VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

School of Information Technology & Engineering

Master of Computer Applications

(M.C.A)

Curriculum and Syllabi

(2019-2020)

INDEX

VISION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

Transforming life through excellence in education and research.

MISSION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

World class Education: Excellence in education, grounded in ethics and critical thinking, for improvement of life.

Cutting edge Research: An innovation ecosystem to extend knowledge and solve critical problems.

Impactful People: Happy, accountable, caring and effective workforce and students.

Rewarding Co-creations: Active collaboration with national & international industries & universities for productivity and economic development.

Service to Society: Service to the region and world through knowledge and compassion.

VISION STATEMENT OF THE SCHOOL OF INFORMATION TECHNOLOGY AND ENGINEERING

- To be a leading school that provides transformative education through qualitative teaching and learning practices.
- To be a centre of excellence in education and research, producing global leaders for improvement of the society.

MISSION STATEMENT OF THE SCHOOL OF INFORMATION TECHNOLOGY AND ENGINEERING

- To provide sound fundamentals, and advances in Information Technology, Software Engineering, Digital Communications and Computer Applications by offering world class curricula.
- To create ethically strong leaders and trend setters for next generation IT.
- To nurture the desire among faculty and students from across the globe to perform outstanding and impactful research for the benefit of humanity and, to achieve meritorious and significant growth.

Master of Computer Applications

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates will be practitioners and leaders in their chosen field and function in their profession with social awareness and responsibility.

2. Graduates will interact with their peers in other disciplines in their work place and society and contribute to the economic growth of the country.

3. Graduates will be successful in pursuing higher studies in their chosen field with career path in teaching or research.

Master of Computer Applications

PROGRAMME OUTCOMES (POs)

PO_1: Having an ability to apply mathematics and science in computer applications.

PO_2: Having a clear understanding of the subject related concepts and of contemporary issues.

PO_3: Having an ability to design a component or a product by applying all the relevant standards and with realistic constraints.

PO_4: Having an ability to design and conduct experiments, as well as to analyze and interpret data.

PO_5: Having an ability to use techniques and skills necessary for computational practices.

PO_6: Having problem solving ability- solving social issues and problems.

PO_7: Having adaptive thinking and adaptability.

PO_8: Having a clear understanding of professional and ethical responsibility.

PO_9: Having a good working knowledge of communicating in English.

PO_10: Having interest in lifelong learning.

Master of Computer Applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of M.C.A. (Master of Computer Applications) programme, graduates will be able to

- PSO1: To exhibit practical competencies in a broad range of programming languages and software platforms.
- PSO2: To provide intensive software solutions for real-world applications with the aid of modern computational tools and techniques.
- PSO3: To instill skill set towards life-long learning by creating research ambience and higher educational opportunities.

Master of Computer Applications

CREDIT STRUCTURE

Category-wise Credit distribution

Category	Credits
University core (UC)	**29**
Programme core (PC)	**24**
Programme elective (PE)	**21**
University elective (UE)	**06**
Bridge course (BC)	-
Total credits	**80**

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Master of Computer Applications

DETAILED CURRICULUM

University Core

S. No.	Course Code	Course Title	L	T	P	J	C
1.	ENG5003	English for Science and Technology/GER5001/FRE5001	0	0	4	0	2
2.	ITA5001	Software Project Management	2	0	0	0	2
3.	ITA6099	Master Thesis	0	0	0	0	16
4.	MAT5007	Applied Statistical Methods	2	0	2	0	3
5.	SET5001	Science, Engineering and Technology Project – I	0	0	0	0	2
6.	SET5002	Science, Engineering and Technology Project – II	0	0	0	0	2
7.	STS4011	Essentials of Business etiquettes	3	0	0	0	1
8.	STS4012	Preparing for Industry	3	0	0	0	1

Master of Computer Applications

Programme Core

S. No.	Course Code	Course Title	L	T	P	J	C
1.	ITA5002	Problem solving with Data structures and Algorithms	3	0	2	0	4
2.	ITA5003	Data Communication and Networking	3	0	0	0	3
3.	ITA5004	Object Oriented Programming using JAVA	2	0	2	0	3
4.	ITA5005	Object Oriented Software Engineering	3	0	0	0	3
5.	ITA5006	Distributed Operating Systems	2	0	0	4	3
6.	ITA5007	Data Mining and Business Intelligence	3	0	0	4	4
7.	ITA5008	Database Technologies	3	0	2	0	4

Programme Elective

S. No.	Course Code	Course Title	L	T	P	J	C
1.	ITA6001	Mobile Application Design and Development	3	0	0	4	4
2.	ITA6002	Programming in C#	3	0	2	0	4
3.	ITA6003	Internet and Web Programming	2	0	2	4	4
4.	ITA6004	Soft Computing	3	0	0	4	4
5.	ITA6005	Online Transaction using Mainframe Computing	3	0	0	0	3
6.	ITA6006	Storage Systems and Management	3	0	0	0	3
7.	ITA6007	Network and Information Security	3	0	0	4	4
8.	ITA6008	Big Data Analytics	3	0	0	4	4
9.	ITA6009	Cloud Computing	3	0	0	4	4
10.	ITA6010	Internet of Things	3	0	0	4	4
11.	ITA6011	Advanced Computer Architecture	3	0	0	4	4
12.	ITA6012	Semantic Web	3	0	0	4	4
13.	ITA6013	Advanced Software Testing	3	0	2	0	4
14.	ITA6014	Software Process and Metrics	3	0	0	0	3
15.	ITA6015	Accounting and Financial Management	3	0	0	4	4
16.	ITA6016	Machine Learning	3	0	2	0	4
17.	ITA6017	Python Programming	2	0	2	0	3
18.	ITA6018	Digital Forensics	3	0	0	4	4
19.	ITA6019	Game Programming	3	0	2	0	4

University Core

ENG5003	English for Science and Technology	L	T	P	J	C
		0	0	4	0	2
Pre-requisite	Nil	Syllabus version				
		v. 1.1				

Course Objectives:

1. To provide an exposure to professional and technical communication skills in the area of science and technology.
2. To develop the domain-specific linguistic knowledge for better employability prospects.
3. To practice the required productive and receptive skills with hands-on activities.

Expected Course Outcomes:

1. Communicate in clear, concise and correct manner in social and academic contexts.
2. Develop listening comprehension, summarization techniques and critical thinking ability.
3. Participate actively in group discussions by applying speaking and coordinating strategies within the group.
4. Present information with appropriate presentation techniques in professional and business contexts.
5. Write different types of reports and SoP with better interpretative, summarizing and editing techniques.
6. Read and comprehend general articles as well as academic texts.
7. Prepare an effective resume and face interviews for employment.

Module:1	Career Goals	4 hours

Short term and long term career goals

Activity: SWOT Analysis/ Comprehending speeches

Module:2	Interpersonal Skills	4 hours

Interpersonal Communication in/with Groups (Corporate Etiquette: Journey from Campus to corporate)

Activity: Role Plays/Mime/Skit

Module:3	Listening Skills	4 hours

Listening to Documentary

Activity: Critically evaluate/Review a documentary/TED Talk

Module:4	Reading Skills	4 hours

Skimming, Scanning, Intensive & Extensive reading

Activity: Reading News Papers/Magazines/Scientific Texts

Module:5	Report Writing	4 hours

Language and mechanics of writing report

Activity: Writing a Report/Mini Project

Module:6	**Study Skills**	**4 hours**
Summarizing the report Activity: Abstract, Executive Summary, Digital Synopsis		
Module:7	**Interpreting skills**	**4 hours**
Interpret data in tables and graphs Activity: Transcoding		
Module:8	**Editing Skills**	**4 hours**
Proof Reading Sequencing Activity: Editing any given text		
Module:9	**Presentation Skills**	**4 hours**
Oral Presentation using digital tools Activity: Oral presentation on the given topic using appropriate non-verbal cues		
Module:10	**Group Discussion**	**4 hours**
Intragroup interaction (avoid, accommodate, compete, compromise, collaborate) Activity: Group discussion on a given topic		
Module:11	**Professional Skills**	**4 hours**
Résumé Writing Activity: Prepare an Electronic Résumé		
Module 12	**Skill-Gap Analysis**	**4 hours**
Tailor your skills to suit the Job needs Activity: Write a SoP for higher Studies/Purpose Statement for job		
Module 13	**Interview Skills:**	**4 hours**
Placement/Job Interview Activity: Mock Interview		
Module 14	**Managerial Skills**	**4 hours**
Official Meeting to organize events Activity: Writing Agenda, Minutes of Meeting (video conferencing) and Organising an event		
Module 15	**Problem Solving Skills**	**4 hours**
Conflict Management & Decision Making Activity: Case analysis of a challenging Scenario		
	Total Lecture hours:	**60 hours**

Text Book(s)	
1	Kuhnke, E. Communication Essentials For Dummies, 2015 1st Edition. John Wiley & Sons.
2	Hewings, *M. Advanced Grammar in Use Book with Answers and CD-ROM: A Self-Study Reference and Practice Book for Advanced Learners of English,* 2013, 3rdEdition. Cambridge University Press. UK.
Reference Books	
1.	Churches, R. Effective Classroom Communication Pocketbook, Management Pocketbooks 2015, 1st Edition. USA.
2	Wallwork, A. English for Writing Research Papers, 2016, 2nd Edition, Springer.
3	Wood, J. T. Communication in Our Lives, 2016, Cengage Learning, Boston, USA.
4	Anderson, C. TED Talks: The Official TED Guide to Public Speaking, 2016, 1stEdition, Boston, Houghton Mifflin, New York
5	Tebeaux, Elizabeth, and Sam Dragga, The essentials of Technical Communication, 2015, 1st Edition, Oxford University Press, USA**.**
6	Zinsser, William, On writing well, , 2016, 13th Edition, HarperCollins Publishers, New York.

List of Challenging Experiments (Indicative)		
1.	Setting short term and long term goals	2 hours
2.	Mime/Skit/ Activities through VIT Community Radio	6 hours
3.	Critically evaluate / review a documentary/ Activities through VIT Community Radio	4 hours
4.	Mini Project	10 hours
5.	Digital Synopsis	4 hours
6.	Case analysis of a challenging Scenario	4 hours
7.	Intensive & Extensive reading of Scientific Texts	4 hours
8.	Editing any given text	8 hours
9.	Group discussion on a given topic / Activities through VIT Community Radio	8 hours
10.	Prepare a video résumé along with your video introduction and then create a website (in Google Sites/Webly/Wix) showcasing skills and achievements.	10 hours
	Total Practical Hours	60 hours

Recommended by Board of Studies	22-07-2017		
Approved by Academic Council	46	Date	24-08-2017

FRE5001	Francais Fonctionnel	L	T	P	J	C
		2	0	0	0	2
Pre-requisite		**Syllabus version**				
Nil		v.1				

Course Objectives:

The course gives students the necessary background to:

1. Demonstrate competence in reading, writing, and speaking basic French, including knowledge of vocabulary (related to profession, emotions, food, workplace, sports/hobbies, classroom and family).
2. Achieve proficiency in French culture oriented view point.

Expected Course Outcomes:

The students will be able to

1. Remember the daily life communicative situations via personal pronouns, emphatic pronouns, salutations, negations, interrogations etc.
2. Create communicative skill effectively in French language via regular / irregular verbs.
3. Demonstrate comprehension of the spoken / written language in translating simple sentences.
4. Understand and demonstrate the comprehension of some particular new range of unseen written materials.
5. Demonstrate a clear understanding of the French culture through the language studied.

Module:1	Saluer, Se présenter, Etablir des contacts	**3 hours**

Les Salutations, Les nombres (1-100), Les jours de la semaine, Les mois de l‟année, Les Pronoms Sujets, Les Pronoms Toniques, La conjugaison des verbes réguliers, La conjugaison des verbes irréguliers- avoir / être / aller / venir / faire etc.

Module:2	**Présenter quelqu'un, Chercher un(e) correspondant(e), Demander des nouvelles d'une personne.**	**3 hours**

La conjugaison des verbes Pronominaux, La Négation, L‟interrogation avec *'Est-ce que ou sans Est-ce que'*.

Module:3	**Situer un objet ou un lieu, Poser des questions**	**4 hours**

L‟article (défini/ indéfini), Les prépositions (à/en/au/aux/sur/dans/avec etc.), L'article contracté, Les heures en français, La Nationalité du Pays, L'adjectif (La Couleur, l'adjectif possessif, l'adjectif démonstratif/ l'adjectif interrogatif (quel/quelles/quelle/quelles), L'accord des adjectifs avec le nom, L'interrogation avec Comment/ Combien / Où etc.,

Module:4	**Faire des achats, Comprendre un texte court, Demander et indiquer le chemin.**	**6 hours**

La traduction simple :(français-anglais / anglais –français)

Module:5	**Trouver les questions, Répondre aux questions générales en français.**	**5 hours**
L'article Partitif, Mettez les phrases aux pluriels, Faites une phrase avec les mots donnés, Exprimez les phrases données au Masculin ou Féminin, Associez les phrases.		
Module:6	**Comment ecrire un passage**	**3 hours**
Décrivez : La Famille /La Maison, /L'université /Les Loisirs/ La Vie quotidienne etc.		
Module:7	**Comment ecrire un dialogue**	**4 hours**
Dialogue: a) Réserver un billet de train b) Entre deux amis qui se rencontrent au café c) Parmi les membres de la famille d) Entre le client et le médecin		
Module:8	**Invited Talk: Native speakers**	**2 hours**
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Echo-1, Méthode de français, J. Girardet, J. Pécheur, Publisher CLE International, Paris 2010.
2	Echo-1, Cahier d"exercices, J. Girardet, J. Pécheur, Publisher CLE International, Paris 2010.
Reference Books	
1.	CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau,Les Éditions Didier, 2004.
2	CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2004.
3	ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M. Kizirian, Béatrix Sampsonis, Monique Waendendries , Hachette livre 2006.

Mode of Evaluation: CAT / Assignment / Quiz / FAT			
Recommended by Board of Studies	26-2-2016		
Approved by Academic Council	No 41	Date	17-6-2016

GER5001	Deutsch für Anfänger	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	**NIL**	**Syllabus version**				
		v.1				

Course Objectives:

The course gives students the necessary background to:

1. Enable students to read and communicate in German in their day to day life
2. Become industry-ready
3. Make them understand the usage of grammar in the German Language.

Expected Course Outcomes:

The students will be able to

1. Create the basics of German language in their day to day life.
2. Understand the conjugation of different forms of regular/irregular verbs.
3. Understand the rule to identify the gender of the Nouns and apply articles appropriately.
4. Apply the German language skill in writing corresponding letters, E-Mails etc.
5. Create the talent of translating passages from English-German and vice versa and to frame simple dialogues based on given situations.

Module:1	**3 hours**

Einleitung, Begrüssungsformen, Landeskunde, Alphabet, Personalpronomen, Verb Konjugation, Zahlen (1-100), W-fragen, Aussagesätze, Nomen – Singular und Plural

Lernziel:

Elementares Verständnis von Deutsch, Genus- Artikelwörter

Module:2	**3 hours**

Konjugation der Verben (regelmässig /unregelmässig) die Monate, die Wochentage, Hobbys, Berufe, Jahreszeiten, Artikel, Zahlen (Hundert bis eine Million), Ja-/Nein- Frage, Imperativ mit Sie

Lernziel :

Sätze schreiben, über Hobbys erzählen, über Berufe sprechen usw.

Module:3	**4 hours**

Possessivpronomen, Negation, Kasus- AkkusatitvundDativ (bestimmter, unbestimmterArtikel), trennnbare verben, Modalverben, Adjektive, Uhrzeit, Präpositionen, Mahlzeiten, Lebensmittel, Getränke

Lernziel :

Sätze mit Modalverben, Verwendung von Artikel, über Länder und Sprachen sprechen, über eine Wohnung beschreiben.

