Phases of Testing, Defects,Defect Life Cycle, Defect Report, Test Plan(IEEE format), Importance of testing in software production cycle. **Black box testing:** Need of black box testing, Black box testing Concept, Requirement Analysis, Test case design criteria, Testing Methods, requirement based testing, Positive & negative testing, Boundary value analysis, Equivalence Partitioning class, state based or graph based, cause effect graph based, error guessing, documentation testing &domain testing, design of test cases, case studies of Black Box testing. **White box testing:** Need of white box testing, Testing types, Test adequacy criteria, static testing by humans, Structure ,logic coverage criteria, Basis path testing, Graph metrics, Loop Testing, Data flow testing, Mutation Testing – Design of test cases. Testing of Object oriented systems , Challenges in White box testing , Case study of White, Box testing. **Metric tools and non functional testing:** DIAC Test organization, Structure of testing, Measurement tools, Testing metrics: Type of metric – Project, Progress, Productivity. Other Software Testing: GUI testing , Validation testing , Regression testing , Scenario testing ,Specification based testing , Adhoc testing , Sanity testing , Smoke testing , Random Testing. Advances in Software Testing Methods. **Software Quality management:** Software quality , Quality attribute , Quality control & assurance , Methods of quality management , Cost of quality, Quality factor , project management , Software quality metrics , TQM , Six Sigma – ISO , SQA Model.

Total Hours: 45

Text Books:
1 Arun Kumar Khannur,"Software Testing, techniques and applications",2011, Pearson
2 Ron Patton,"Software Testing", 2nd edition, Pearson, 2011.
3 Stephen H Kan," Metric and Model in Software Quality Engineering", Pearson, 2014

Reference Books:
1 M.G. Limaye ," Software Testing Principles and Tools" ,TMG Hill Publication,2009
2 Naresh Chauhan ," Software Testing Principles and Practices" , Oxford University Press, 2010.

Web References:
1 http://www.aptest.com/resources.html
2 http://www.testingstuff.com/references.html

Online Resources:
1 http://www.etestinghub.com/

Assessment Methods & Levels (based on Bloom'sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
C01	Remember	Quiz	**5**
C02	Understand	Writing Skills	**5**
C03	Understand	Class Presentation	**5**
C04	Apply	Group Assignment	**5**

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	20	40	40	40
Understand	80	60	60	60
Apply	-	-		
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS413   **Building Enterprise Applications**   3/0/0 /3

Nature of Course   : C (Theory Concept)

Prerequisite   : Exposure to any object oriented programming language (such as Java)
                            and RDBMS.

Course Objectives:

1. To introduce different enterprise applications
2. To provide an insight of business modelling
3. To explore construction and testing of enterprise application

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Familiarize with concept of Enterprise Analysis and Business Modeling.	R
CO2	Understand requirements validation, planning and estimation	U
CO3	Design and document the application architecture.	U
CO4	Understand the importance of application framework and designing other application components.	U
CO5	Construct and develop different solution layers.	AP
CO6	Perform Code review, Code analysis, build process	AP

Course Contents:

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.

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

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.

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.

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 Hours: 45

Text Books:

1   Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu, Raising Enterprise Applications, Wiley, 2010

2   Brett McLaughlin, Building Java Enterprise Applications, O'Reilly Media, 2002

Reference Books:

1   Soren Lauesen, Software Requirements: Styles & Techniques, Addison-Wesley Professional

, 2001

2   Brian Berenbach, Daniel J. Paulish, Juergen Kazmeier, Arnold Rudorfer, Software Systems Requirements Engineering: In Practice, McGraw-Hill/Osborne Media, 2009

3   Dean Leffingwell, Don Widrig, Managing Software Requirements: A Use Case Approach, Pearson, 2003

4   Patton, Software Testing, 2nd edition, Pearson, 2005

5   Vasudeva Varma, Software Architecture: A Case Based Approach, Pearson, 2007

6   Srinivasan Desikan, Software testing Principles and Practices, Oxford University Press, 2006

Web References:

http://java.sun.com/blueprints/guidelines/designing_enterprise_applications_2e/)

Online Resources:

1.   https://www.entrepreneur.com/slideshow/224155
2.   https://www.peterindia.net/EnterpriseApplications.html

Assessment Methods & Levels (based on Bloom'sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1,CO2	Understand	Quiz	**5**

CO5	Apply	Case Study	**5**
CO3,CO4	Understand	Class Presentation	**5**
CO6	Apply	Group Assignment	**5**

Summative assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment | | | End Semester Examination |
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	[60 marks]
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS414　　　　　**DATA WAREHOUSING AND MINING**　　　　　3/0/0/3

Nature of Course　　　　:G (Theory analytical)
Course Objectives:

1　　To learn the fundamentals of data warehouse and OLAP
2　　To acquire knowledge in data pre-processing and association rule mining
3　　To perform data classification and clustering
4　　To gain knowledge about the emerging trends in data mining

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Design a data warehouse	[U]
CO2	Perform data pre-processing	[U]
CO3	Evaluate association, classification and clustering methods	[A]
CO4	Apply data mining techniques for real world problems	[AP]

Course Contents :