Module:4	**6 hours**

Übersetzungen : (Deutsch – Englisch / Englisch – Deutsch)

Lernziel :

Grammatik – Wortschatz – Übung

Module:5		**5 hours**
Leseverständnis,Mindmap machen,Korrespondenz- Briefe, Postkarten, E-Mail **Lernziel :** Wortschatzbildung und aktiver Sprach gebrauch		
Module:6	.	**3 hours**
Aufsätze : Meine Universität, Das Essen, mein Freund oder meine Freundin, meine Familie, ein Fest in Deutschland usw		
Module:7		**4 hours**
Dialoge: e) Gespräche mit Familienmitgliedern, Am Bahnhof, f) Gespräche beim Einkaufen ; in einem Supermarkt ; in einer Buchhandlung ; g) in einem Hotel - an der Rezeption ;ein Termin beim Arzt. Treffen im Cafe		
Module:8		**2 hours**
Guest Lectures/Native Speakers / Feinheiten der deutschen Sprache, Basisinformation über die deutschsprachigen Länder		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	**Studio d A1 Deutsch als Fremdsprache, Hermann Funk, Christina Kuhn, Silke Demme : 2012**
Reference Books	
1	Netzwerk Deutsch als Fremdsprache A1, Stefanie Dengler, Paul Rusch, Helen Schmtiz, Tanja Sieber, 2013
2	Lagune ,Hartmut Aufderstrasse, Jutta Müller, Thomas Storz, 2012.
3	Deutsche SprachlehrefürAUsländer, Heinz Griesbach, Dora Schulz, 2011
4	ThemenAktuell 1, HartmurtAufderstrasse, Heiko Bock, MechthildGerdes, Jutta Müller und Helmut Müller, 2010
	www.goethe.de wirtschaftsdeutsch.de hueber.de, klett-sprachen.de www.deutschtraning.org

Mode of Evaluation: CAT / Assignment / Quiz / FAT			
Recommended by Board of Studies	04-03-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

ITA5001	Software Project Management	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.1				

Course Objectives:

1. To explore the characteristics of Software projects and understand the project management activities.
2. To gain knowledge on estimation techniques of software projects and to know about Risk Management.
3. To provide an exposure to Monitor and Control of software projects and to learn how to manage people and build the effective team.

Expected Course Outcomes:

1. Demonstrate knowledge of the fundamental elements and concepts related to Project Management activities and types of software projects.
2. Analyze the Steps involved in analyzing the Software projects and concepts to meet the estimation of the software Projects.
3. Schedule the activities of the project to get a critical path.
4. Develop an activity network to perform PERT and to get knowledge of Risk Management.
5. Use and apply Visualization techniques for planning the activities related to Software projects.
6. Gain knowledge on contracts management.
7. Estimate the organizing team based on industry exposure.

Module:1	**Introduction to software project management**	**4 hours**

Project Definition – Types of Project –Problem with Software Project- Activities covered By Software Project Management – Management Control Cycle.

Module:2	**Step wise approach and Project evaluation**	**5 hours**

Step wise approach for planning the software project- Product break down structure for identifying the project activities- Strategic Assessment – Technical Assessment –Cost Benefit Evaluation Techniques – Risk Evaluation

Module:3	**Activity planning**	**6 hours**

Objectives – Project Schedule –Activity based approach- Product based approach- Hybrid approach Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass.

Module:4	**Risk management**	**4 hours**

Nature Of Risk – Types Of Risk – Managing Risk – Software project risk and strategies to reduce the risk- PERT using three estimates.

Module:5	**Monitoring**	**3 hours**

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned

Value Analysis		
Module:6	**Control**	**3 hours**
Change Control – Managing Contracts – Introduction – Types Of Contract – Contract Management		
Module:7	**Managing people and organizing teams**	**3 hours**
Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Working in group- Decision Making- Leadership.		
Module:8	**Contemporary issues:**	**2 hours**
Expert talk		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Mike Cotterell, Bob Hughes, Rajib Mall - Software Project Management, 2011, 5TH Edition, Tata McGraw-Hill.
Reference Books	
1.	Greg Horine-Project Management Absolute Beginner's Guide, 2012, 3rd Edition, Que Publishing.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Mode of assessment:			
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	47th	Date	05-10-2017

ITA6099	Master's Thesis	L	T	P	J	C
		0	0	0	0	16
Pre-requisite	**75% of total credits**	**Syllabus version**				
		v. **1.0**				

Course Objectives:

To provide sufficient hands-on learning experience related to the design, development and analysis of suitable product / process so as to enhance the technical skill sets in the chosen field and also to give research orientation

Expected Course Outcomes:

At the end of the course the student will be able to

1. Formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.
2. Perform literature search and / or patent search in the area of interest.
3. Develop a suitable solution methodology for the problem.
4. Conduct experiments / Design & Analysis / solution iterations and document the results.
5. Perform error analysis / benchmarking / costing.
6. Synthesise the results and arrive at scientific conclusions / products / solution.
7. Document the results in the form of technical report / presentation.

Contents

1. Capstone Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities.
2. Project can be for 10 months duration based on the completion of required number of credits as per the academic regulations.
3. Should be individual work.
4. Carried out inside or outside the university, in any relevant industry or research institution.
5. Publications in the peer reviewed journals / International Conferences will be an added advantage

Mode of Evaluation: Periodic reviews, Presentation, Final oral viva, Poster submission

Recommended by Board of Studies	10.06.2016		
Approved by Academic Council	41stAC	Date	17.06.2016

MAT5007	Applied Statistical Methods	L	T	P	J	C
		2	0	2	0	3
Pre-requisite	Nil	Syllabus Version				
		v. 3.0				

Course Objectives:

1. To provide students with a framework that will help them choose the appropriate descriptive methods in various data analysis situations.
2. To apply estimation and testing methods to make inference and hypothesis for decision making.

Expected Course Outcomes:

At the end of the course the students are expected to learn

1. Independently calculate basic statistical parameters. (measures of central tendency, measures of dispersion)
2. Provide a clear sense of how to investigate the strength and direction of a relationship between two or more variables by collecting measurements and using appropriate statistical analysis.
3. Apply basics of discrete and continuous random variables.
4. Understand the logical frame work of testing of hypothesis and based on the acquired knowledge to interpret the meaning of the calculated statistical indicators.
5. Choose a statistical method for solving practical problems.
6. Demonstrate R programming for statistical data.

Module:1	Introduction to Statistics:	7 hours

Introduction to Statistics and data analysis-Measures of central tendency, Measures of dispersion, Skewness and Kurtosis.

Module:2	Correlation and regression:	5 hours

Correlation and Regression–Rank Correlation-Partial and Multiple Correlation Regression, Multiple Regression.

Module:3	Testing of hypothesis I:	6 hours

Introduction-Types of errors, Critical region, procedure of testing hypothesis-Large sample tests-Z-test for Single Proportion, Difference of Proportion, Single mean and difference of means.

Module:4	Testing of hypothesis II:	10 hours

Small Sample Tests - Student t-test, F-test, Chi-Square test for independence of Attributes, Analysis of Variance-One-way, Two-way Classification, Principles of experimental design, Completely randomized design, Randomized block design, Latin Square design- Problems.

Module:5	**Contemporary issues:**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Applied Statistics and Probability for Engineers, 6ed, (2016),Douglas C. Montgomery George C. Runger, John Wiley & Sons
2	Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences(2017) by J. Susan Milton and Jesse Arnold, Mc.Grawhill education
Reference Books	
1.	Statistics for Engineers and Scientists (2017) by Navidi ,McGraw-Hill Education – Europe
2	Fundamentals of Statistics (2016) by S.C. Gupta seventh revised and enlarged edition

List of Challenging Experiments (Indicative)		
1.	Introduction: Understanding Data types; importing/exporting data.	2 hours
2.	Computing Summary Statistics /plotting and visualizing data using Tabulation and Graphical Representations.	2 hours
3.	Applying correlation and simple linear regression model to real dataset; computing and interpreting the coefficient of determination	2 hours
4.	Applying multiple linear regression model to real dataset; computing and interpreting the multiple coefficient of determination	2 hours
5.	Testing of hypothesis for One sample mean and proportion from real-time problems.	2 hours
6	Testing of hypothesis for Two sample mean and proportion from real-time problems.	2 hours
7	Applying the t test for independent and dependent samples	2 hours
8	Applying Chi-square test Contingency test to real dataset	2 hours
9	Performing ANOVA for One-way, Two-way classification for real dataset	2 hours
10	Performing ANOVA in Design of Experiments- Completely randomized design, Randomized Block design ,Latin square Design.	2 hours
11	Performing two-way ANOVA in Randomized block design	2 hours
12	Performing three-way ANOVA in Latin square Design.	2 hours
	Total Laboratory Hours	24 hours

Recommended by Board of Studies	16.08.2017		
Approved by Academic Council	No. 46	Date	24-08-2017

Programme Core

ITA5002	Problem Solving with Data Structures and Algorithms	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	Nil	Syllabus version				
		v.1.0				

Course Objectives:

1. Familiarize with basic techniques of algorithm analysis and master the implementation of linked data structures.
2. Familiarize with several sub-quadratic sorting algorithms.
3. Familiarize with graph algorithms.

Expected Course Outcomes:

1. Able to Compute time and space complexities of various algorithms.
2. Choose appropriate data structure as applied to specified problem definition.
3. Handle operations like searching, insertion, deletion and traversing mechanism on various data structures.
4. Use linear and non-linear data structures.
5. Solve problems using data structures.
6. Apply concepts learned in various domains.

Module:1	Introduction to algorithm analysis	4 hours

The Problem-solving Aspect, Analysis framework, Asymptotic notations, Growth rate of functions, Complexity analysis, Mathematical analysis of recursive and non-recursive algorithms.

Module:2	Fundamental Data Structures – List, Stacks and Queues	7 hours

List ADT, Singly linked lists, Doubly Linked lists and Circular Linked Lists – Stack ADT, Implementation of Stacks and applications. Queue ADT, Implementation of Queue and applications

Module:3	Trees	7 hours

Tree ADT, Binary tree, Search Tree ADT, Tree Traversals, AVL tree, Splay tree

Module:4	Sorting and Searching	6 hours

Insertion Sort, Selection, heap sort and Merge sort. Linear time sorting – bucket and radix sort. Linear search and binary search.

Module:5	Graph algorithms	7 hours

The Graph ADT, Representation of adjacency list and matrix, Graph traversals – Depth First Search and Breadth First Search implementation. Shortest path – weighted graphs – Dijkstra‟s algorithm. Minimum spanning tee – Prim‟s and Kruskal‟s algorithm.

Module:6	Algorithm Design Techniques	7 hours

Greedy algorithms – Simple scheduling algorithms, Huffman code, Divide and Conquer – Running time of divide and conquer technique, Closest point problem and Selection problem,

Backtracking technique		
Module:7	**Dynamic Programming**	**5 hours**
Using a table Instead of recursion, Ordering matrix multiplication, Optimal binary search tree and All Pairs Shortest path.		
Module:8	**Contemporary issues:**	**2 hours**
Expert talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Mark Allen Weiss, Data Structure and Algorithm Analysis in C++, 2014, 4th Edition, Pearson Education Limited.
Reference Books	
1.	AnanyLevitin, Introduction to design and analysis of algorithm, 2012, 3rd Edition, Addison – Wesley.
2	Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Paper Back, 2010, 3rd Edition, MIT Press.

List of Challenging Experiments (Indicative)		
1.	Write a program to implement a 3-stacks of size „m‟ in an array of size „n‟ with all the basic operations such as IsEmpty(i), Push(i), Pop(i), IsFull(i) where „i‟ denotes the stack number (1,2,3), m n/3. Stacks are not overlapping each other. Leftmost stack facing the left direction and other two stacks are facing in the right direction.	2 hours
2.	Students of a Programming class arrive to submit assignments. Their register numbers are stored in a LIFO list in the order in which the assignments are submitted. Write a program using array to display the register number of the ten students who submitted first. Register number of the ten students who submitted first will be at the bottom of the LIFO list. Hence pop out the required number of elements from the top so as to retrieve and display the first 10 students.	2 hours
3.	To facilitate a thorough net surfing, any web browser has back and forward buttons that allow the user to move backward and forward through a series of web pages. To allow the user to move both forward and backward two stacks are employed. When the user presses the back button, the link to the current web page is stored on a separate stack for the forward button. As the user moves backward through a series of previous pages, the link to each page is moved in turn from the back to the forward stack. When the user presses the forward button, the action is the reverse of the back button. Now the item from the forward stack is popped, and becomes the current web page. The previous web page is pushed on the back stack. Simulate the functioning of these buttons using array implementation of Stack. Also provide options for displaying the contents of both the stacks whenever required.	2 hours

4.	Most of the bugs in scientific and engineering applications are due to improper usage of precedence order in arithmetic expressions. Thus it is necessary to use an appropriate notation that would evaluate the expression without taking into account the precedence order and parenthesis. a) Write a program to convert the given arithmetic expression into i) Reverse Polish notational ii) Polish notation	2 hours
5.	In a theme park, the Roller-Coaster ride is started only when a goodnumber of riders line up in the counter (say 20 members). When the ride proceeds with these 20 members, a new set of riders will line up in the counter. This keeps continuing. Implement the above scenario of lining up and processing using arrays with Queue ADT.	2 hours
6.	When burning a DVD it is essential that the laser beam burning pits onto the surface is constantly fed with data, otherwise the DVD fails. Most leading DVD burn applications make use of a circular buffer to stream data from the hard disk onto the DVD. The first part, the „writing process" fills up a circular buffer with data, then the „burning process" begins to read from the buffer as the laser beam burns pits onto the surface of the DVD. If the buffer starts to become empty, the application should continue filling up the emptied space in the buffer with new data from the disk. Implement this scenario using Circular Queue.	2 hours
7.	**Assume FLAMES** game that tests for relationship has to be implemented using a dynamic structure. The letters in the FLAMES stand for Friends, Love, Affection, Marriage, Enmity and Sister. Initially store the individual letters of the word „flames" in the nodes of the dynamic structure. Given the count of the number of uncommon letters in the two names „n", write a program to delete every nth node in it, till it is left with a single node. If the end of the dynamic structure is reached while counting, resume the counting from the beginning. Display the letter that still remains and the corresponding relationship.	2 hours
8.	Assume in the Regional Passport Office, a multitude of applicants arrive each day for passport renewal. A list is maintained in the database to store the renewed passports arranged in the increased order of passport ID. The list already would contain their cords renewed till the previous day. Apply Insertion sorting technique to place the current day"s records in the list. Later the office personnel wish to sorting the records based on the date of renewal so as to know the count of renewals done each day. Taking into consideration the fact that each record has several fields (around 25 fields), follow Selection sorting logic to implement the same.	2 hours
9.	Write a program to implement Bubble sort, Heap sort and Quick sorting techniques to arrange the following sequence of elements in descending order. 9, -4, 5, 8, -3, 7, 0, 4, 1, 2. Display the count of number of comparisons and swaps made in each method. Apply the same sorting techniques for sorting a large data set [Randomly generate 5000 integers within the range -5 0000 to 50000 to build the data set. From your observation and analysis, determine the best sorting technique for working	2 hours

	with large numbers.	
10.	Write a program to implement Radix Sort on 1D array of Faculty structure (contains faculty name, faculty_ ID, subject_ codes, class_ names), with key as faculty_ ID. And count the number of swap performed.	2 hours
11.	Given a text file T, write a program that will output the longest sentence in the text file.	2 hours
12.	Write a program to implement Binary search on 1D array of Employee structure (contains employee_ name, emp_ no, emp_ salary), with key as emp_ no. And count the number of comparison happened.	2 hours
13.	Write a program for Binary Search Tree to implement following operations: a. Insertion b. Deletion i. Delete node with only child ii. Delete node with both children c. Finding an element d. Finding Min element e. Finding Max element f. Left child of the given node g. Right child of the given node h. Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.	2 hours
14.	Write a program for AVL Tree to implement the insertion operations: (For nodes as integers). Test the program for all cases (LL, RR, RL, LR rotation)	2 hours
15.	Write a program to match the string PATTERN for the given string TEXT and return the index of the leftmost character of the PATTERN if its exists in the string TEXT and return -1 otherwise.	2 hours
16.	Given a graph G = (V, E) and |V| = n and |E| = m, where V is the set of vertices and E is the set of edges. Write a program that will output the parent nodes of each nodes in each of the following traversal mechanisms: a. Depth First Traversal, b. Breadth First Traversal.	2 hours
17.	Let $G = (V, E)$ be a given graph with $\|V\| = n$and $\|E\| = m$, where V is the set of vertices and E is the set of edges. Write a program to find the shortest path in G, given a source node s and destination node t.	2 hours
	Total Laboratory Hours	34 hours

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA5003	Data Communication and Networking	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.1				

Course Objectives:

1. To provide the logical description for layered communication with an overview of the global network infrastructure.
2. To facilitate students to understand the state-of-the-art in network protocols, architectures, design principles and applications.
3. To empower and provide exposure to recent developments and address contemporary issues.