DATA WAREHOUSING - Basic Concepts – Architecture – Data warehouse modeling – Data cube and OLAP – Data warehouse design and usage – Framework for data warehouse design – Data warehouse design process - Data warehouse implementation – Efficient data cube computation – Indexing OLAP data – Efficient processing of OLAP queries – OLAP server architectures. **DATA MINING -** Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data transformation and discretization – Mining frequent patterns, associations and correlations – Basic concepts - Frequent Item set mining methods – Pattern evaluation methods – Pattern mining in multilevel, multidimensional space - Constraint-based frequent pattern mining. **CLASSIFICATION -** Classification - Basic concepts - Decision Tree Induction – Bayesian Classification – Rule Based Classification – Model evaluation and selection – Techniques to improve classification accuracy – Bayesian belief networks - Classification by Back propagation – Support Vector Machines – Classification using frequent patterns – Lazy Learners – Other classification methods – Genetic algorithms – Rough set approach – fuzzy set approach. **CLUSTER ANALYSIS -** Overview of basic clustering methods - Partitioning Methods – k-Means – k-Medoids- Hierarchical methods – Density-Based Methods – DBSCAN – OPTICS – DENCLUE - Grid-Based Methods – STING – CLIQUE – Evaluation of clustering – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis – Outlier detection methods – Statistical, proximity and clustering based approaches. **CURRENT TRENDS -** Graph mining – Temporal data mining – Spatial data mining – Distributed data mining – Privacy, security and legal aspects of data mining – Data mining applications – Financial data analysis – Telecommunication industry – Retail industry – Health care and biomedical research.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　Total Hours:　　**45**

Text Books:

1　Jiawei Han, Micheline Kamber and Jian Pei,"Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012.

2　M. Kantardzic, "Data Mining: Concepts, Models, Methods, and Algorithms", 2nd edition, Wiley-IEEE Press, 2011.

Reference Books:

1　Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", McGraw Hill, 2012.

2   Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2012.

Web References:

1   www.cs.purdue.edu/homes/clifton/cs490d/

2   www.tutorialspoint.com/data_mining/dm_cluster_analysis.htm

3   www.cs.waikato.ac.nz/ml/weka/

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Understand	Online Quiz	5
CO2	Understand	Technical Presentation	5
CO3	Apply	Group Assignment	5
CO4	Analyse	Surprise Test	5
Summative assessment based on Continuous and End Semester Examination			

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	80	40	40	40
Apply	20	60	40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

16CS415   **DESIGN PATTERN AND DESIGN THINKING**   **3/0/0/3**

Nature of Course   :K (Problem Programming)
Course Objectives:
1. To remember and understand the importance of design patterns
2. To demonstrate and analyse the different aspects of how the objects interact with each other and with physical components of the design solutions.
3. To provide an insight into design thinking with graphical interfaces to provide dynamism in transformations of a design product or a solution.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO 1	Understand the various design patterns and its purpose	[U]
CO 2	Analyse the various behavioural aspects of design pattern to be solved.	[AN]
CO 3	Study the importance of dynamic responsibility in evaluating the standard design patterns by invoking object oriented concepts.	[E]
CO 4	Evaluate the different pattern interactions between various physical components and the user, managing a design solution through visual representations and simulation models.	[E]
CO 5	Unresolve different transformations of a product or a service through brainstorming and incremental approach, etc.	[AP]

Course Contents:

Course Contents with Course Outcomes/Blooms Taxonomy/Assessment Methods
Introduction to Design patterns: Describing design pattern, Design problems, Design problems solved by design patterns, Selection of a design pattern, Usage of design patterns. **The catalog of design pattern:** Creational pattern, Structural pattern, Behavioural pattern, Class & object communication. **Case Study:** Designing a document editor. **Design Thinking:** Defining design thinking, needs, requirements. **Stages in design thinking:** Immersion: Preliminary immersion, In-depth immersion. Analysis and Synthesis: Insight, Affinity diagram, Conceptual Map, Guiding criteria, Empathy map. Ideation: Brainstorming, Co-creation workshop, Idea menu, Decision matrix. Prototyping: Paper prototyping, Volumetric model, Staging, Storyboard, Service prototyping. **Case Study:** Andorinha project.

Total Hours : 45

Text Books:
1. Enrich Gamma, Richard Helm, Ralp Johnson and John Vissides, "Design Patterns: Elements of reusable object oriented software", Pearson education, Oct 1994.
2. Maurício Vianna, Ysmar Vianna, Brenda Lucena and Beatriz Russo," Design thinking : Business innovation", MJV Technologies and innovation press, 2011.

Reference Books:
1. Alan Shalloway and James R. Trott," Design Pattern Explained: A new perspective on object oriented design", Addison Wesley publication, 2011.
2. Tim Brown, "Change by Design: Design Thinking Transforms organizations and inspires innovations", Harper Collins publication, 2009
3. Design Patterns : Elements of Reusable Object-Oriented Software (1995)
4. The Design Patterns Smalltalk Companion (1998) Alpert, Brown & Woolf

E-Books
1. https://sourcemaking.com/design_patterns
2. https://www.goodreads.com/book/show/8013346-design-thinking
3. https://dschool.stanford.edu/sandbox/groups/designresources
4. http://courses.washington.edu/art166sp/documents/Spring2012/readings/week_3/design_thinking.pdf

Web References:
1. http://www.centrodeinnovacionbbva.com/en/ebook/ebook-design-thinking
2. https://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm
3. http://www.oodesign.com/
4. https://code.tutsplus.com/articles/a-beginners-guide-to-design-patterns--net-12752
5. https://dzone.com/refcardz/design-patterns
6. http://dschool.stanford.edu/dgift/
7. https://hbr.org/2008/06/design-thinking
8. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/
9. http://www.designthinkingforeducators.com/design-thinking/

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Quiz	5
CO2	Analyse	Presentation	5
CO3	Evaluate	Problem solving	5
CO4	Evaluate		
CO5	Apply	Case Study	5

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	**Continuous Assessment**				**End Semester Examination (Theory) [60 marks]**
	Theory			**Practical**	
	CIA1 [6 marks]	**CIA2 [6 marks]**	**Term End Assessment [8 marks]**	**Rubric based CIA [40 Marks]**	
Remember	-	-	-	-	-
Understand	20	20	20	-	20
Apply	20	20	20	-	20
Analyse	30	30	30	-	30
Evaluate	30	30	30	-	30
Create	-	-	-	-	-

16CS416   **DATA SCIENCE**   **3/0/0/3**

Nature of Course: F (Theory Programming)

Course Objectives:
1. To introduce the basic of visualization design and evaluation principles.
2. To enable the students to understand the operation of various types of data.
3. To enable the students to understand the principles of interactive data visualization.
4. To prepare the students to handle the network, temporal, text based, geospatial, hierarchical and graph based data.
    counters
5. To allow the students to learn and make use of R.

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Describe the necessity of interactive web pages.	[R]
CO2	Discuss the efficiency of data representation.	[U]
CO3	Understand the concepts of visualization perspectives.	[U]
CO4	Apply the functionalities and usage of scripting languages	[AP]
CO5	Write programs using R.	[AP]

Course Contents
Introduction: HTML – Introduction-Elements-Attributes-Paragraphs-Formatting-Links-Images-CSS-Java Script.**Text Representation:** Basic Charts and Plots- Priniciples of perception-Text data visualization-temporal data visualization. **Visualization And Statistical Perspectives:** Geospatial data visualization – redesign principles – hierarchical data-network data visualization.**Visualization Design:** The Power of Representation – Data Ink and Graphical Redesign – Chart-Junk. **R**: Overview of R- Control Structures-functions-Looping-Simulation.
                                                      Total Hours: **45**

Text Books:
1. "Storytelling with Data – A Data Visualization guide for Business Professionals", Wiley Publishers, 2015.
2. Richard Cotton ,"Learning R: A Step by Step Function Guide to Data Analysis", 1st Edition, , O Reilly Publishers.

Reference Books:
1. The Visual Display of Quantitative Information, By Edward R.Tuftle, Graphic Press.
2. Handle on Programming with R: Write your own Functions and Simulations By Garrett Grolemund, O Reilly Publishers.

Web References:
1. http://www.creativebloq.com/design-tools/data-visualization-712402

Online Resources:
1. http://www.instantatlas.com/
2. http://dygraphs.com/

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Remember	Quiz	**5**

CO2	Understand	Quiz	5
CO3	Understand	Technical Presentation	5
CO4	Apply	Group Assignment	3
CO5	Apply	Group Assignment	2

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA1	CIA2	Term End Assessment	
Remember	20	0	10	10
Understand	30	20	20	10
Apply	50	40	40	40
Analyse	0	40	30	40
Evaluate	0	0	0	0
Create	0	0	0	0

16CS417   **USER EXPERIENCE DESIGN**   **3/0/0/3**

Nature of Course   : C (Theory Concept)
Course Objectives:
  1   To understand user experience design principles & end users of the product
  2   To understand various methodologies used in user experience research activity
  3   To apply tools for testing user experience
Course Outcomes:
Upon completion of the course, students shall have ability to
  CO1   Understand user experience design principles   [U]
  CO2   Choose a right method for conducting user experience research activity   [U]
  CO3   Analyze user experience & interpret the results of user experience
         research   [A]
  CO4   To test user experience design using Morae tool   [AP]

Course Contents:
Introduction to user experience: What is user experience, user-centered design, principles, life cycle, design thinking, variety of requirements, getting stakeholder buy-in for your activity, Learning about product users, Existing research, Learning about product, Special populations, Ethical & legal considerations.
User experience research activity: Methods, Diary studies, Interviews, Surveys, Card sort, Focus groups, Field studies, Evaluation methods, Differences among the methods, Choosing the right method.
Diary studies: Diary study formats, Sampling frequency, Preparing and conducting a diary study, data analysis & interpretation.
Interviews: Preparing & conducting an interview, Data analysis & interpretation.
Surveys: Need, Survey awareness, Creating & distributing survey, Data analysis & interpretation.
Focus groups: Preparing & conducting focus group, Modifications, Data analysis & interpretation.
Case Study: Morae software for usability testing

                                                                 Total Hours: **45**

Text Books:
  1   Kathy Baxter, Catherine Courage & Kelly Caine, "Understanding your users - A practical guide to user research methods", 2nd Edition, Morgan Kaufmann Publishers, Elsevier Inc., 2015.
  2   Preece, Rogers & Sharp, "Interaction Design beyond human-computer interaction", 4th Edition, John Wiley & Sons Ltd., 2015.
Reference Books:
  1   Gavin Allanwood, Peter Beare, "User Experience Design – Creating designs users really love", 1st Edition, Bloomsbury Publishers, 2014.
  2   Patrick J. Lynch & Sarah Horton, "Web Style Guide – Foundations of User

Experience Design", 4th Edition, Yale University Press, 2016.