Expected Course Outcomes:

1. Demonstrate the fundamental knowledge on the components of a data communication system, layered architecture and addressing schemes.
2. Analyze the various characteristics of different types of signals and the performance metrics.
3. Familiarity on the taxonomy of circuit switched networks and their features.
4. Apply error control, flow control and congestion control schemes in data communication and understand the media access mechanisms.
5. Develop solutions for efficient forwarding, delivery and routing of network layer protocols.
6. Identify the most appropriate networking architecture and technology to develop applications addressing the deficiency in transport and application layer protocols for effective communication.

Module:1	**Introduction**	**3 hours**

Data Communication, Networks, Layered task, OSI Model, Layers in the OSI model, TCP/IP Protocol suite, Addressing.

Module:2	**Physical Layer and Media**	**6 hours**

Data and Signals, Analog and Digital, Digital Signals, Transmission Impairment, Data Rate Limits, Performance, Multiplexing, Spread Spectrum.

Module:3	**Circuit-Switched Networks**	**6 hours**

Datagram Networks, Virtual-Circuit Networks, Structure of a Switch.

Module:4	**Data Link Layer**	**8 hours**

Error Detection and Correction – Block Coding, Cyclic Redundancy Check, Checksum, Data Link Control – Framing, Flow and Error Control, Multiple Access – Random Access, ALOHA, CSMA, CSMA/CD, CSMA/CA, Channelization

Module:5	**Network Layer**	**8 hours**
IPv4 Addresses, IPv6 Addresses, Logical Addressing Internet Protocol - IPv4, IPv6 596, Transition from IPv4 to IPv6, Address Mapping, Delivery, Forwarding Unicast Routing Protocols, Multicast Routing Protocols		
Module:6	**Transport Layer**	**6 hours**
Process-to-Process Delivery, UDP, TCP, Congestion Control		
Module:7	**Application Layer**	**6 hours**
DNS, Telnet, FTP, SNMP, QOS		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Behrouz A. Forouzan, Data Communications and Networking, 2012, 5th Edition, McGraw-Hill, India.
Reference Books	
1.	Larry L.Peterson, Bruce S.Davie, Computer Networks: A System Approach, 2012, 5th Edition, Morgan Kaufmann.
2	BehrouzA.Forouzan, TCP/IP Protocol Suite, 2012, 5th Edition, Tata McGraw-Hill.
3	W.Richard Stevens, TCP/IP Illustrated The Protocols, 2012, 2nd Edition, Prentice Hall.
4	Andrew S.Tenanbaum, Computer Networks, 2012, 5th Edition, Prentice Hall.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47th	Date	05-10-2017

ITA5004	Object Oriented Programming using JAVA	L	T	P	J	C
		2	0	2	0	3
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. Comprehending basic and object oriented concepts in java& libraries of java.
2. Applying learnt concepts and developing various approaches to solve problems.
3. Designing and building real-time applications with an event-driven graphical user interface accessing files or database.
4. Introducing the concept of web technologies in java - RMI and Servlets.

Expected Course Outcomes:

1. Ability to familiarize with core object oriented concepts in Java.
2. Apply inheritance and interface concepts in java to solve problems.
3. Recognize exceptions and parallel threads in real world problems and solve them with appropriate provisions.
4. Design GUI with Applets and Swings.
5. Design appropriate back end support for an application using file-processing or JDBC.
6. Analyse Generic classes and Collections interfaces that help solve problems using different data structures.
7. Develop web-based solutions using RMI and Servlets.
8. Practice all the concepts of Java and apply appropriate techniques to a specific problem domain.

Module:1	**Introduction**	**4 hours**

Classes & Objects – Overloading Methods – Passing and returning objects – Controlling access to members – this, static, and final keywords , String handling

Module:2	**Inheritance & Packages**	**3 hours**

Inheritance – Types of Inheritance - Method Overriding, Dynamic Method Dispatch – Abstract classes - Interfaces, Packages – Access Specifiers – importing packages

Module:3	**Exception Handling and Multithreading**	**4 hours**

Exception handling Model – Built in exceptions – User defined exceptions.
Multithreading-Thread creation - Thread class - Runnable interface.

Module:4	**GUI in Java**	**5 hours**

Applet Programming, AWT Programming, Event handling – Swing Components.

Module:5	**Files & JDBC**	**4 hours**

FILE class – Its Methods; I/O Streams- Byte Stream and Character Stream classes - Random

Access file. JDBC Statement - Callable and Prepared object – Processing Result set.		
Module:6	**Generics & Collections**	**4 hours**
Generic methods, generic classes – Collection Interfaces - Collection Classes - Collection Algorithms.		
Module:7	**RMI & Servlets**	**4 hours**
RMI – creating stubs, skeleton – Remote Method Invocation; Servlets – Life Cycle – Client Request - Accessing Form Data – database access.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**30 hours**

Text Book(s)		
1.	Deitel and Deitel, Java How to Program (late objects), 2015, 10th Edition, Prentice Hall.	
Reference Books		
1.	Herbert Schildt, Java™: The Complete Reference, 2014, 9th Edition, Oracle Press.	
2.	Eric Jendrock, Ricardo Cervera-Navarro, Ian Evans,KimHaase, William Markito, Java EE 7Tutorial, 2014, 5th Edition, Prentice Hall.	
3.	E. Balaguruswamy, Programming With Java: A Primer, 2012, 3rd Edition, The McGraw Hill.	
List of Challenging Experiments		
1.	Programs on Control Flow – Decision Making, Branching and Looping	2 hours
2.	Program designs on OOP in Java – Classes & Objects, Method Overloading, Inheritance, Dynamic Method Dispatch, Interfaces.	2 hours
3.	Programs with packages	2 hours
4.	Programs on String handling (Use classes String and String Buffer)	2 hours
5.	Programs on Exception Handling	2 hours
6.	Programs on Files and I/O Streams	2 hours
7.	JDBC Programs	2 hours
8.	Programs on Networking (both TCP/IP and UDP)	2 hours
9.	Applet Programming (Including Event Handling)	2 hours
10.	GUI Design with AWT and Swing (Including Event Handling)	2 hours
11.	Program to invoke functions on a remote system.	2 hours
12.	Auto page refresh using Servlets.	2 hours
13.	A small airline has just purchased a computer for its new automated reservations system. You‟ve been asked to develop the new system. You‟re to write an application to assign seats on each flight of the airline‟s only plane (capacity: 10 seats). Your application should display the following	2 hours

	alternatives: Please type 1 for First Class and Please type 2 for Economy. If the user types 1, your application should assign a seat in the first-class section (seats 1–5). If the user types 2, your application should assign a seat in the economy section (seats 6–10). Your application should then display a boarding pass indicating the person‟s seat number and whether it‟s in the first-class or economy section of the plane. Use a one-dimensional array of primitive type Boolean to represent the seating chart of the plane. Initialize all the elements of the array to false to indicate that all the seats are empty. As each seat is assigned, set the corresponding element of the array to true to indicate that the seat is no longer available. Your application should never assign a seat that has already been assigned. When the economy section is full, your application should ask the person if it‟s acceptable to be placed in the first-class section (and vice versa). If yes, make the appropriate seat assignment. If no, display the message "Next flight leaves in 3 hours"	
14.	Net Banking Application – Object based concepts, Networking, JDBC, JSF/Swing	2 hours
15.	Cryptography schemes for encoding of secret image/text – Object based concepts, Networking,	2 hours
16.	Chat for Multiuser - Object based concepts, Networking, JSF/Swing	2 hours
17.	Data mining algorithms to analyse medical data – Files, Collection framework, AWT/Swing	2 hours
	Total Laboratory Hours	34 hours

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA5005	Object Oriented Software Engineering	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	Nil	Syllabus version				
		v. 1.1				

Course Objectives:

1. To learn various SDLC models and requirement gathering techniques.
2. To focus on understanding the user and their task, mapping to object oriented modeling.
3. To focus on techniques needed to develop a complete and consistency product.

Expected Course Outcomes:

1. Analyse various SDLC models and select appropriate model as per project nature and complexity.
2. Produce accurate and complete software product.
3. Develop a specialised knowledge, skills and judgement for complex software development.
4. Produce appropriate documentation accurately with a professional standard.
5. Reinforce the requirement changes by achieving interoperability and integrity at each stages of the software development process.
6. Develop the products using object oriented techniques.

Module:1	Software and Software Engineering	6 hours

The nature of software-Types of software- Characteristic of software-Stakeholders in software engineering – SDLC Process Models- Waterfall, RAD, Agile Software Development. – RUP

Module:2	Review of object orientation	6 hours

Introduction to object orientation- Classes and objects- inheritance- types of inheritance- Aggregation-Instance variables - Methods, operations and polymorphism -Organizing classes into inheritance hierarchies

Module:3	Developing requirements	6 hours

Domain analysis - Functional Requirement and Non-Functional requirements – Requirements gathering – object-based requirements analysis - Use cases: describing how the user will use the system - techniques for gathering requirements- Managing changing requirements, class-based requirements design

Module:4	Modeling with classes	7 hours

Introduction to UML - Essentials of UML class diagrams – Use case diagram- Activity diagram- Class diagram with Associations and multiplicity - Generalization - More advanced features of class diagrams

Module:5	Focusing on users and their tasks	6 hours

User-centered design - Characteristics of users - The basics of user interface design -Usability principles - Evaluating user interfaces- Modeling interactions and behavior: Interaction diagrams - State diagrams - Activity diagrams - Implementing classes based on interaction and state diagrams

- Difficulties and risks in modeling interactions and behavior.		
Module:6	**Architecting and designing software**	**6 hours**
The process of design - Principles leading to good design - Design Principles- Techniques for making good design decisions - Model Driven Development		
Module:7	**Basing software development on reusable technology**	**6 hours**
Reuse: building on the work and experience of others -Incorporating reusability and reuse into software engineering-Frameworks: reusable subsystems,the client-server architecture -Technology needed to build client-server systems -The Object Client-Server Framework (OCSF)		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Timothy C Lethbridge, Object-Oriented Software Engineering Practical Software Development using UML and Java, 2010, 3rd Edition, McGraw-Hill Higher Education.
Reference Books	
1.	Ivar Jacobson, Object-Oriented Software Engineering: A Use Case Driven Approach, 2004, 1stEdition, Addison Wesley Longman Publishing

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	47th	Date	05-10-2017

ITA5006	Distributed Operating Systems	L	T	P	J	C
		2	0	0	4	3
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. Understanding the foundations of Distributed Systems.
2. Understanding the system level and support required for distributed operating system.
3. Understanding the issues involved in study process and resource management.
4. Understanding and to resolve the issues in fault tolerance and recovering the error using suitable approaches.

Expected Course Outcomes:

1. Demonstrate knowledge of the process synchronization.
2. Analyze the architecture of distributed systems and issues in distributed operating systems.
3. Analyze and identify the limitations of distributed systems.
4. Use and apply deadlock handling strategies in distributed environment.
5. Analyze and test algorithm for distributed shared memory.
6. Analyze the performance of load distribution algorithms and to resolve the issues in load distribution.
7. Design a protocol to ensure failure recovery and fault tolerance in distributed operating system.
8. Design and develop domain specific application for distributed operating system.

Module:1	**Fundamentals of Process Synchronization**	**4 hours**

Overview – Synchronization Mechanisms – The Critical-Section Problem, Peterson's Solution, Semaphores, Classic Problems of Synchronization, Process Scheduling algorithms.

Module:2	**Distributed Operating Systems**	**4 hours**

Architectures of Distributed Systems, issues in distributed operating systems, communication networks, communication primitives.

Module:3	**Theoretical Foundations**	**5 hours**

Inherent limitations of a distributed system, lamp ports logical clocks, vector clocks, causal ordering of messages, global state

Module:4	**Distributed Deadlock Detection**	**5 hours**

Deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, centralized deadlock detection algorithms, path-pushing algorithm, Edge-chasing algorithm.

Module:5	**Distributed Shared Memory**	**4 hours**

Architecture, algorithms for implementing DSM, memory coherence protocols. Case studies: IVY, mirage.

Module:6	**Distributed Scheduling**	**3 hours**
Issues in Load distributing, Load distribution algorithms, performance comparison		
Module:7	**Failure Recovery & Fault Tolerance**	**3 hours**
Classification of failures, backward and forward error recovery approaches, Fault Tolerance issues, commit protocols		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Mukesh Singhal & Niranjan G. Shivaratri, Advanced concepts in Operating Systems: Distributed, Database and Multiprocessor operating systems, 2017, 1st Edition, McGraw-Hill Education
Reference Books	
1.	Silberschatz, P.B. Galvin & G. Gagne, Operating System Concepts, 2013, 9th Edition, John Wiley.
2.	Pradeep K. Sinha, Distributed Operating Systems: concepts and design, 2009, Prentice Hall India Learning Private Limited.
3.	Andrew S. Tanenbaum, Modern Operating System, 2016, 4th Edition, Pearson Education India.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA5007	Data Mining and Business Intelligence	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To learn and apply appropriate data pre-processing techniques.
2. To learn data mining algorithms and significance.
3. To learn to apply appropriate predictive and descriptive mining algorithms for business intelligence.

Expected Course Outcomes:

1. Understand the distribution of data and its type to proceed the data pre -processing and mining.
2. Apply data summarization and appropriate pre-processing techniques as per the requirement of the data mining task.
3. Understand and incorporate the statistical models behind prediction process.
4. Apply various representations of classification models and evaluate the performance.
5. Identify the appropriate data mining techniques to improvise business application.
6. Implement the clustering techniques and apply in real time business applications.
7. Use previously observed values to evaluate and interpret the future results.

Module:1	**Introduction**	**6 hours**

Data Mining(DM)–origin–rapid growth--Core Ideas in Data Mining-Supervised and Unsupervised Learning - Steps in Data Mining – Data Warehousing -Business Intelligence(BI)-Role of mathematical model, Business Intelligent Architecture, Development of business intelligent system.

Module:2	**Dimension Reduction**	**6 hours**

Data Summaries, Correlation Analysis, Reducing the Number of Categories in Categorical Variables- Converting a Categorical Variable to a Numerical Variable - Principal Components Analysis.

Module:3	**Performance Evaluation and prediction**	**7 hours**

Evaluating Classification and Predictive Performance - Introduction - Judging Classification Performance - Evaluating Predictive Performance –Prediction - Multiple linear regression- Explanatory vs predictive modelling – Estimating the regression equation and prediction variable selection in linear regression.