Web References:
1. https://www.cmu.edu/dietrich/english/classroom_and_beyond/user-experience-lab/morae-documentation.pdf
2. http://download.techsmith.com/morae/docs/whitepapers/morae_overview_whitepaper.pdf
3. https://www.techsmith.com/tutorial-morae-documentation.html

Online Resources:
1. http://www.ieee.org/about/webteam/resources/uxlab.html
2. http://usabilitygeek.com
3. http://www.allaboutux.org

Assessment Methods & Levels (based on Bloom'sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Quiz	**5**
CO2	Understand	Assignment	**5**
CO3	Analyze	Case study	**5**
CO4	Apply	Quiz	**5**
Summative assessment based on Continuous and End Semester Examination			

Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Nature of Course   : G (Theory analytical)

Course Objectives:
1. To introduce applications of machine learning and case studies
2. To provide an insight to different supervised learning techniques, merits and demerits
3. To enable the students to understand Graphical models and their applicability to real world problems
4. To explore discovering clusters in the given data
5. To study and evaluate dimensionality reduction for the given data

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Explore the acquired knowledge on recalling the applications of machine learning	[R]
CO2	Understand the concepts behind different types of learning and their appropriateness	[U]
CO3	Choose and apply appropriate learning technique for a given real world problem	[AP]
CO4	Analyse the observations for a given set of data	[AN]

Course Contents:

Introduction to Machine Learning: what and why?, Designing a learning system, Issues. Examples of Machine Learning Applications, Overview: Supervised Learning, Learning Associations, Classification, Regression, Unsupervised learning and Reinforcement Learning. **Supervised Learning**: Generative vs discriminative learning, Gaussian mixture models, Decision Tree learning, Neural Networks, Support vector machines, Instance based learning, Ensemble learning. **Graphical models:** Bayesian Learning , Markov random Fields, Hidden Markov model, conditional random fields. **Regression:** Linear regression, logistic regression, other types of regression, Overfitting, Model selection. **Unsupervised learning:** Discovering clusters, Discovering latent factors, Discovering graph structure, **Dimensionality reduction, Case Studies:** Classification, Regression, clustering and anomaly detection

                                                     Total Hours: **45**

Text Books:
1. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series", 3rd Edition, MIT Press, 2014
2. Kevin P. Murphy, Machine Learning A probabilistic Perspective, MIT press, 2012.
3. Christopher Bishop. Pattern Recognition and Machine Learning., Springer, 2006.

Reference Books:
1. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals, 1st Edition, Wiley, 2014
2. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

3   Tom Michael Mitchell, "Machine Learning", McGraw-Hill Education, 1997

Web References:
1   https://onlinecourses.nptel.ac.in/noc16_cs18/
2   http://freevideolectures.com/Course/2257/Machine-Learning

Online courses:
1   https://www.coursera.org/learn/machine-learning
2   https://www.edx.org/course/machine-learning-data-science-analytics-columbiax-ds102x-0#!

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Quiz	5
CO2	Understand	Writing Skills	5
CO3	Apply	Class Presentation	5
CO4	Analyze	Group Assignment	5

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination (Theory) [40 marks]**
	Theory			
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	30	30	20	20
Understand	30	30	20	20
Apply	40	20	20	20
Analyse	-	20	40	40
Evaluate	-	-	-	-
Create	-	-	-	-

16CS419   **GAME THEORY AND ITS APPLICATIONS**   **3/0/0/3**

Nature of Course   :C (Theory Concept)

Course Objectives:
1. To provide an analytical skills into increasingly complex conflicts
2. To introduce logic and strategic decision making involved in the theory of games.
3. To enable the students to be aware of rational behaviour in strategically interdependent situations.
4. To introduce Theorize possible and probable strategies where information is incomplete.

Course Outcomes:

Upon completion of the course, students shall have ability

CO1	Demonstrate the basic knowledge of a "game" into a wide range of conflicts from the standpoint of rationality	[R]
CO2	Understand the strategic games between two and more agents in non cooperative scenario.	[U]
CO3	Understand and Evaluate Game Theory principles in workplace settings.	[U]
CO4	Apply the Nash equilibrium, dominant strategy, equilibrium, Subgame perfect equilibrium for achieving various applications	[AP]

Course Contents:

Introduction to Game Theory:Nash Equilibrium, Strategic games , the Prisoner's Dilemma , the Stag Hunt , Matching Pennies, Best response functions, Dominated actions, Equilibrium in a single population: symmetric games and symmetric equilibria, Cournot's model of oligopoly, Bertrand's model of oligopoly, Electoral competition, The War of Attrition , Accident law **Mixed Strategy Equilibrium:** Strategic games in which players may randomize , Mixed strategy Nash equilibrium, Dominated actions, Equilibrium in a single population , **Extensive games with perfect information:**Strategies and outcomes,Subgame perfect equilibrium , backward induction , Extensive Games with Perfect Information: The ultimatum game, the holdup game, and agenda control , Stackelberg's model of duopoly, **Coalitional Games and the Core :**Games with Imperfect Information, Bayesian Games, Variants and Extensions , Strictly Competitive Games and Maxminimization, **Applications:** Bayesian Games ,Auctions and Voting.