Module:4	**Classifications**	**6 hours**

Classification methods- Naïve Bayes- K-Neares-Neighbors- classification and regression trees – logistic regression models-Evaluating classification performance- Evaluating Goodness of fit - logistic regression for more than two classes

Module:5	**Discriminant Analysis and Association Rules**	**6 hours**
Discriminant analysis-classification performance of discriminant -prior probabilities-unequal classification costs- classifying more than two classes. Association Rules: Introduction - Discovering Association Rules in Transaction Databases - Generating Candidate Rules - Selecting Strong Rules**.**		
Module:6	**Cluster Analysis**	**6 hours**
Cluster analysis –Introduction –distance between two records- measuring distance between two clusters-Hierarchical clustering-Non-hierarchical clustering –k-means algorithm		
Module:7	**Forecasting Time Series**	**6 hours**
Introduction to time series - Explanatory versus Predictive Modelling - Popular Forecasting Methods in Business - Time Series Components - Data Partitioning -Regression-Based Forecasting - Model with Trend - Model with Seasonality - Model with Trend and Seasonality - Autocorrelation and ARIMA Models -Smoothing Methods .		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Galit Shmueli, Peter C. Bruce, Nitin R. Patel. Data Mining for Business Analytics: Concepts, Techniques and Applications in XL Miner, 2010, 2nd Edition, Wiley Publications.
2	Carlo Vercellis, Business Intelligence: Data Mining and optimization for Decision Making, 2009, 1st Edition, Wiley Publications.
Reference Books	
1.	Jiawei Han, Micheline, Jian Pei. Data Mining: Concepts and Techniques, 2011, 3rd Edition, The Morgan Kaufmann Series.
2	Margaret. H. Dunham, Data Mining: Introductory and Advanced Topics, 2006, 1st Edition, Pearson Education.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA5008	Database Technologies	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To design conceptual and implementation schema of a database.
2. To implement and manipulate relational and object-relational database using SQL and PL/SQL
3. To introduce the concept of distributed database, parallel database, multimedia database and semi-structured and unstructured database.

Expected Course Outcomes:

1. Design conceptual and implementation schema of a database.
2. Learn how to implement relational database schema and manipulate the same using SQL and PL/SQL
3. Improve the database design by normalization.
4. Learn how to implement object-relational schema and manipulate the same using SQL
5. Learn concept of distributed database and parallel database.
6. Learn concept of XML database and an overview of NoSQL database models.
7. Expose to the idea of multimedia database along with some implementation aspects of the same using SQL

Module:1	**Database Introduction & Design Techniques**	**8 hours**

Introduction to Database Systems, DBMS Architecture, Introduction to Data Modeling, ER Model, EER Model -Specialization/Generalization, Aggregation, Composition, Relational model-algebra operations, ER,EER to Relational Model.

Module:2	**Advanced Design Technique -Normalization**	**8 hours**

Normalization – Informal Guidelines, Functional dependencies, decomposition algorithms , Normal Forms up to 5NF, SQL - Basic & Advanced Operations, Query Processing, Query optimization, Storage and File organization

Module:3	**Distributed Database**	**6 hours**

Concepts, advantages, types, functions, architecture, data allocation, fragmentation, replication, transparencies, Date's rules, transaction management, concurrency control, dead lock, recovery-2PC, 3PC.

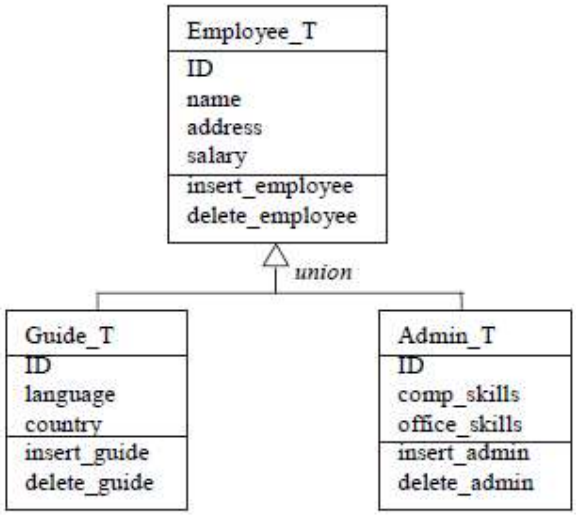
Module:4	**Parallel DBMS**	**6 hours**

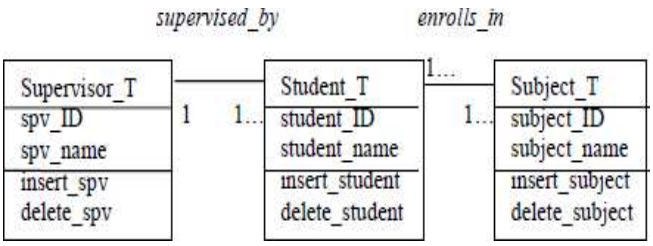
Partition techniques, Architecture, Parallel algorithms for sorting, Parallel join, Parallel Queries.

Module:5	**Object Relational DBMS**	**6 hours**
Overview, Complex Data Types, ODBMS & ORDBMS, Structured Types and Inheritance in SQL, Table Inheritance, Object-Identity and Reference Types in SQL.		
Module:6	**Semi structured & Unstructured data base**	**6 hours**
OEM, Overview of XML, DTD, XML schema, XML query languages, XML related technologies, XML and databases, Unstructured database – NOSQL an Overview		
Module:7	**Multimedia Database**	**3 hours**
Multimedia sources, issues, Multimedia database applications Multimedia database queries-LOB in SQL.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Thomas M. Connolly and Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation, and Management, 2015, 6th Edition, Pearson India.
Reference Books	
1.	RamezElmasri&B.Navathe: Fundamentals of database systems, 2014, 7th Edition, Addison Wesley.
2	S.K.Singh, Database Systems: Concepts, Design & Applications, 2011, 2nd Edition, Pearson education.
3	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 2003, 3rd Edition, McGraw Hill.
4	Joe Fawcett, Danny Ayers, Liam R. E. Quin: Beginning XML, 2012, 5th Edition, Wiley India Private Limited.
5	Abraham Silberschatz, S. Sudarshan, Henry F. Korth: Database System Concepts, 2011, 6th Edition, Tata McGraw - Hill Education.

List of Challenging Experiments (Indicative)		
1.	Creating applications with RDBMS a) Table creation with constraints, alter schema ,insert values, aggregate functions, simple and complex queries with joins b) PLSQL-PROCEDURES,CURSORS,FUNCTIONS,TRIGGERS	2 hours
2.	a) Design the XML elements to hold the membership information for a Computer Club, (i) Construct a Well formed XML Document to hold the elements for 5 students (ii) Construct and link to a CSS to display the 5 students b) Create an XML file for a credit card statement Create a data schema for a credit card statement	2 hours

	Answer the following questions using XPath 1. List all customers 2. Select all customers in Sweden. 3. Who made payments on 2003-12-04? 4. Select all customers in Sweden sorted by customer name.	
3.	Create applications with ORDBMS i) Giant Travel is a well-known travel agency that operates guided tours. With offices around the world, they maintain accurate and detailed employee data. The employee data are kept in an object Employee_T and can be divided into two child objects: Guide_T and Admin_T. An employee can be categorized as a guide or an administration staff, but he or she can also be both. This is important because in the peak season, an administration worker might be needed to guide the tours and vice versa. The objects and the attributes are shown below  Createthe tables for each object have been created; write the implementation of insertion into and deletion from tables Employee and Guide. ii) The following figure shows the relationship among objects Supervisor_T, Student_T, and Subject_T in a university. A student can take many subjects, and a subject can be taken by many students. For every subject a student takes, there is a mark given. In another relationship, a student can be supervised by only one supervisor, but a supervisor can supervise many students. Create the objects and the tables from these objects a) Write generic methods to insert into and delete from table Enrolls_ In. b. Write generic member methods to insert into and delete from table Supervisor.	2 hours



Supervisor	
Spv_ID	**Spv_Name**
1001	Steve Donaldson
1003	Erin Goldsmith
1007	Tony Wibowo

Student	
Student_ID	**Student_Name**
11013876	Robert Tan
11014832	Julio Fernandez
11014990	Colin Brown

Subject	
Subject_ID	**Subject_Name**
CSE31DB	Database System
CSE31UIE	User Interface Engineering
CSE42ADB	Advanced Database

Enrolls_In		
Student_ID	**Subject_Code**	**Mark**
11013876	CSE31DB	86
11013876	CSE31UIE	90
11014832	CSE31ADB	78
11014990	CSE31DB	74
11014990	CSE31UIE	70

Set up a distributed database and create tables ,insert values ,fragment the data and apply queries

i) Assume we have a global conceptual schema that contains the following table with the key underlined: Employee (Eno,Ename,Title,Dno). Also assume that we horizontally fragment the table as follows:

Employee1(Eno;Ename; Title;Dno), where 1<= Dno<=10
Employee2(Eno;Ename; Title;Dno), where 11 <= Dno<=20
Employee3(Eno;Ename; Title;Dno), where 21 <= Dno<=30

In addition, assume we have 4 sites that contain the following fragments:
Site1 has Employee1
Site2 has Employee2
Site3 has Employee2 and Employee3
Site4 has Employee1

	Implement at least 5 suitable queries using suitable database system on Employee fragments. ii) We are given the following three relations with their keys underlined: *Supplier(Sno,Sname,City,State)* *Part(Pno,Pname,Color)* *Supplier-Part(Sno,Pno,Qty).* We know that Suppliers can supply many Parts and many Suppliers can supply a Part. Assume the Supplier table is horizontally fragmented using the predicates: State =Maharashtra and State = Karnataka. We can also assume that Suppliers are evenly located in only those two states. In addition, the Part table is horizontally fragmented using the predicates: 1<= Pno<=100,101<=Pno<=200, 201<=Pno<=300, 301<=Pno<=400, 401<=Pno<=500. Part numbers are continuous from 1 to 500, inclusive. Now we are to horizontally fragment the Supplier- Part relation according to your choice. Implement at least 5 suitable queries using suitable database system.	
4.	Consider we have the following relation EMP(EmpId, Name, Location, Sal, DOB, Dept.) For security reasons salary information for employees needs to be maintained at Company Headquarter Server located in Mumbai. Write the procedure for doing the above activity and fire suitable queries on the separated/fragmented data.	2 hours
5.	Suppose we have the following Database CUSTOMER (CID, CNAME, STREET, CCITY); BRANCH (BNAME, ASSETS, BCITY); ACCOUNT (A#, CID, BNAME, BAL); LOAN (L#, CID, BNAME, AMT); TRANSACTION (TID, CID, A#, Date, AMOUNT); Suppose we want to retrieve the name of all customers who have one or more accounts in branches in the city of Mumbai. Write the all possible SQL statement for this query. Do optimization of all alternative statements using total cost and response time as measure of resources consumption.	2 hours
	Total Laboratory Hours	10 hours

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

Programme Elective

ITA6001	Mobile Application Design and Development	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	ITA5006	Syllabus version				
		v. 1.0				

Course Objectives:

1. To understand mobile design principles and its applications.
2. To explore the various prototypes for hybrid and native mobile application.
3. To gain expertise in software development methodologies for deploying mobile applications

Expected Course Outcomes:

1. Understand software architecture for mobile applications.
2. Get insight into the scripting technologies available for mobile applications.
3. Understand Android Environment and basic components.
4. Develop basic applications for Android using Eclipse IDE.
5. Develop Android apps portable across variety of devices.
6. Develop and deploy applications for mobile cross platforms.
7. Learn and apply the concepts of Android to develop graphics applications.
8. Understand various engineering works going-on in the industry towards mobile app development.

Module:1	Mobile application development	5 hours

A brief history of mobile**,** Mobile ecosystem, Designing for context, Developing a Mobile Strategy, Mobile Information Architecture, Mobile Design, Types of mobile application

Module:2	Technologies:	7 hours

HTML5-elements,form,graphics,media,CSS3-2Dtransforms, 3Dtransforms, transitions, animations, images, JavaScript-forms, objects, error handling, validations, JQuery- selectors, effects, traversing, Ajax

Module:3	Android programming	5 hours

Android toolkit, Java for android, components of an Android Application.

Module:4	Android software development	6 hours

Eclipse Concepts and Terminology, Eclipse Views and Perspectives, Eclipse and Android, Effective java for Android.

Module:5	Android Framework	7 hours

Building a View, Fragments and Multiplatform Support, Handling and Persisting Data.

Module:6	Android UID principles	6 hours

Designing powerful user interfaces, handling advanced user input, designing accessible applications.

Module:7	**Drawing, Animations and Graphics programming**	**7 hours**
Developing 2D graphics applications, working with animations developing Android 3D graphics applications, using Android NDK.		
Module:8	**Contemporary issues**	**2 hours**
Expert talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	ZigurdMednieks, Laird Dornin, G. Blake Meike, and Masumi Nakamura, Programming Android, 2011, 1st Edition, O"Reilly Media.
Reference Books	
1.	Jonathan Stark, Building iPhone Apps with HTML, CSS and JavaScript, 2011, 1st Edition, O"Reilly Media.
2.	Brian fling, Mobile Design and Development, 2009, 1st Edition, O'Reilly Media.
3.	Paul Deitel, Harvey Deitel, Abbey Deitel, Michael Morgana, Android for Programmers An App-Driven Approach, 2012, 2nd Edition, Deitel Developer Series, Pearson Education.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6002	Programming in C#	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.1				

Course Objectives:

1. To utilize the .NET framework to build distributed enterprise applications and leverage the major namespaces and classes of the .NET Framework.
2. To acquire knowledge on object oriented programming, Multi-threaded, Database Connectivity and Networking programs.
3. To design and develop Console application, windows application, ASP.NET Web application and Services.

Expected Course Outcomes:

1. Demonstrate the knowledge of .NET Framework and the fundamentals of developing modular application by using C# programming.
2. Design and Develop Solutions for real time problems using object oriented principles.
3. Analyse and evaluate user requirements for software functionality and create new applications.
4. Demonstrate Component Services and develop Windows based application.
5. Implement interactive executable web applications using Network Programming and Remoting.
6. Create database driven applications using ADO.NET.
7. Design and Develop client /server side model and mobile application using ASP.NET
8. Apply .NET progamming in industry based application.

Module:1	**.NET Framework**	**5 hours**

.NET Framework – Common language Runtime (CLR) – Common Type System (CTS) – Common language Specification (CLS) – Compilation process – Visual Studio .NET IDE – Menu bar – Tool box – Project Explorer - Solution Explorer – Server Explorer – Properties window – Using Help

Module:2	**C# Language Fundamentals**	**5 hours**

C# language fundamentals – Programming constructs – value types and reference types – object oriented concepts – Encapsulation – Inheritance – polymorphism – Interfaces – collections – Multithreading

Module:3	**SOAP and Delegates**	**7 hours**

Console Application – Indexers - Multicast delegates – Events - Registry programming – File I/O - Serialization – Binary format – SOAP format – Type Reflection and attribute-based programming – Late binding

Module:4	**Forms and Controls**	**6 hours**

Windows Forms – Tool box controls – Container control – Menu – Tool bar – Tool tip Controls during design time – Run time – Graphics programming GDI+

Module:5	**Socket Programming**	**6 hours**
Remoting – Architecture - Marshal By value (MBV) – Marshal By Reference (MBR) – Network programming using C# - Socket – TCP – UDP		
Module:6	**Connecting Database**	**7 hours**
Data Access with ADO.NET – Architecture – Data reader – Data Adapter – Command – Connection – Data set – Data binding – Data Grid Control – XML based Data sets		
Module:7	**Web Development and Sessions**	**7 hours**
Web Development and ASP.NET – Architecture – web forms – web form controls – Life time Management - Application – Session – ASP with ADO.NET Validation controls – website security		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture Hours:	**45 hours**

Text Book(s)	
1.	Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, 2012, 6thEdition, A Press.
Reference Book(s)	
1.	Joh Skeet, C# in depth, 2014, 3rd Edition, Manning Publications.
2.	Adrew Stellman and Jennifer Greene,. Head First C#, A Learner's Guide to Real-World Programming with C#, XAML, and .NET, 2013, 3rd Edition, O‟Reilly Media.

Lab Challenging Experiments		
1	Create a DLL for ATM Object with necessary fields, properties and methods such as initiating, deposit and withdrawal. Write a menu driven program to perform the following, (i) Discover all the types that are available in the DLL using the concept of multicast delegates. (ii) After initiating the basic information of the customer perform serialization using SOAP format. (iii) Deserialize the above and invoke the methods such as deposit and withdrawal using the concept of late binding. While performing withdrawal, check for the minimum balance value that has to be retrieved from registry.	2 hours
2	Create a DLL Sum with overloaded methods such as, Sum_a(double s, double t); Sum_a(int i, int j); Sum_a(int k, double b); Write a menu driven program to perform the following, 1. Discover all the types that are available in the DLL using the concept of multicast delegates. 2. After initiating the values perform serialization using Binary format. 3. Deserialize the above and invoke the methods using the concept of late binding. If the signature of a method which is invoked is (double, double) then store the result value in registry.	2 hours
3	Create a DLL for foreign currency to Indian rupees convertor calculator	2 hours

	with following specifications, 1 dollar = 65.58 Indian rupees 1 Euro = 73.47 Indian rupees 1 Saudi Riyal = 3.75 Indian rupees 1 Ringgit = 15.36 Indian rupees 1 Chinese Yuan = 1.49 Indian rupees Write a Menu driven program using console application to invoke the above DLL with the below given functionalities, (i). Use the concept of multicast delegates to perform the above. (ii). Store the latest calculated values of conversion done for all the above five in user defined registry. (iii). Provide an option for displaying the largest conversion done foreign currency name with Rupee value stored in the registry.	
4	Write a database program using ADO for students CAT Analysis system that performs various basic operations such as addition, modify, delete and viewing of student records. Also, provide an option for calculating the grades for the subjects based on the marks and display the results in grid control	2 hours
5	Develop a website for E-shopping with necessary functionalities.	2 hours
6	Create a DLL for mobile phone object that has set of interfaces, properties, fields and methods related to it. Write a program to discover all the types available in the DLL using the concept of reflection and display it in windows form	2 hours
7	Create a generalized DLL that displays the signature information of any method which is passed as an input.	2 hours
8	Develop a chat application using client/server programming.	2 hours
9	Write a program using indexer for storing the temperature at various time of a day. Provide an option to retrieve the temperature at any given time. Store the maximum temperature of the day in registry.	2 hours
10	Create a DLL for User Authentication System with methods and properties. Using the concept of Remoting validate a user from the client side whereas, the user information has to be stored at the side of server Registry.	2 hours
	Total Laboratory hours	20 hours

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	47th	Date	05-10-2017

ITA6003	Internet and Web Programming	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v.1.0				

Course Objectives:

1. To understand the basic concepts of web programming.
2. To understand how the client-server model of Internet programming works.
3. To develop interactive, client-side, executable web applications.

Expected Course Outcomes:

1. Demonstrate the knowledge of fundamental elements and concepts related to Web clients and servers.
2. Design Static Client Side web documents using markup languages and style sheets.
3. Design and Implement interactive Websites using client-side scripting.
4. Analyze and understand the web document objects.
5. Design and Implement Server Side programming using open source scripting.
6. Examine and implement the server side open source scripting using utility functions.
7. Understand the fundamental concepts of Open Source database.

Module:1	**Introduction to Web**	**3 hours**

Internet Overview - Basic Internet Protocols – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers

Module:2	**Static Web Programming – HTML and CSS**	**5 hours**

HTML – Lists – Links – Forms – Frames – Tables – Web Page Design – Cascading Style Sheet (CSS). Basics

Module:3	**Client Side Scripting Language – JavaScript**	**5 hours**

JavaScript Introduction – Data Types - Operators – Control Structures – Arrays - Functions

Module:4	**Host Objects – DOM**	**3 hours**

Introduction to Document Object Model – DOM Event Handling

Module:5	**Server Side Scripting Language - PHP**	**6 hours**

Introduction to PHP – Operators – Conditionals – Looping – Functions – Objects – Arrays- Sessions-Cookies

Module:6	**Practical PHP**	**3 hours**

Date and Time Functions – File Handling - File Uploading – Email Basics - Email with attachment

Module:7	**Backend Data Management**	**3 hours**
MySQL Basics – Querying MySQL Database with PHP		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**30 hours**

Text Book(s)

1. Robin Nixon, Learning PHP, MySQL, JavaScript and CSS, 2012, 2nd Edition, O"Reilly.

Reference Books

1. Thomas A. Powell, The Complete Reference HTML & CSS, 2010, 5th edition, McGraw-Hill.
2. Steve Suehring, JavaScript – Step by Step, 2010, 2nd edition, PHI.
3. Deitel Deitel Nieto, Internet & World Wide Web How To Program, 2012, 5th edition, Pearson Education.
4. Jeffrey C. Jackson, Web Technologies A Computer Science Perspective, 2011, Pearson Education.

List of Challenging Experiments (Indicative)

1.	Introduction to HTML Exercises a. Create a webpage that prints your name to the screen. b. Create a webpage that prints the numbers 1 - 10 to the screen. c. Create a webpage and set its title to "This is a webpage". d. Create a webpage that prints the message "When was this webpage created? Check page's title for the answer." to the screen, and set the title of the page to the current date. e. Create a webpage that prints any text of your choice to the screen; do not include a head section in the code. f. Create a webpage which keeps track of the browsers information and do the following • refreshes its page in 5 seconds, • expires in a duration of time	2 hours
2.	HTML text Exercises a. Print your name in green b. Print the numbers 1 - 10, each number being a different color. c. Prints your name in a Tahoma font. d. Display a part of a word with bold underline. e. Print a paragraph with 4 - 5 sentences. Each sentence should be a different font f. Print a paragraph that is a description of a book; include the title of the book as well as its author. Names and titles should be underlined, adjectives should be italicized and bolded. g. Print your name to the screen with every letter being a different heading size. h. Write a comment line on your code and make sure it is not	2 hours

	displayed in the page i. Print $a^2+b^2=2ab$ j. Print H_2O k. Display a c code as it is in the page l. Set the background color of the page as yellow m. Set an image as background of the page n. Set the font size as 10. Print it. Again try to decrease the font size. Check whether the font size is reduced. o. Apply marquee for your name p. Display a paragraph contents in a single line. q. Display 2 paragraph contents using div.	
3.	HTML Text Formatting, Lists Exercises a. Print the squares of the numbers 1 - 20. Each number should be on a separate line, next to it the number 2 superscripted, an equal sign and the result. b. Prints 10 names with a line break between each name. The list should be alphabetized, and to do this place a subscripted number next to each name based on where it will go in the alphabetized list. (Example: $Alan_1$). Print first, the unalphabetized list with a subscript number next to each name, then the alphabetized list. Both lists should have an <h1> level heading. c. Print two lists with any information you want. One list should be an ordered list, the other list should be an unordered list d. Print a list which starts with 7 with the type i e. Prints an h1 level heading followed by a horizontal line whose width is 100%. Below the horizontal line print a paragraph relating to the text in the heading. f. Print a definition list with 5 items g. Print two addresses in the same format used on the front of envelopes (senders address in top left corner, receivers address in the center) h. Print ten acronyms and abbreviations of your choosing, each separated by two lines. Specify the data that the abbreviations and acronyms represent	2 hours
4.	HTML Image Exercises a. Display five different images. Skip two lines between each image. Each image should have a title. b. Display an image that has a border of size 2, a width of 200, and a height of 200. c. Display the image towards the right corner of the webpage	2 hours
5.	HTML Tables	2 hours

<table>
<tr><td></td><td>
<table>
<tr><th colspan="4">Table Heading Cell Spanning 4 Columns</th></tr>
<tr><td>Normal cell</td><td colspan="2">Cell spanning 2 columns</td><td>Normal cell</td></tr>
<tr><td rowspan="3">Cell spanning 3 rows with a gray (US spelling) background</td><td>Normal cell</td><td>Normal cell</td><td>Normal cell</td></tr>
<tr><td>Normal cell</td><td colspan="2" rowspan="2">Cell spanning 2 rows and 2 columns</td></tr>
<tr><td>Normal cell</td></tr>
</table>
</td><td></td></tr>
<tr><td>6.</td><td>HTML Forms
<table>
<tr><th colspan="2">Pizza Shop 2.0</th></tr>
<tr><td>Name</td><td></td></tr>
<tr><td>Pizza Topping</td><td>Supreme
Vegetarian
Hawaiian</td></tr>
<tr><td>Pizza Sauce</td><td>Tomato</td></tr>
<tr><td>Optional Extras</td><td>Extra Cheese Gluten Free Base</td></tr>
<tr><td colspan="2">Delivery Instructions:</td></tr>
<tr><td colspan="2">Send my Order</td></tr>
</table>
</td><td>2 hours</td></tr>
<tr><td>7.</td><td>HTML Frames</td><td>2 hours</td></tr>
<tr><td>8.</td><td>CSS</td><td>2 hours</td></tr>
<tr><td>9.</td><td>JavaScript
a. Write a program that reads number of miles, cost of a gallon of gas, and car gas consumption (miles per gallon) and then determines the cost of a specific trip. The output should be displayed using document.writeln
b. Form Validation</td><td>2 hours</td></tr>
</table>

	Test JavaScript Form Validataion Name* Please enter your name! Address Zip Code* Country* Please select... Gender* Male Female Preferences* Red Green Blue Phone* Email* password (6-8 characters)* Verify password* SEND CLEAR Validate the following • * - Mandatory Fields • Name should not have a maximum of 20 characters • Address – Specify in Text Area • Preferences – Minimum Two colors should be selected c. Implement Image mapping for an animal by displaying the tool tip when touched on the parts of the animal (Image can be anything). d. Consider a PAN Number "BFIPP5629E". Compute the following by writing a JavaScript code. • Display all the odd numbers from the PAN which is greater than 5. • Display the number of Vowels	
10.	PHP	2 hours
11.	PHP – MySQL Design the following form and create a shipping address database which gets the input from the form and store it into the database using PHP/MySQL. * Required Shipping Address *Name: *Address: Address: *City: *State: *Zip: Note: If the required fields are not filled with data, an alert should be	2 hours

	thrown	
12.	PHP – ODBC	2 hours
13.	PHP – File handling CACM Department faculty is handling the course ITA6003. After completing the syllabus, the faculty has decided to get feedback from the students as a document. The document content can be in any format like text, image or combination of both, etc., as they wish and the document size should not exceed 10 MB. Design a form using PHP code to help the faculty to receive the feedbacks by checking the input file size limit.	2 hours
	Total Laboratory Hours	26 hours

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6004	Soft Computing	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To explore the fundamental concepts of neural network algorithms, architecture and its applications.
2. To explore the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.
3. To provide an exposure to the basics of an evolutionary computing paradigm and its application to optimization problems.

Expected Course Outcome:

On Completion of the course, the students will be able to

1. Demonstrate the knowledge of the fundamental concepts of Neural networks.
2. Analyse the architecture and algorithms of Neural networks to meet the challenges of soft computing problems.
3. Demonstrate the basic concepts of fuzzy approach, fuzzy inference systems for knowledge representation.
4. Develop applications using Fuzzy logic control to solve machine intelligence problems.
5. Demonstrate the basic concepts of genetic algorithms with its applications.
6. Develop applications using evolutionary computing paradigms to solve optimization problems.
7. Analyze the architecture of integration of neural networks, fuzzy logic and genetic algorithms.

Module:1	**Neural Networks**	**7 hours**

Biological Neural networks, introduction, evolution, basic models of Artificial Neural Network, Pitts model, Perceptron, Adaline(Adaptive Linear Neuron), Back-propagation network, Radial Basis Function network.

Module:2	**Memory Models**	**6 hours**

Pattern association, auto & hetero associative memory models, Bi directional Associative Memory model, Hopfield network

Module:3	**Unsupervised Networks**	**6 hours**

Self-organizing maps, Learning Vector Quantization network, and Adaptive Resonance Theory network.

Module:4	**Fuzzy sets**	**6 hours**

Introduction, fuzzy sets, operations, fuzzy relations, membership functions, fuzzification & defuzzification.

Module:5	**Fuzzy logic and approximate reasoning**	**7 hours**
Fuzzy truth values, fuzzy propositions, fuzzy rules, formation, decomposition and aggregation of rules, fuzzy reasoning, FIS, Fuzzy Decision Making		
Module:6	**Genetic Algorithm**	**5 hours**
Difference between traditional algorithms and GA, basic operators, schema theorem, convergence analysis, stochastic models, applications in search and optimization. Encoding, Fitness Function, reproduction, cross over, mutation. Convergency Theory; Applications-Match word finding, Travelling sales man problem.		
Module:7	**Hybrid Systems**	**6 hours**
Integration of neural networks, fuzzy logic and genetic algorithms.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Sivanandam and S N Deepa, Principles of Soft Computing, 2011, 2nd Edition, Wiley Publications**.**
Reference Books	
1	Samir Roy and Udit Chakraborty: Introduction to Soft Computing Neuro Fuzzy and Genetic Algorithms, 2013, 1st Edition, Dorling Kindersley Licenced by Pearson Education in South Asia.
2.	Ross Timothy J, Fuzzy Logic with Engineering Applications, 2010, 3rd Edition, Wiley Publications

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6005	Online Transaction using Mainframe Computing	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To explore various Technologies and Terminologies associated with online Transactions using Mainframes.
2. To build a sound Mainframe application developer.
3. To provide an exposure to industry uses of mainframe-based online systems.

Expected Course Outcomes:

1. Familiarize with Mainframe terminologies, Operating systems, COBOL programming and data processing used on mainframes.
2. Analyse Dynamic Data Communication and Data Handling Services using CICS-BMS
3. Use and apply Online Processing Case Study (Front End CICS, Back end DB2,Programming Language COBOL)
4. Design and implement unusual features, such as associative arrays and dynamic variable scoping using REXX
5. Apply a structured approach to identify needs, and functionalities of Web-sphere applications.
6. Develop real time applications for the industry.

Module:1	**Introduction**	**6 hours**

DB2- introduction - RDBMS – SQL – Database Administrator (DBA) – DDL,DCL- Application Developer –DML,TCL – Z/OS DB22 vs LUW DB2 – DB2 disk storage allocation – Tablespace – create table – create index – create views – bufferpool – Grant permission – DB2I – SPUFI – QMF

Module:2	**COBOL**	**6 hours**

Advanced COBOL programming – Embedded SQL – SQLCA- SELECT – INSERT – UPDATE – DELETE – CURSORS – COBOL DB2 compiler , binder and run using JCL statement

Module:3	**COBOL VSAM**	**6 hours**

COBOL VSAM – file sequential using KSDS – OPEN- START – READ – WRITE – REWRITE – DELETE – CLOSE statements.