                                        Total Hours: 45

Text Books:
1. Matsumoto, Akio and Szidarovszky, Ferenc,'Game Theory and Its Applications', McGraw Hill Education (India) Private Ltd., 2016
2. Martin Osborne, 'An Introduction to Game Theory (2003)', published by Oxford University Press.

Reference Books:
1. Avinash Dixit and Susan Skeath 'Games of Strategy', 2nd Ed. McGraw Hill Education India Private Ltd., 2013.
2. Leyton-Brown, K., Shoham, Y., Essentials of Game Theory: A Concise, Multidisciplinary Introduction, Morgan & Claypool Publishers. 2008.

Web References:
1.   www.economics.utoronto.ca
2.   www.cs.stanford.edu
3.   www.utsystem.edu

Online Resources:

1   http://www.economics.utoronto.ca/osborne/igt

Assessment Methods & Levels (based on Bloom'sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Remember	Quiz	**5**
CO2	Understand	Writing Skills	**5**
CO3	Understand	Class Presentation	**5**
CO4	Apply	Group Assignment	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS420	Business Intelligence	3/0/0 /3

Nature of Course   :C (Theory Concept)

Prerequisite   : Basic knowledge of RDBMS (relational database management system) concepts with hands-on exposure (includes design & implementation of table structures).

Course Objectives:

1. To learn the fundamentals of business intelligence
2. To acquire knowledge in data integration
3. To perform multi-dimensional data modelling
4. To explore enterprise reporting

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Describe the need for Business Intelligence	R
CO2	Understand the technology and processes associated with Business Intelligence framework	U
CO3	Demonstrate understanding of Data Warehouse implementation methodology and project life cycle	U
CO4	Identify the metrics, indicators and make recommendations to achieve the business goal	AP
CO5	Design an enterprise dashboard that depicts the key performance indicators which helps in decision making	AP

Course Contents:

Introduction to Business Intelligence : 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. **Basics of Data Integration (Extraction Transformation Loading):** 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. **Introduction to Multi-Dimensional Data Modeling :** 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. **Basics of Enterprise Reporting :** Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.

Total Hours: 45

Text Books:

1   David Loshin, Business Intelligence, Morgan Kaufmann, 2nd Edition, 2012.

2   Mike Biere, Business intelligence for the enterprise, Prentice Hall Professional, 2003.

Reference Books:

1	Larissa Terpeluk Moss, Shaku Atre, Business intelligence roadmap, Addison-Wesley Professional, 2003.
2	Cindi Howson, Successful Business Intelligence: Secrets to making Killer BI Applications, McGraw Hill Professional,2007
3	Brain Larson, Delivering business intelligence with Microsoft SQL server 2008, McGraw Hill Professional,2009
4	Lynn Langit, Foundations of SQL Server 2005 Business Intelligence, Apress, 2007
5	Stephen Few, Information dashboard design, O'Reilly, 2006

Web References:

1. www.wipro.com/documents/resource-center/library/bidw_bilogistics.pdf
2. *https://en.wikipedia.org/wiki/Business_intelligence*

Online Resources:

1. https://www.coursera.org/learn/business-intelligence-tools
2. https://www.coursera.org/courses?query=business%20intelligence

Assessment Methods & Levels (based on Bloom'sTaxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
CO1 & CO2	Understand	Quiz	**5**
CO3	Understand	Case Study	**5**
CO4 & CO5	Apply	Class Presentation	**10**

Summative assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment | | | End Semester Examination |
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	[60 marks]
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Nature of Course   :G (Theory analytical)

Course Objectives:

1.   To understand the basic concepts of neural networks and deep networks.
2.   To provide an insight to major architectures of deep networks.
3.   To explore the tuning of deep networks.
4.   To apply deep learning for understand and know about the platforms and tools of wireless sensor network.