Module:4	**BMS**	**6 hours**

BMS (Basic Mapping Support) – Formatted screen – physical map – symbolic map – MAP and MAPSET – BMS assembly language program – DFHMSD (Mapset definition) – DFHMDI (MAP definition) – DFHMDF (Map field definition) - DFHMSD parameters – DFHMDI parameters – DFHMDF parameters – Modified Data Tag – cursor positioning technique – COBOL BMS mapping code – SEND MAP command – CICS RECEIVE – CICS RETURN

Module:5	**CICS**	**7 hours**
CICS – Role of CICS – CICS control program – FCP-JCP-KCP-PCP-SCP-TCP-TDP-TSP. CICS START UP- CICS SHUT DOWN - CICS program preparation – Translator – DB2 pre-compiler – COBOL compiler and linker. CICS supplied transaction – CESN/CESF transaction –CECI command level interpreter – CEMT Master terminal transaction – CEDF execution diagnostic ficility – CEBR temporary storage browse - CICS File control – CICS READ (VSAM) – CICS WRITE – CICS DELETE.		
Module:6	**REXX**	**6 hours**
REXX (Restructured EXtendedeXecutor) – I/O – say and pull – run TSO command in REXX – Assigning simple variable – arithmetic expression, logical expression and operation – built in functions – STRING manipulation functions – formatting numbers - Array – single and multidimensional array - Condition and looping – IF-THEN-ELSE, DO-END, SWITCH-WHEN-THEN-OTHERWISE, DO-WHILE, DO-UNTIL. PROCEDURES and FUNCTIONS - Parsing data - Storage – manipulation dataset – stack –LIFO-FIFO		
Module:7	**Web programming**	**6 hours**
Websphere application server – HTML - Java Web Server programming – Servlet – Servlet API– sending HTML information – Session handling – Servlet DB2 connectivity – generating web archive (WAR) file – starting websphere application server – login through console – deploying WAR files- starting and stopping deployed web applications.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1	Chris Rayns, Amy Farrell, Sarah Bertram, Gordon Keehn, CICS Transaction Server from Start to Finish, 2011, IBM Red Books.
Reference Books	
1.	Paolo Bruni, Felipe Bortoletto, Ravikumar Kalyasundaram, Sabine Kaschta, Glenn McGeoch and Cristian Molaro, DB2 –11 for z/OS Technical Overview, 2013, IBM Redbooks.
2.	Fabio Albertoni, Jan Bajerski, DavideBarillari, Libor Cada et al, Websphere Application Server V8.5 Concepts, Planning and Design Guide, 2013, IBM Redbooks.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6006	Storage Systems and Management	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	ITA5008	Syllabus version				
		v. 1.1				

Course Objectives:

1. Understand the types of storage systems.
2. Utilize redundant array of independent disks (RAID) technologies effectively
3. Setup data protection.
4. Configure replication for information storage.

Expected Course Outcomes:

1. Analyze the data center requirements for a business setup and apply the right information cycle.
2. Apply the best storage configuration to protect users‟ data.
3. Select the best techniques for facilitation backup and recovery of lost or corrupted data.
4. Design, analyze storage systems and select an optimal storage network.
5. Design and compare cloud storage setup for efficient business transaction setup.
6. Analyze and design fiber channel setup for efficient network performance.

Module:1	Introduction to Information Storage and Management	6 hours

Information storage, Evolution of storage technology and architecture, Data center infrastructure, Key challenges in managing information, Information lifecycle.

Module:2	Storage System Environment	7 hours

Components of a storage system environment, Disk drive components, Disk drive performance and fundamental laws of governing disk performance, Logical components of the Host, Application requirements and disk performance

Module:3	Data Protection using RAID	6 hours

RAID and its implementation aspects, RAID array components, RAID levels and comparison, RAIP impact of disk performance, Hot spares, Intelligent Storage System

Module:4	Cloud and big data file systems	6 hours

Hadoop Distributed File System (HDFS), GFS, Windows Azure file systems, Amazon S3 file systems, Map Reduce.

Module:5	Direct-attached storage and introduction to SCSI	6 hours

Benefits, limitations and types of direct-attached storage (DAS), Disk drive interfaces, Introduction to SCSI and its command model.

Module:6	**Storage Area Networks**	**6 hours**
Fiber channel, Evolution and components of SAN, Fiber channel (FC), connectivity, FC ports and architecture, Zoning, FC login types, FC topologies.		
Module:7	**Network-attached storage**	**6 hours**
General purpose servers versus network attached storage (NAS) devices, NAS file I/O, NAS components and implementation, NAS file-sharing protocols and I/O operations, Factors affecting NAS performance and availability.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture Hours:	**45 hours**

Text Book	
1.	G. Somasundaram, Alok Shrivastava, EMC Education Services, Information Storage and Management, 2012, 2nd Edition, Wiley publications
Reference Books	
1.	Robert Spalding, Storage Networks: The Complete Reference, 2017, McGraw Hill Education.
2.	Troppen, Rainer Erkens, Wolfgang Muller, Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS, ISCSI and Infiniband, 2009, Wiley.

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	47th	Date	05-10-2017

ITA6007	Network and Information Security	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	ITA5003	Syllabus version				
		v. 1.0				

Course Objectives:

1. To aid in identifying network security threats, distinguishing threats and attacks and their classes.
2. To acquire knowledge on standard algorithms that offer confidentiality, integrity and authenticity.
3. Focus on malicious, non-malicious programs and users in cyber and cloud environment.

Expected Course Outcomes:

1. Analyze and evaluate systems with respect to maintaining operations in the presence of risks and threats.
2. Measure the performance of security systems within an enterprise-level information system.
3. Gain knowledge on various cryptographic techniques.
4. Implement continuous network monitoring and provide real-time security solutions.
5. Formulate, update and communicate short- and long-term organizational cyber security strategies and policies.
6. Get on insight improvise the security measures against malicious program.
7. Weigh the impact of improperly controlled cloud computing environments on organizational sustainability.

Module:1	Introduction	4 hours

Threats, vulnerabilities, controls, Confidentiality, integrity, availability, Attackers and attack types.

Module:2	Authentication, Access Control and Cryptography	6 hours

Authentication, Identification Versus Authentication, Authentication Based on biometrics, Authentication Based on Tokens, Federated Identity management, Multifactor Authentication, Secure Authentication. Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control.

Module:3	Cryptography	7 hours

Problems Addressed by Encryption Terminology, DES: The Data Encryption Standard, AES: Advanced Encryption System, Public Key Cryptography, Trust Certificates: Trustable Identities and Public Keys, Digital Signatures.

Module:4	Browser Attacks	6 hours

Browser Attack Types, How Browser Attacks Succeed: Failed Identification and Authentication, Web Attacks Targeting Users False or Misleading Content, Malicious Web Content Protecting Against Malicious Web Pages, Foiling Data Attacks, Email Attacks.

Module:5	Cyber Security	7 hours

Cyber Security Fundamentals – Attacker techniques and motivation – Malicious Code – Defense and Analysis Techniques – Memory Forensics – Honeypots – Malicious code Naming – Automated code analysis systems – Intrusion Detection System.		
Module:6	**Replication**	**7 hours**
Self-Replicating Malicious Code ,Evading Detection and Elevating Privileges, Persistent Software Techniques, Rootkits, Spyware, Virtual Machine Detection.		
Module:7	**Cloud Security**	**6 hours**
Cloud Computing Concepts, Service Models, Deployment Models, Moving to the Cloud, Risk Analysis Cloud Provider Assessment, Switching Cloud Providers, Cloud Security Tools and Techniques Data Protection in the Cloud, Cloud Application Security, Cloud Identity Management.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talks		
	Total Lecture Hours:	**45 hours**

Text Book

1.	Charles P. Fleeger, Security in Computing, 2011, 5th edition, Prentice Hall, New Delhi.

Reference Books

1.	P.W.Singer and Allan Friedman, Cyber security and cyber war what everyone needs to Know, 2014, 1st edition, Oxford university press, USA.
2.	Taylor Sutton Finch Alexander, Information Security Management Principles, 2012, 2nd edition BCS Learning and development Limited, United Kingdom.

Recommended by Board of Studies	05-03-2016		
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ITA6008	Big Data Analytics	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**ITA5008**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To understand the big data platform and its use cases.
2. To impart knowledge in applying skills and tools to manage and analyze the big data.
3. To apply analytics on structured and unstructured data.

Expected Course Outcomes:

1. Demonstrate knowledge of the fundamental elements and concepts related to big data.
2. Analyze the core architectural concepts to meet the challenges in implementing big data systems.
3. Design and develop a Big Data Environment according to the benchmarks.
4. Setup a Big Data Environment and implement security techniques.
5. Evaluate the use of data through cleansing, warehousing, analytics, and visualization to the ultimate business decision.
6. Analyze the data using various statistical methods.
7. Develop applications using large scale analytics tools to solve open big data problems.

Module:1	**Introduction to Big Data Analytics**	**6 hours**

Big Data Overview, State of practice in analytics, Role of Data Scientists, Examples of Big Data Analytics, Data Analytics Lifecycle

Module:2	**Introduction to Big Data Analytics**	**6 hours**

Components of Hadoop, Analyzing Big data with Hadoop, Design of HDFS, Developing a Map reduce Application

Module:3	**Map Reduce**	**6 hours**

Distributed File System(DFS), Map Reduce, Algorithms using Map Reduce, Communication cost Model, Graph Model for Map Reduce Problem

Module:4	**Hadoop Environment**	**7 hours**

Setting up a Hadoop Cluster, Hadoop Configuration, Security in Hadoop, Administering Hadoop, Hadoop Benchmarks, Hadoop in the cloud.

Module:5	**Big Data Analytics Methods using R**	**6 hours**

Introduction to R-Attributes, R Graphical user interfaces, Data import and export, attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis.

Module:6	**Statistical methods for evaluation**	**6 hours**

Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II errors, power and sample size, ANOVA		
Module:7	**Advanced Analytics - technologies and tools**	**6 hours**
Analytics for unstructured data, The Hadoop ecosystem – pig – Hive- HBase- Mahout- NoSQL		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture Hours:	**45 hours**

Text Book(s)	
1.	Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services, 2015, publishing.
Reference Books	
1.	Anand Raja Raman and Jeffrey David Ullman, Mining of Massive Datasets, 2012, Cambridge University Press.
2.	Tom White, Hadoop: The Definitive Guide, 3rd Edition, O"Reilly Media

Recommended by Board of Studies	05-03-2016		
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ITA6009	Cloud Computing	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	ITA5003	Syllabus version				
		v. 1.0				

Course Objectives:

1. To learn recent computing paradigms.
2. To introduce the concept of Virtualization and the secured cloud environment.
3. To understand the concepts and programming models in parallel and distributed computing environment.
4. To set up an own cloud computing environment and provide various services to the users.

Expected Course Outcomes:

1. Explore the various service and deployment models in cloud computing.
2. Able to create VM, migrate and provide QOS to the committed users.
3. Analyze the core architectural concepts for scheduling the resource and job in Inter cloud computing to support scalability and fault tolerance.
4. Develop programs and implement for the parallel and distributed computing environment.
5. Explore the possible ways for providing secured cloud environment.
6. Ability to use tool and techniques for processing a large scale of data in high performance computing environment.
7. Ability to select the appropriate tools, open source cloud and APIs to set up a own cloud.
8. Design, implement and evaluate a cloud-based system, process, component, or program to meet desired needs.

Module:1	Introduction	6 hours

Cloud models-Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – On-demand Provisioning – Elasticity in Cloud – deployment models – service models-cloud service providers

Module:2	Virtualization	6 hours

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms – resource sharing and resource pooling - Desktop Virtualization – Server Virtualization.

Module:3	Cloud Infrastructure	6 hours

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

Module:4	Programming Model	6 hours

Parallel and Distributed Programming Paradigms – Map Reduce, Twister and Iterative Map

Reduce – Hadoop Library from Apache – Mapping Applications - Programming Support.		
Module:5	**Security in the Cloud**	**6 hours**
Security Overview – Cloud Security Challenges – Access control mechanisms – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Virtual Machine Security.		
Module:6	**Enterprise Cloud-Based High Performance Computing (HPC)**	**7 hours**
Overview of High Performance Computing (HPC) on Cloud-Enterprises HPC applications (high-performance grid computing, high-performance big data computing/analytics, high performance reasoning)-HPC Cloud vendor solutions: compute grids (Windows HPC, Hadoop, Platform Symphony ,Gridgain), data grids (Oracle coherence, IBM Object grid, Cassendra, HBase, Memcached, HPChardware (GPGPU, SSD, Infiniband, Non-blocking switches)		
Module:7	**Setting up own Cloud**	**6 hours**
Cloud setup-How to build private cloud using open source tools-Understanding various cloud plugins-Setting up your own cloud environment-Autoprovisioning-Custom images-Integrating tools like Nagio-Integration of Public and Private cloud.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book	
1.	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, 2012, 1st Edition, Morgan Kaufmann Publishers.
Reference Books	
1.	Katarina Stanoevska-Slabeva, Thomas Wozniak, SantiRistol, Grid and Cloud Computing – A Business Perspective on Technology and Applications, 2010, Springer.
2.	John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security", 2010, CRC Press.
3.	Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 2009, TMH.
4.	George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud O'Reilly, 2009.

Recommended by Board of Studies	05-03-2016		
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ITA6010	Internet of Things	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	ITA5003	Syllabus version				
		v. 1.0				

Course Objectives:

1. Exploring the characteristics of Internet of things and its design.
2. Defining the communication model with cloud environment.
3. Extrapolating the design thinking skills to new IoT based prototypes for real life applications.

Expected Course Outcomes:

1. Design the logical and physical structure of Internet of Things.
2. Develop the communication system and protocol in implementing Internet of Things.
3. Define the virtualization for Internet of things.
4. Configuration of IOT devices.
5. Design functional model specification for Internet of Things based on domain specification.
6. Develop an Internet of Things application based on domain specification and real time applications.
7. Perform interactive product development using IoT technologies.

Module:1	Introduction to IoT	6 hours

Definition and Characteristics, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies.

Module:2	M2M and IoT	6 hours

Introduction to M2M**,** Difference between IoT and M2M, SDN and NFV for IoT.

Module:3	IoT Protocols	8 hours

IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, 6LoWPAN, RPL

Module:4	Developing Internet of Things	6 hours

IoT Platforms Design Methodology, Python packages of Interest for IoT, IoT Physical Devices and Endpoints

Module:5	IoT and Cloud	5 hours

IoT Physical Servers and Cloud Offerings, IoTTools:Chef,Puppet

Module:6	Data Analytics for IoT	7 hours

Big Data Platforms for the IoT, Hadoop Map Reduce for Batch Data Analysis, Apache Oozie Workflows for IoT Data Analysis, In-Memory Analytics using Apache Spark, Apache Storm for Real Time Data Analysis, Sustainability Data and Analytics in Cloud based M2M Systems, Fog Computing: A Platform for IoT and Analytics		
Module:7	**Domain Specific IoTs**	**5 hours**
Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle, Virtual Reality Internet Advertising, Intelligent Transportation Systems, Health Information System: Genomics Driven Wellness Tracking and Management System(Go-WELL)		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture Hours:	**45 hours**

Text Book(s)

1.	Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, 2015, 1st Edition, Universities Press.

Reference Books

1.	Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, 2012, Wiley Publication.
2.	Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, 2012, CRC Press.
3.	Dieter Uckelmann; Mark Harrison; Florian Michahelles Architecting the Internet of Things, 2011, Springer.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6011	Advanced Computer Architecture	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		v. 1.0				

Course Objectives:

1. To infer the evolution and operation of modern architectures.
2. To apply fundamental techniques to speed-up program execution.
3. To analyze the impact of design principles on computer performance.

Expected Course Outcomes:

1. Understand the organization and performance characteristics of different processor architecture.
2. Interpret techniques to improve processor‟s ability to exploit parallelism.
3. Identify characteristics and challenges in multicore.
4. Design the organization of cache and virtual memory.
5. Develop parallel programming for computer problems with multicore.
6. Acquire knowledge with tools for power and performance trade-offs.

Module:1	Modern Computer Architectures	8 hours

Introduction, Fundamentals of RISC, CISC, Instruction Level Parallelism (ILP)- Concepts and challenges , Instruction Scheduling: Branching with Prediction, Dynamic Scheduling: Hazards and Solutions, Measuring Performance of ILP, Limitations of ILP.

Module:2	Introduction to Threads and multiprocessors architecture	5 hours

Thread level parallelism, simultaneous multithreading, introduction to multiprocessor architecture- Types, Limitation.

Module:3	Introduction to Multicore architecture	5 hours

Evolution of multicore, Architecting with multicore: Homogenous, Heterogenous cores, Shared resources, shared buses, optimal resource sharing strategies, Performance evaluation of multicore processors.