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Understand neural and deep networks.	[U]
CO2	Choose appropriate deep network architecture.	[U]
CO3	Apply deep learning for real world problem.	[AP]

Course Contents:

Foundations of Neural Networks - Neural Networks - Training Neural Networks - Activation Functions - Loss Functions - Hyperparameters. **Fundamentals of Deep Networks** - Defining Deep Learning - Common Architectural Principals of Deep Networks - Building Blocks of Deep Networks. **Major Architectures of Deep Networks** - Unsupervised Pre-Trained Networks - Convolutional Neural Networks - Recurrent Neural Networks - Recursive Neural Networks. **Tuning Deep Networks** - Basic Concepts in Tuning Deep Networks - Matching Input Data and Network Architectures - Relating Model Goal and Output Layers - Working with Layer Count, Parameter Count, and Memory - Weight Initialization Strategies - Using Activation Functions. **Applications** – Large-Scale deep learning – Computer Vision – Speech Recognition – Natural Language Processing

Total Hours: 45

Text Books:

1   Adam Gibson, Josh Patterson, Deep Learning: DL4J and Beyond, O'Reilly Media, 2017.

2   Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Reference Books:

1   Daniel Graupe, Deep Learning Neural Networks: Design and Case Studies, World Scientific Publishing , 2016.

2   Yu and Li Deng, Deep Learning: Methods and Applications, Now Publishers Inc, 2014.

Web References:

1. http://nptel.ac.in/courses/110106064/36
2. http://deeplearning.cs.cmu.edu/
3. http://deeplearning.net/

Online Resources:

1. https://www.udacity.com/course/deep-learning--ud730
2. https://bigdatauniversity.com/courses/introduction-deep-learning/

Assessment Methods & Levels (based on Bloom'sTaxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C01	Understand	Case Study	5
C02	Understand	Class Presentation	10
C03	Apply	Group Assignment	5

Summative assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment | | | End Semester Examination |
| | CIA-I | CIA-II | Term End Examination | |
	[6 marks]	[6 marks]	[8 marks]	[60 marks]
Remember	20	40	20	20
Understand	80	60	40	40
Apply	-	-	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS501   **INTERNET MARKETING AND E-COMMERCE**   **3/0/0/3**

Nature of Course   :C (Theory Concept)

Course Objectives:
1. To recognize how information technologies (IT) influence businesses and how they provide competitive advantages.
2. To gain knowledge about various electronic payment methods.
3. To identify desirable properties of secure communication and ways to achieve them.
4. To know about management's role in information security

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1   Demonstrate knowledge on recalling the Network and Internet concepts   [R]

CO2   Understand the methodologies for online business dealings.   [U]

CO3   Understand the role of Internet technology in E-Commerce.   [U]

CO4   Understand various aspects of E-Commerce.   [U]

Course Contents:

Introduction to Electronic commerce Benefits of Electronic commerce Impact of Electronic commerce Classification of Electronic commerce Application of Electronic commerce **Electronic Commerce: Business Models** Electronic Data Interchange EDI, Layered Architecture, Benefits of EDI, Applications of EDI Electronic Commerce: Architectural Framework **Network Infrastructure** LAN, ELAN, WAN, TCP/IP Reference Model, Domain Name System **Information Distribution and Messaging** FTP, WWW server, HTTP, Web Server **Information Publishing Technology** Information publishing, Web Browsers, HTML, Common Gateway, VRML **Electronic Commerce: Securing the Business on Internet** Why information on internet is vulnerable, Site Security, Protecting the Network, HTTP services **Electronic Commerce: Securing Network Transaction** Transaction Security, Cryptology, Cryptographic Algorithms, Public Key Algorithms, Digital Signature, Email Security Influence on supply chain Management **Electronic Payment System** Online, Pre Paid, Post paid payment system **Electronic Commerce: Influence on Marketing** Product, Physical Distribution Price Promotion **Electronic Commerce: Search Engine and Directory Services** Search engines, Search engines marketing, Internet Advertising Mobile Commerce: Introduction, Framework and Models **Agents in Electronic Commerce** Need for Agents Types of Agents, Standards and Protocols, Application.

                                                  Total Hours: **45**

Text Books:
1.   Bharath Baskar ,"Electronic Commerce: Framework, Technologies and Applications ",Tata 4e McGraw-Hill Education, 2013

Reference Books:
1.   "Kamesh K.Bajaj and Debjani Nag, E-Commerce the Cutting Edge of Business", Tata McGraw Hill, 2005
2.   Ravi Kalakota and Andrew B.Whinston,"Frontiers of E-Commerce", Pearson Education Asia,2006

3   Gary Schneider, "Electronic Commerce", 12th Edition, Cengage Learning, 2016

Web References:

1   nptel.ac.in/courses/106108102/34

2   nptel.ac.in/courses/106105084/35

3   nptel.ac.in/courses/106108102/37

Online Resources:

1   http://www.marketing-schools.org/types-of-marketing/internet-marketing.html

2   https://www.tutorialspoint.com/e_commerce/

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Remember	Quiz	5
CO2	Understand	Writing Skills	5
CO3	Understand	Class Presentation	5
CO4	Understand	Group Assignment	5

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	20	40	40	40
Understand	80	60	60	60
Apply	-	-	-	-
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS502   **GREEN COMPUTING**   **3/0/0/3**

Nature of Course   :C (Theory Concept)
Course Objectives:
1.   To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment
2.   To infuse skill in energy saving practices in their use of hardware, examine technology tools that can reduce paper waste and carbon footprint by user.
3.   To understand how to minimize equipment disposal requirements

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1	Demonstrate the benefits and policies of energy efficient computing.	[U]
CO2	Understand the change in processes and products to make them green safe and economically acceptable.	[U]
CO3	Apply the strategies of going Green for energy aware applications	[AP]
CO4	Devise energy efficient computing application	[A]

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

                                                          Total Hours: 45

Text Books:
1   Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2016.
2   2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

Reference Books:
1   Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011.
2   John Lamb, "The Greening of IT", Pearson Education, 2009.
3   Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.
       Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.

Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

Web References:
1   http://www.igi-global.com
2   http://www.washingtonpost.com

Online Resources:
1   https://cs.anu.edu.au
2   http://www.academia.edu

Assessment Methods & Levels (based on Bloom'sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Group Assignment	5
CO2	Understand	Technical Presentation	5
CO3	Apply	Online Quiz	5
CO4	Analyze	Case Study	5

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember				
Understand	50	40	60	60
Apply	40	40	20	20
Analyse	10	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

16CS503   **FUNDAMENTALS OF DATABASE TECHNOLOGIES**   **3/0/0/3**

Nature of Course   : C (Theory Concept)
Course Objectives:
1 To impart the knowledge of basic data Base Management Systems and models
2 To understand the traditional relational database systems implementation using SQL.
3 To study the normalization theory concepts
4 To understand the internal storage structures using different file and indexing techniques
5 To get familiarized with query processing, optimization and transactions

Course Outcomes:
Upon completion of the course, students shall have ability to

CO1   Understand the fundamentals of data models and depict a database system using ER diagram and transform into relational database design   [U]

CO2   Demonstrate with understanding of SQL Programming and normalization theory   [AP]

CO3   Understand the basic database storage structures and access techniques   [U]

CO4   Practice the query evaluation and query optimization techniques.   [AP]

CO5   Understand the basic issues of transaction processing and concurrency control   [U]

Course Contents:

Data modelling: Purpose of Database System, Views of data, Data Models, Database Languages-Database System Architecture, Database users and Administrator, Entity Relationship model (E-R model) – E-R Diagrams, Introduction to relational databases. Relational Algebra: Basic Operators, Additional Operators, composition of operators, Extended relational algebra, Relational calculus, Entity-Relationship Diagram, **SQL fundamentals:** Creation and Basic Query Structure, Basic Operations, Aggregate and Grouping, Nested Subqueries and Sets, Updates and Joins, Views ,Triggers and security, Advanced SQL features, Embedded SQL, Dynamic SQL, Introduction to Distributed Databases and Client/Server Databases. Database Normalization: Functional Dependencies, 1NF, 2NF, 3NF and BCNF, **Storage techniques:** Overview of physical storage media- File structures, Indexing: Basics, Hashing, B-tree and B+-tree, **Query Processing and optimization:** Selection, Sorting, Basic Nested Loop Join, Block and Indexed Nested Loop Joins, Merge and Hash Joins, Query Optimization: Equivalent Expressions and simple equivalent rules, Estimating Sizes, **Database Transaction concepts:** Introduction, Features of Transactions, ACID Properties, Types of Recovery Systems, Log-based Schemes, Transaction Schedules: Conflicts and Abort, Serializability, Recoverability, Concurrency Control: Locks, Two-phase Locking Protocols, Timestamp Ordering Protocol, Validation-based protocol, Multiple Granularity Locks, Deadlock Prevention and detection and Deadlock recovery and update operations.

Total Hours: 45

Text Books:
1 Silberschatz, A., Korth, H. F., Sudharshan, S., "Database System, Concepts", 6th Edition, Tata McGraw Hill, 2011.
2 Date, C. J., Kannan, A., Swamynathan, S., "An Introduction to Database Systems", 8th Edition, Pearson Education ,2006

Reference Books:
1 Gupta G K, "Database Management Systems", Tata McGraw Hill Education Private Limited, New Delhi, 2011.

2   Elmasri, R. and Navathe, S. B., "Fundamentals of Database Systems", 4th Edition , Pearson / Addision Wesley,2007.

3   Bhattacharya, P. and Majumdar, A., "Introduction to Database Management Systems", Tata McGraw Hill,2001

4   Desai, B. C., "Introduction to Database Systems" West Group, 11th Ed,1990

Web References:

1   http://nptel.ac.in/video.php?subjectId=106106093

2   http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/

Online Resources:

1   http://www.nptelvideos.in/2012/11/database-management-system.html

2   http://www.sqlcourse.com/

3   https://mva.microsoft.com/en-us/training-courses/database-fundamentals-8243?l=TEBiexJy_5904984

4   https://lagunita.stanford.edu/courses/Engineering/db/2014_1/about

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Class Presentation	**4**
CO2	Apply	Group Assignment	**5**
CO3	Understand	Online Quiz	**3**
CO4	Apply	Group Assignment	**5**
CO5	Understand	Online Quiz	**3**

Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	**Continuous Assessment**			**End Semester Examination [60 marks]**
	CIA-I [6 marks]	**CIA-II [6 marks]**	**Term End Examination [8 marks]**	
Remember	-	-	-	-
Understand	70	60	60	60
Apply	30	40	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

16CS504   **SOFTWARE PRODUCT DEVELOPMENT AND MANAGEMENT**   3/0/0/3

Nature of Course   :G (Theory analytical)

Course Objectives:

1. To understand the fundamentals of product design, practical management concepts like leadership and motivation.
2. To induce entrepreneurial intent as well as understand the practical issues faced by entrepreneurs.
3. To practice software product management techniques in software development process.
4. To induce the qualities of software product manager in the software management process.

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Relate software product management to better software products	[U]
CO2	Recognize the role of a software product manager	[U]
CO3	Reflect on how management the principles will improve software projects	[AP]
CO4	Demonstrate various software design techniques in software	[AP]
CO5	Gauge the applicability of process models for a software development project.	[AN]

Course Contents : Software Product –Terms and Characterstics–External and Internal views – Software Product as type – Attributes of software products –Elements of Software Product Management –Role of software product manager – Framework – Market analysis – Product analysis – Product Strategy – Product planning – development-**Software Pricing**- Elements of product pricing – Product Pricing in corporate structure.Product Design – Importance – Objectives – Factors influencing product design – Characteristics of a good product design - **Product Development Process** – Sources of Ideas for designing new products – Stages in Product Design – Effect of Products Design on Product Cost. - Characteristics of Management – Managerial Skills – Contribution of F.W.Taylor and Henry Fayol – Industrial Ownership. - **Leadership Styles** – Qualities of Leadership – Morale – Motivation Theories (Maslow, Herzberg and ERG theory).

                                                 Total Hours: **45**

Text Books:

1. Software Product Management and Pricing: Key Success Factors for Software Organization, Hans-Bernd Kittlaus, Peter N. Clough, 2011, Springer Science & Business Media.
2. Text book of production management, ShridharaBhat.K, 1st Edition, Himalaya Publishing House,2012.

Reference Books:

1. Industrial Engineering and Management, Khanna.O.P, 2nd Edition, Dhanpat Rai Publications, 2013.
2. Entrepreneurial Development, Jayshree Suresh, 5th Edition, Margham Publications,2010.
3. Entrepreneurship, Robert D. Hisrich, 6th Edition, Tata McGraw Hill Publications.,2014.

Web References:

1. http://nptel.ac.in/courses/106101061/29
2. http://nptel.ac.in/courses/106105087/
3. http://www.acm.org/about/se-code

Online Resources:

1 https://cs.stanford.edu/people/eroberts/cs181/projects/2010-11/Licensure/indexba53.html?page_id=2
2 https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

Assessment Methods & Levels (based on Blooms'Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
CO1	Understand	Online Quiz	3
CO2	Understand	Technical Presentation	3
CO3	Apply	Group Assignment	5
CO4	Apply	Group Assignment	5
CO5	Analyse	Surprise Test	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [60 marks]
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	
Remember	-	-	-	-
Understand	80	40	40	40
Apply	20	60	40	40
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Nature of Course   :G (Theory Programming)

Course Objectives:

1   To gain insight knowledge of OOP concepts
2   To analyze different types of constructor, Inheritance and polymorphism
3   To understand and apply package, Interface and Applet concepts
4   To know the fundamental concepts of collection framework and multithreading in solving real world problems

Course Outcomes:

Upon completion of the course, students shall have ability to

CO1	Demonstrate the fundamental concepts of object oriented programming	[R]
CO2	Understand the basis of Package, multithreading, and interface concepts	[U]
CO3	Use I/O functionality to code basic file operations and experiment with exceptions handling.	[AP]
CO4	Apply the concepts of Applets, AWT and Event handling mechanism to solve a given problems.	[AP]

Course Contents : Overview of Object oriented programming features**- JAVA:** Introduction to java programming –Features of java- Classes and objects - Arrays -Methods-Constructor-Access Specifier – Nested Classes-Inner Classes -Command line arguments**.** Inheritance, packages and Interface: Inheritance types- Method overriding - Abstract Classes- Packages-Interfaces-Strings. **Exceptions and I/O handling:** Exception handling fundamentals-I/O basics – Reading console input – Writing console output-Files-**Applets, AWT and Event Handling:** Applet classes-AWT event handling –multithreaded programming-Collection framework-JDBC Connectivity

	Total Hours:	**45**

Text Books:

1   Herbert Schildt, "Java : The Complete Reference", 9th edition, TMH, 2014.

Reference Books:

1   Paul Deitel, Harvey Deitel, "Java How To Program", 10th Edition, Prentice Hall Publications,2014.

2   Y. Daniel Liang ,"Introduction to Java Programming", 9th Edition , Prentice Hall Publications ,2015

Web References:

1   http://www.nptel.ac.in
2   http://www.javaworld.com

Online Resources:

1   https://www.coursera.org/learn/object-oriented-java
2   https://www.coursera.org/specializations/java-object-oriented

Assessment Methods & Levels (based on Blooms'Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
CO1	Understand	Online Quiz	5
CO2	Understand	Online Quiz	5
CO3	Apply	Technical Presentation	5
CO4	Apply	Group Assignment	5

Summative assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment | | | End Semester Examination |
	CIA-I [6 marks]	CIA-II [6 marks]	Term End Examination [8 marks]	Examination [60 marks]
Remember	30	10	20	20
Understand	70	60	50	50
Apply	-	30	30	30
Analyse	-	-		
Evaluate	-	-	-	-
Create	-	-	-	-