Module:4	Memory Module Design	6 hours

Conceptual view of memory cell, memory address map, memory connections to CPU, cache memories- cache memory management techniques, Types of caches-Lookthrough and look aside, write through, write around, unified, split caches, Cache details: multilevels, cache levels, cache misses, performance issues, mean memory access time, execution time, cache coherence protocols, snoopy, MSI, MESI, MOESI.

Module:5	Multi-Threading Concepts	7 hours

Fundamentals of multithreaded programming, concurrency Vs parallelism, threading design concepts for developing an application, correctness concepts: critical region, mutual exclusion, synchronization, race conditions, Multithread Performance: performance concepts: simple speedup, computing speedup, efficiency, granularity, load balance.		
Module:6	**Multicore programming**	**7 hours**
Introduction to OpenMP, OpenMP directives, parallel constructs, work-sharing constructs, data environment constructs, synchornization constructs, extensive API library for finer control, benchmarking multicore architectures: benchmarking of processors, comparison of processor performance for specific processors.		
Module:7	**Multicore power and performance measurement**	**5 hours**
Multicore power and performance measurement using programming constructs (like loop unrolling) and tools/utilities (like gprof from GNU, Linux time command, Tuning and Analysis Utilities, VTune) using multicore benchmarks		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book

1.	John L Hennessey, David A Patterson, Computer Architecture: A Quantitative Approach, 2011, 5th Edition, Morgan Kauffmann.

Reference Books

1	Shameen Akhter, Jason Roberts, Multicore programming, 2006, 1st Edition, Intel press.
2	Barbara Chapman, Gabriele Jost, Ruud van van de Pas, Using OpenMP: Portable shared memory, parallel programming (scientific and engineering computation), 2008, 1st Edition, MIT Press.
3	Vincent P Heuring, Harry F Jordan, Computer System Design and Architecture, 2004, 2nd Edition, Pearson.
4	David B Kirk, Wen-mei W Hwu, Programing Massively Parallel Processors: A Handson Approach (Application of GPU Computing Series) 2013, 2nd Edition, Morgan Kaufmann.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6012	Semantic Web	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To explain the features, rationale and advantages of Semantic Web technology.
2. Sketch overall architecture of the Semantic Web and identify the component technologies of the Semantic Web and explain their roles.
3. Illustrate the design principles of the Semantic Web by applying the technologies and understand certain limitations of the Semantic Web technologies, and be aware of the kinds of services.

Expected Course Outcomes:

1. Understand the concept and structure of the semantic web technology and how this technology revolutionizes the World Wide Web.
2. Understand the concepts of metadata, semantics of knowledge and resource, ontology, and their descriptions in XML.
3. Implement the programs using RDF and XML.
4. Familiarize with logic semantics and inference with OWL.
5. Program semantic applications with Java API.
6. Use ontology engineering approaches in semantic applications.
7. Applying semantic technologies to concrete problems of information delivery and use.

Module:1	**Introduction**	**5 hours**

The history of semantic web ,Semantic web standards, layered approach of semantic web, Technologies for semantic web, building semantic web, languages , object models , structure of ontology, syntactic Vs semantic Vs symbiotic web, overview of annotations on various resources -documents, texts, web pages, web services, DBs.

Module:2	**XML**	**5 hours**

The tree model of XML documents, Namespaces, XML Schema. Querying XML documents.

Module:3	**RDF**	**7 hours**

RDF data model, RDF Schema. RDF syntax, RDF/S semantics .RDF extraction from unstructured data streams, RDF schema syntax in XML, Terse RDF Triple Language Turtle.Querying semantic web- Discovering Information , SPARQL Query Language

Module:4	**OWL-Web Ontology Language**	**7 hours**

OWL family tree, Requirements for ontology language, Layering, Vocabulary, lite, syntax, Axioms-property, individual, Ontology-based data access, From RDFS to OWL. OWL ontologies.

Module:5	**Description Logic**	**7 hours**
Expressiveness and Decidability: SIGMA and RIF, DL semantics, Reasoning (Fact++); Rules (SWRL), Linked Data and Publishing on the Semantic Web.		
Module:6	**Ontology Engineering**	**7 hours**
Tools used in building and processing ontologies- Protégé, WordNet, Schema Matching, OWL ontologies in life sciences and industry, Open vs. closed worlds. Reasoning with OWL, Entity Extraction, and Semantic interoperability.		
Module:7	**Semantic Web Frameworks**	**5 hours**
Multicore power and performance measurement using programming constructs (like loop unrolling) and tools/utilities (like gprof from GNU, Linux time command, Tuning and Analysis Utilities, VTune) using multicore benchmarks		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph Foundations of Semantic Web Technologies, 2015, CRC Press/Chapman and Hall.
Reference Books	
1.	Grigoris Antoniou, Paul Groth, Frank van vanHarmelen and Rinke Hoekstra, A Semantic Web Primer, 2012, 3rd Edition The MIT Press.
2.	Dean Allemang, James Hendler, Morgan Kaufmann, Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL, 2011, 2nd Edition.
3.	Mike Dean, Andrew Perez-Lopez, Ryan Blace, Matthew Fisher, Semantic Web Programming, John Hebeler, 2009, John Wiley &Sons.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6013	Advanced Software Testing	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.1				

Course Objectives:

1. To learn the overview of software testing concepts and its techniques.
2. To expose to various testing tools.
3. To understand and manage the effective testing process.

Expected Course Outcomes:

1. Design, implement and evaluate effective and efficient test cases to meet desired needs.
2. Choose appropriate testing techniques and tools for real time testing applications.
3. Write stubs and drivers code during unit, integration and system testing phase.
4. Develop Test Plan document and produce Test Summary Reports in synchronization with the software development activities.
5. Apply Software Testing process models and to improve the quality of the software from maintenance point of view.
6. Design Test cases to test object oriented application, web based systems and to test mobile apps.

Module:1	**Introduction**	**6 hours**

Basics of Software Testing –Evolution - Myths and Facts-Goals -Definitions-Model for Software Testing- Software Testing as a Process- Software Testing Terminology and Methodology- Software Testing Life Cycle(STLC)- types of testing- testing in the development life-cycle - testing principles-Verification and Validation – Test case design strategies.

Module:2	**Dynamic Testing**	**8 hours**

Black-Box Testing Techniques - Requirement based testing - Boundary Value Analysis (BVA) - Equivalence Class Testing - State Table-Based Testing - Cause-Effect Graphing Based Testing - Decision Table-Based Testing - Error Guessing. White-Box Testing Techniques: Need - Logic Coverage Criteria - Basis Path Testing - Graph Matrices - Loop Testing - Data Flow Testing - Mutation Testing.

Module:3	**Levels of Testing**	**5 hours**

Need for Levels of Testing - unit testing – Test Harness - Integration testing - system testing – Types of system test: Functional, performance, stress and configuration testing - Regression testing - Acceptance testing.

Module:4	**Static and Regression Testing**	**5 hours**

Inspections- Structured Walkthroughs- Technical Reviews- Validation Activities – Progressive vs. Regressive Testing - Regression Testing Produces Quality Software - Regression Testability - When is Regression Testing Done?- Types- Regression Testing Techniques.

Module:5	**Managing the Testing Process**	**6 hours**
Test Organization-Structure of Testing Group-Test Planning- Detailed Test Design and Test Specifications-Definition of Software Metrics-Classification -Entities to be Measured-Size Metrics-Testing Metrics for Monitoring and Controlling the Testing Process-Estimating Testing Efforts- Cyclomatic Complexity Measures for Testing-Function Point Metrics for Testing-Test Point Analysis (TPA).		
Module:6	**Quality Management**	**6 hours**
Software Quality- Quality Costs- Benefits of Investment on Quality-Quality Control and Quality Assurance- Quality Management and Project Management-Quality Factors-Methods of Quality Management-SQA Models-Testing Process Maturity Models- Need for Test Process Maturity- Measurement and Improvement of Test Process- Test Process Maturity Models.		
Module:7	**Testing for Specialized Environment**	**7 hours**
Object oriented testing - Testing Web based System – Challenges in testing for Web based software – Mobile app testing –Testing Mobile Apps – Mobile test Automation and tools – Mobile Test and Launch strategies.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture hours:	**45 hours**

Text Book(s)		
1.	Naresh Chauhan, Software Testing Principles and Practices, 2013, 6th impression, Oxford University Press.	
Reference Books		
1.	Ilene Burnstein, Practical Software Testing, 2013, 12th Edition, Springer Verlag International Edition, Springer, India.	
2.	Srinvasan Desikan, Software Testing principles and practices, 2012, 4th Edition, Pearson Publication.	
List of Challenging Experiments (Indicative)		
1.	Write the Procedure for RPT. Record the test for VIT intranet portal with some 10 links and Create Performance Schedule and generate the Test Report for the same.	2 hours
2.	Design a selenium web driver program to handle pop ups. Go to student login page, click on login button without giving username and password, and handle that pop up message	2 hours
3.	Imagine a program which reads in the length of three sides of a triangle and outputs a message naming the kind of triangle: EQUILATERAL, ISOCELES or SCALENE. Length not in range 1 - 99 cause error message INVALID INPUT. If lengths don't make a triangle, output NOT A TRIANGLE. Assumptions (pre-conditions for the program) Three lengths are entered separated by blanks or returns. Input of decimals or characters causes unpredictable results. Input from keyboard, simple text output to display. Even though equilateral triangle is also isoceles, only print EQUILATERAL.	2 hours

	Write the Junit Test cases for above given logic.	
4.	Online STP Registration	2 hours
5.	Testing of online mobile shopping systems	2 hours
6.	Testing the efficiency measures of deadlock handling strategies using bankers algorithms	2 hours
7.	Blood bank automation	2 hours
8.	Testing on online shopping website for leather industry	2 hours
9.	Performance testing of Leather web catalogue using data analytics	2 hours
10.	Create test plan, test design, test cases, test data and generate test result for all test conducted.	2 hours
	Total Laboratory Hours	20 hours

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	47th	Date	05-10-2017

ITA6014	Software Process and Metrics	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.1				

Course Objectives:

1. To educate various metrics and models to assess software products.
2. To emphasize the use of software product and quality metrics.
3. To study various metrics models in the applications of quality software design and production.

Expected Course Outcomes:

1. Gain knowledge on concepts related to software process models and metrics.
2. Identify the appropriate metrics needed to design a framework to perform software measurement.
3. Apply the relevant and empirical studies needed for data collection.
4. Analyze and perform the various statistical techniques for measuring the software measurement data.
5. Measure the internal product attributes for software size and structure metrics.
6. Interpret the software quality attributes for quality assurance and security.
7. Perform correlation and regression in software process for prediction and decision making.

Module:1	**Software Processes**	**5 hours**

Prototype, Rapid and Agile processes models – CMM levels – processes in Requirements, Design, Construction and Testing.

Module:2	**Basics of Measurements**	**6 hours**

Measurements in Software Engineering - Scope and basics of Software Measurement - A Goal Based Framework for Software Measurement.

Module:3	**Investigation and Data Collection**	**7 hours**

Empirical Investigation-Principles of Empirical Studies-Planning Experiments-Planning Case Studies as Quasi-Experiments-Relevant and Meaningful Studies-Software Metrics Data Collection.

Module:4	**Analyzing Software Measurement Data**	**7 hours**

Statistical Distributors and Hypothesis Testing-Classical Data Analysis Techniques-Examples of simple Analysis Techniques. More advanced Methods-Overview of Statistical Tests.

Module:5	**Measuring Internal Product attributes**	**6 hours**
Properties of Software Size - Functionality and Computation complexity - Tools for product Size Measurement. Structural Measures-Control flow, Object-Oriented Structural Attributes and Measures.		
Module:6	**External Product Attributes**	**6 hours**
Modeling Software Quality-Measuring Aspects of Quality-Usability--Maintainability -Security.		
Module:7	**Metrics for Decision Support**	**6 hours**
Metrics for Decision Support- from Correlation and Regression to Causal Models- Bayes theorem and Bayesian Networks-Applying Bayesian Networks to the Problem of Software Defects Prediction-Bayesian Networks for Software Project Risk Assessment and Prediction.		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture Hours:	**45 hours**

Text Book(s)

1.	Norman Fenton, James Bieman, Software Metrics: A Rigorous and Practical Approach, 2015, 3rd Edition, CRC Press.

Reference Books

1.	Stephan H. Kan, Metric and Models in Software Quality Engineering, 2015, 2nd Edition, Pearson Education.
2.	Ravindranath Pandian C., Software Metrics A Guide to planning Analysis and Application, 2011, 1st Indian Reprint, Auerbach.

Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	47th	Date	05-10-2017

ITA6015	Accounting and Financial Management	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. Evaluating the financial performance and interpret the financial structure of an organization.
2. Developing decision making skills in the financial analysis context.
3. Gaining knowledge of financial management that can be applied in making financial decisions and resolving financial problems.

Expected Course Outcomes:

1. Prepare consolidated financial statements using current international accounting standards.
2. Manage the financial operations including revenues, expenses, assets, liabilities and equity.
3. Determine the break-even point and analyze the profit on large volume of output by differentiating between fixed and variable costs.
4. Improve the business management by recording all the costs incurred in conducting the business.
5. Evaluate and determine the organization's large expenses or investments through capital budgeting.
6. Apply accounting and financial information for decision making and achievement of business goals.

Module:1	**Introduction to Accounting**	**4 hours**

Meaning - Scope – Objectives of accounting - Basic accounting concepts and conventions – Accounting standards.

Module:2	**Accounting Records.**	**6 hours**

Accounting Transactions – Terms of accounting – Preparation of Journal, Ledger and Trial Balance.

Module:3	**Final Accounting and Ratios**	**9 hours**

Preparation of Trading, Profit and Loss Account and Balance Sheet with simple adustments. Basic accounting ratios – liquidity – profitability and solvency ratios.

Module:4	**Cost Accounting**	**6 hours**

Meaning - Elements and Classification of costs - Preparation of cost sheet.

Module:5	**Marginal Costing**	**6 hours**

Meaning - Variable cost and fixed cost – Cost – volume - profit analysis -Break even analysis – Managerial decision making on - Make or buy - Key factor - Sales mix.

Module:6	**Budgetary Control**	**6 hours**
Meaning– Preparation of budgets - purchase budget - production budget – cash budget – flexible budget.		
Module:7	**Capital Budgeting**	**6 hours**
Meaning – Techniques - Payback period - Accounting rate of return (ARR) - Net present value (NPV) - Profitability index (PI) - Internal rate of return (IRR).		
Module:8	**Contemporary issues**	**2 hours**
Expert Talk		
	Total Lecture Hours:	**45 hours**

Text Book(s)	
1.	R.L. Gupta and V.K. Gupta, Financial Accounting – Sultan Chand and Sons, 2015, New Delhi.
2.	Shashi K Gupta and RK Sharma, Management Accounting Principles and Practice, 2014, Kalyani Publications, New Delhi.
Reference Books	
1.	S.P. Jain and K.L.Narang, Financial Accounting, 2014, Edition, New Delhi.
2.	S. N. Maheshwari, Financial Accounting, 2015, Vikas Publishing House Pvt. Ltd., New Delhi.
3.	T.P.Ghosh, Financial Accounting for Managers, 2014, Taxmann Publications, New Delhi.
4.	C. Eugine Franco, Management Accounting, 2016, Charulatha publications, Chennai.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	40th	Date	18-03-2016

ITA6016	Machine Learning	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	Nil	Syllabus version				
		V.1.0				

Course Objectives:

1. To develop a deeper understanding of several major topics in machine learning.
2. To implement, train, and validate their own neural network.
3. To learn deep recurrent and memory networks.
4. To demonstrate a toolbox of techniques that can be immediately applied to real world problems.

Expected Course Outcomes:

1. Good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity etc.
2. Analyze the strengths and weaknesses of many popular machine learning approaches.
3. Appreciate the underlying mathematical relationships within and across machine learning algorithms.
4. Characterize the paradigms of supervised, semi-supervised and unsupervised learning.
5. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
6. Understand how to perform evaluation of machine learning algorithms and model selection.
7. Design and Implement various machine learning algorithms in a range of real-world applications.

Module:1	Machine Learning Foundations	4 hours

Three types of Machine Learning, Supervised Learning, Reinforcement Learning, Unsupervised Learning, Machine Learning Systems, Preprocessing, Training and Choosing Predictive Models, Model Evaluation and Validation of unseen data instances

Module:2	Different Training Models	5 hours

Gradient Descent, Polynomial Regression, Regularized Linear Models, Support Vector Machine, Soft Margin and Non-Linear SVM classification, Similarity Features, Quadratic Programming

Module:3	Artificial Neural Networks	7 hours

The Perceptron, MLP and Backpropagation, Train a DNN, Construction and Execution phase, How to use the Neural Network, Fine-tuning the Hyperparameters, The Number of Hidden Layers, Activation Functions.

Module:4	Working with Convolutional Neural Networks	6 hours

Visual Cortex Architecture, Convolutional Layers, Filters, Common CNN architectures, LexNet-

5,AlexNet,GoogleNet and ResNet		
Module:5	**Recurrent Neural Networks**	**7 hours**
Recurrent Neurons, Training RNNs, The Complexity of Training over multiple steps, The LSTM cell using Peephole Connections, GRU cells, Natural Language Processing Applications.		
Module:6	**Autoencoders**	**7 hours**
Efficient Data Representations, Stacked Autoencoders, Visualize the Reconstructions, Using Stacked Autoencoders for unsupervised pre-training, Variational Autoencoders.		
Module:7	**Reinforcement Learning**	**7 hours**
Learning How to Optimize Rewards, Policy Search, Neural Network Policies, Action Evaluation: Credit Assignment problem, Using Policy Gradients, Markov Decision Processes, Using Deep Q-Learning to learn how to play Pacman.		
Module:8	**Contemporary issues:**	**2 hours**
Industry Expert talk on recent advancements in Reinforcement Learning		
	Total Lecture hours:	**45 hours**

Text Book(s)

1. EthemAlpaydi, Introduction to Machine Learning, Second Edition, The MIT Press, 2015
2. ShaiShalev- Shwartz and Shai Ben David, Understanding Machine Learning: From Theory to Algorithms, First Edition, Cambridge University Press, 2014.

Reference Books

1. Russell and Norvig, Artificial Intelligence, Third Edition, Prentice Hall, 2015
2. Sudharsan Ravichandran, Reinforcement Learning with Python: Master reinforcement and deep reinforcement learning using OpenAI Gym and TensorFlow, Packt Publishers, 2018.
3. BharathRamsundar and Reza BosaghZadeh, TensorFlow for Deep Learning, O‟Reilly Publications, 2018.

Mode of Evaluation: Assessment, Quizzes and Digital Assignment

List of Challenging Experiments (Indicative)		
1.	Implement SVM with different kernel methods	2 hours
2.	Implement Adaboost to enhance traditional algorithms	2 hours
3.	Implement Bagging using Random Forests	2 hours
4.	Implement CNN models for classification of images	4 hours
5.	Evaluating ML algorithm with balanced and unbalanced datasets	4 hours
6.	Comparison of Machine Learning techniques.	4 hours
7.	Implement machine learning algorithms.	4 hours
8.	Implement Neural Network to play games	4 hours
9.	Implement DQN and DRQN for heavy datasets.	4 hours
	Total Laboratory Hours	30 hours

Recommended by Board of Studies	02-03-2019	
Approved by Academic Council	54th	Date : 14-03-2019

ITA6017	Python Programming	L	T	P	J	C
		2	0	2	0	3
Pre-requisite	**Nil**	**Syllabus version**				
		v.1.0				

Course Objectives:

1. To design and apply programming constructs in Python.
2. To learn how to write loops and decision statements in Python.
3. To learn how to use lists, tuples, and dictionaries in Python programs.
4. To apply embedded programming features in Python.

Expected Course Outcomes:

1. Apply a solution clearly and accurately in a problem using Python.
2. Implement a given algorithm as a computer program using Python constructs.
3. Demonstrate the implications of specialized data structures in Python.
4. Develop simple embedded oriented applications in Python.
5. Develop data visualization trends in Python.
6. Perform real-time applications using Python.

Module:1	**Introduction to Python**	**4 hours**

History of Python, Unique features of Python, Demo on IDE, Ipython, Spyder etc., "Hello world" program in Python, Keywords, Identifiers, Reading input from user-Demo, Python Data Types, Declaring and using Numeric data types: int, float, complex and string

Module:2	**Python Operators, Expressions and Flow controls**	**4 hours**

All Operations and simple expressions, Conditional blocks using if, else and elif, Simple for loops in python, For loop using ranges, Use of while and do while-loop in python, Loop manipulation using pass, continue, break and else.

Module:3	**Pythons List, Tuples, Dictionaries & Sets**	**4 hours**

Lists and its operations, Ranges: Iterators and its purpose, Tuples: Operation and usage, Python Dictionaries, examples on Dictionaries, Sets and its operations,

Module:4	**Python Strings & Regular Expressions**	**4 hours**

Strings: Understanding string in build methods and Operations[slicing], Regular Expressions: Powerful pattern matching and searching, Power of pattern searching using regex in python, Real time parsing of networking or system data using regex, Password, email, url validation using regular expression, Pattern finding programs using regular expression

Module:5	**Python Functions, Exceptions and Packages**	**4 hours**

Python user defined functions, Python packages functions, Defining and calling Function, powerful Lamda function in python, organizing python codes using functions, Programming using Exception handling, pandas, NumPy, Scikit, nltk etc.

Module:6	**Data Visualization using Python**	**4 hours**
An introduction into using database interfaces in Python for SQL, MySQL and SQLite, Principles of Information Visualization, Basic Charting, Charting Fundamentals, Applied Visualizations		
Module:7	**Embedded Python**	**4 hours**
Embedded product development life cycle, Learning embedded test environment, tools and protocols. Different Types and phases of embedded testing. Linux command line interface.		
Module:8	**Contemporary issues** Applications of Python in industry/case studies	**2 hours**
	Total Lecture hours:	**30 hours**

Text Book(s)

1.	Martin C. Brown, Python: The Complete Reference, 20 Mar 2018, 4th Edition, McGraw Hill Education, USA.

Reference Books

1.	R. NageswaraRao, Core Python Programming, 2018, 2nd Edition, Dreamtech Press, India.
2.	Zed Shaw, Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code, 1st October 2013, 3rd Edition, Addison Wesley, USA.
3.	Paul Barry, Head First Python: A Brain-Friendly Guide, December 2016, 2nd Edition, Shroff/O'Reilly, India.

Mode of Evaluation: Assignment, CAT1, CAT2 and FAT

List of Challenging Experiments (Indicative)

1.	Python Operators, Expressions and Flow controls	6 hours
2.	Python Strings & Regular Expressions	6 hours
3.	Pythons List, Tuples, Dictionaries & Sets:	6 hours
4.	Python Functions, Modules And Packages	6 hours
5.	Data visualization using python	6 hours
	Total Laboratory Hours	30 hours

Mode of evaluation: CAT1, CAT2 and FAT

Recommended by Board of Studies	02-03-2019		
Approved by Academic Council	No. 54th	Date	14-03-2019

ITA6018	Digital Forensics	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	ITA5003, ITA5008	Syllabus version				
		v.1.0				

Course Objectives:

1. To emphasize the fundamentals and importance of digital forensics.
2. To understand the various stages of investigation.
3. To enable students to perform digital investigation in an organized and systematic way.

Expected Course Outcomes:

After successfully completing the course the student should be able to

1. Explain and document the process of digital forensics analysis.
2. Understand the trade-offs and differences between various forensic tools.
3. Present the evidence and conclusion of an investigation- in report format.
4. Identify the methods for data recovery.
5. Analyze various computer forensics technologies.
6. Apply digital forensic tools for preserving, acquiring and analyzing the artifacts that aid digital forensics.

Module:1	Digital Forensics Fundamentals	4 hours

Digital Forensics Definition and Meaning – Objectives of Digital Forensics – Need for Digital Forensics – Computer Crimes in Real Life and Digital Forensics – IT ACT 2000, sections and amendments - Law Enforcement and Digital Forensics – Challenging Aspects of Digital Forensics

Module:2	Framework for Computer Forensics	5 hours

Introduction to Computer Forensics Lab – Physical Security to Computer Forensics Lab- Fire Safety – Evidence Locker Recommendations – Checking the Security of a Forensics Lab – Work Area of a Forensics Lab – General Configuration of Forensics Lab – Hardware and Software Requirements of Forensics Lab

Module:3	Computer Crime Investigation Process	5 hours

Computer Facilitated Crimes – Policy and Procedure Development – Systematic Approach to an Investigation – Procedure for Corporate Investigations – Conducting an Investigation

Module:4	Data Acquisition	8 hours

Incidence Response – Conducting Preliminary Interview – Implication of Related Law - Collecting and Preserving Electronic Evidence – Data Acquisition Tools – Performing RAID Data Acquisition – Using Remote Network Acquisition Tools – Other Acquisition Tools - Validating Data Acquisition – Packaging and Transporting Electronic Evidence

Module:5	Evidence Examination	7 hours

File System Preliminaries (Windows, DOS and Linux including Variants) – Evidence Examination Procedure – Graphic File Investigation – E-mail Investigation – Embedded Device Forensics – Network and Virtual Machine Forensics

Module:6	Computer Forensic Tools, Analysis and	8 hours

	Validation	
Computer Software Forensic Tools – Computer Hardware Forensic Tools – Validating and Testing Forensic Tools – Determining Data Collection – Validating Forensic Data – Addressing Data Hiding Techniques – Performing Remote Acquisition –Data Recovery		
Module:7	**Evidence Presentation and Legal Issues**	**6 hours**
Procedure for documenting and reporting for law enforcement – Guidelines for Report Writing – Report Writing Tools – Expert Testimony and Legal Issues complying to IT ACT 2000– Ethics for Expert Witness		
Module:8	**Contemporary issues:**	**2 hours**
Industry expert talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Amelia Phillips, Bill Nelson, and Christopher Steuart. Guide to Computer Forensics and Investigation, Course Technology, Cengage Learning, 4th Edition, 2010
Reference Books	
1.	Kevin Mandia, Chris Prosise, Matt Pepe. Incident Response and Computer Forensics, Tata McGraw -Hill, New Delhi, 2006.
2.	EC-Council Staff. Computer Forensics Book 1: Evidence Collection and Preservation, EC-Council Press, 2009
3.	JoakimKävrestad. Guide to Digital Forensics: A Concise and Practical Introduction. Springer, 2017
4.	EC-Council Staff. Investigation Procedures and Response (Computer Forensics), EC – Council Press, 2016
5.	Albert Marcella, Jr., Doug Menendez. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes. Auerbach Publications, 2nd Edition, 2007

Recommended by Board of Studies	02-03-19		
Approved by Academic Council	No. 54th	Date	14-03-2019

ITA6019	Game Programming	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**Nil**	**Syllabus version**				
		V. 1.0				

Course Objectives:

1. To provide an in-depth introduction to technologies and techniques currently used in the game industry.
2. To understand game design and development.
3. To understand the processes, mechanics, issues in game design, and game engine development.

Expected Course Outcomes:

On completion of the course the students will be able to

1. Understand modelling, techniques, handling situations, and logic.
2. Learn and use software engineering, team project management, and prototype presentation principles in a game development context.
3. Design, develop, test, evaluate, debug, and modify code to meet design specifications for games.
4. Design unique gaming environments, levels and characters by choosing appropriate game strategies and patterns based on an analysis of past and present trends.
5. Create and document various games by applying programming concepts using various tools to meet requirements of the current marketplace.
6. Able to build and then integrate technologies such as multimedia, artificial intelligence, and physics modelling into a cohesive, interactive game application.

Module:1	**Introduction to Game Programming**	**2 hours**

Overview of game programming, Structure of a typical game team, game industry, game engine history.

Module:2	**Game Engine Architecture**	**8 hours**

Real Time Game Architecture, Engine Support: Subsystem Start-Up and Shut-Down, Memory Management, Containers and Strings; Resource Management: File System, Resource Manager.

Module:3	**Graphics for game programming**	**8 hours**

Graphics Device Management, The Rendering Engine: The Rendering Pipeline, Lighting and Global Illumination, Sprites, Tile-Based Graphics and Scrolling, GUI programming for games.

Module:4	**Artificial Intelligence for Interactive Environments**	**8 hours**

Why Artificial Intelligence for Games, AI methods in gaming: Tree search, Reinforcement learning, Path finding algorithms: Dijkstra's algorithm, A* algorithm, D* Algorithm and

navigation meshes.

Module:5	**Game Physics**	**8 hours**

Physics based modeling, Rigid Body Dynamics, Integrating a Physics Engine into the Game; Collision detection: Object boundaries, Sphere algorithms, Cuboid algorithms, Point algorithms, Line algorithms.

Module:6	**Game design**	**5 hours**

Game design, Game genres, modes, and perspectives, scripting, audio engineering, Sound and Music, level design, render threading.

Module:7	**Project management in game development**	**4 hours**

Game project management, Game design documentation, Rapid prototyping and game testing

Module:8	**Recent Trends**	**2 hours**

Recent trends in game industry

	Total Lecture hours:	**45 hours**

Text Book(s)

1. Game Engine Architecture, 3rd Edition, Jason Gregory, A K Peters, 2019

Reference Books

1. Yannakakis GN, Togelius J. Artificial intelligence and games. New York: Springer; 2018 Feb 17.
2. Akenine-Moller T, Haines E, Hoffman N. Real-time rendering. AK Peters/CRC Press; 2018 Jul 20.
3. Best of Game Programming Gems, Mark DeLoura, Course Technology, Cengage Learning, 2014
4. Real-Time Collision Detection, Christer Ericson, Morgan Kaufmann, 2005
5. 4. XNA Game Studio 4.0 Programming. Tom Miller and Dean Johnson, Addison-Wesley Professional, 2010
6. Game Coding Complete, Mike McShaffry and David Graham, Fourth Edition, 2012 Cengage Learning PTR
7. Beginning Game Programming, Jonathan S. Harbour, Cengage Learning PTR; 4th edition, 2014
8. Fundamentals of Game Design, 3rd Edition, Ernest Adams, New Riders; 2013
9. Game Design Foundations, Second Edition, Roger E. Pedersen, Jones & Bartlett Learning; 2009
10. Level Up! The Guide to Great Video Game Design, 2nd Edition, Scott Rogers, Wiley 2014.

	Lab (Indicative List of Experiments	
	1. Create a 2D game named “Flappy Bird” which can fly the bird as far as the player can without hitting a pipe kind of border on its left and right side. Once the player reaches a particular level, winning note should be displayed.	2 hours
	2. Create a 3D game name “Ogre”, where a player has to travel and reach the goal inside a maze without hitting the	2 hours

	patrols. 3. Create a 3D Bowling game which has 6 pins and a ball by applying the collision detection techniques and calculate the score accordingly. 4. Create a game component using MAYA/ Blender software. 5. Create a 2D game by extending exercise 1 with multiple levels. 6. Create a tile-based game which allows the user to move the player over the tiles. 7. Develop a VR game which can trigger the player movements using the click events of VR google card. 8. Develop a Tic-Tac-Toe game utilizing only the UI components. 9. Develop a Tetris game. It is a single player game where the player has to manipulate blocks that fall down from the top of the screen in such a way that rows on the bottom are filled. When a row is filled, it disappears and the player receives points. 10. Develop a 2048 game. It is a single-player sliding block puzzle game. The game's objective is to slide numbered tiles on a grid to combine them to create a tile with the number 2048.	2 hours 2 hours 2 hours 2 hours 2 hours 2 hours 2 hours 2 hours
	Total	20 hours
	Recommended by Board of Studies	02 03-2019
	Approved by Academic Council	No:54th Date :14-03-2019