APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CET Campus, Thiruvananthapuram, Kerala-695016

SYLLABUS
For

MASTER OF COMPUTER APPLICATIONS
(REGULAR)

Semester 5 and 6

SEMESTER 5

	Regular Master of Computer Applications (Regular)	Hours / week			IA Marks	ESE Marks	Total	Credits	Exam Slot
Course No	**Course**	**L**	**T**	**P**					
RLMCA301	Web Data Mining	3	1	-	40	60	100	4	
RLMCA303	E-Commerce	3	-	-	40	60	100	3	
RLMCA305	Cryptography and Cyber Security	3	1	-	40	60	100	4	
RLMCA3--	Elective II	3	1	-	40	60	100	4	
RLMCA3--	Elective III	3	1	-	40	60	100	4	
RLMCA341	Seminar	-		2	50	-	50	2	
RLMCA351	Mini Project	-		8	150	-	150	2	
		15	**4**	**10**	**400**	**300**	**700**	**23**	

ELECTIVE-II		**ELECTIVE-III**	
RLMCA361	Compiler Construction	RLMCA381	Cloud Computing
RLMCA363	IPR and Cyber Law	RLMCA383	Human Computer Interaction
RLMCA365	Cyber Forensics	RLMCA385	Bioinformatics
RLMCA367	Internet of Things	RLMCA387	Computer Graphics
RLMCA369	Python Programming	RLMCA389	Parallel and Distributed Computing
RLMCA371	Social Network Analysis	RLMCA391	Artificial Intelligence

SEMESTER 6

	Regular Master of Computer Applications	Hours / week			Sessional	ESE Marks	Total	Credits	Exam Slot
Course No	**Course**	**L**	**T**	**P**					
RLMCA352	Project and Viva Voce			30	70	30	100	12	
		Cumulative Total					**3600**	**123**	

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA301	**Web Data Mining**	**3-1-0-4**	**2016**

Course Objectives

- Provide data mining concepts, principles and methods
- To develop understanding of problems and potentials of current Information Retrieval (IR) Systems.
- Understand how effective information source and retrieval are inter- related

Syllabus

Web Data Mining - Basic Concepts of Association Rules - Supervised Learning - Unsupervised Learning - Information Retrieval and Web Search - Web Usage Mining.

Expected Outcome

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

- Understand theoretical and practical aspects of information and data mining
- Understand the quantitative evaluation methods for the IR systems and data mining techniques

References

1. Bing Liu, “Web Data Mining - Exploring Hyperlinks, Contents and Usage Data”, Second edition, Springer 2011.
2. Matthew A Russell, “Mining the social web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub and more”, Second Edition, O’Reilly October 2013.
3. Jiawei Han and Micheline Kamber, “Data Mining Concepts & Techniques”, Second Edition, Elsevier.
4. Alex Berson and Stephen J Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw –Hill Edition, Tenth Reprint 2007.
5. Pang Ning Tan, Michael Steinbach and Vipin Kumar, “ Introduction To Data Mining”, Pearson Education, 2007.

Suggested MOOC

1. https://ocw.mit.edu/courses/sloan-school-of-management/15-062-data-mining-spring-2003/lecture-notes/
2. http://www.cs.virginia.edu/~hw5x/Course/CS6501-Text-Mining/_site/lectures/

Course Plan

Module	Contents	Hours Allotted	% of marks in End-Semester Examination
I	Introduction - World Wide Web - Web Data Mining - Data Mining - Web Mining - Data Mining Foundations - Basic Concepts of Association Rules - Apriori Algorithm - Data Formats for Association Rule Mining - Basic Concepts of Sequential Patterns - Mining Sequential Patterns based on Generalised Sequential Pattern (GSP) Algorithm *Text : 1*	8	15
II	Supervised Learning - Basic Concepts - Decision Tree Induction - Classifier Evaluation - Rule Induction - Classification based on Associations - Support Vector Machines - Linear SVM - Separable Case -Non Separable Case - Unsupervised Learning - Basic Concepts - K-Means Clustering - Representation of Clusters - Hierarchical Clustering *Text : 1*	12	25
FIRST INTERNAL EXAM			
III	Information Retrieval and Web Search - Basic Concepts of IR - IR Models - Boolean Model, Vector model, Statistical Language Model - Evaluation Measures *Text : 1*	8	15
IV	Text and Web Page Pre-Processing - Stopword Removal, Stemming, Other Pre-Processing Tasks for Text, Web Page Pre-Processing, Duplicate Detection - Inverted Index and its Compression - Latent Semantic Indexing *Text : 1*	8	15
V	WebSearch - Metasearch: Combining Multiple Rankings - Web Spamming - Web Crawling - A Basic Crawler Algorithm - Implementation Issues *Text : 1*	8	15
SECOND INTERNAL EXAM			
VI	Web Usage Mining - Data Collection and Preprocessing - Data Modelling for Web Users Mining - Discovery and Analysis of Web Usage Patterns - Recommender Systems and Collaborative Filtering *Text : 1*	8	15
END SEMESTER EXAM			

QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA303	**E-Commerce**	**3-1-0-4**	**2016**

Course Objectives

- Define E-commerce and describe how it differs from e-business.
- Describe major business models of E-Commerce
- Describe how Internet and Web features support E-Commerce
- Understand the key dimensions of E-Security
- Understand the features of E- Payment systems
- Understand the concepts and technologies of E- marketing systems

Syllabus

Introduction to e-Commerce, Business Models and Concepts, Technology Infrastructure for E-Commerce, E-Security , E-Payment and E-Marketing

Expected Outcome

At the end of the course,

- The students are expected to realise the problems involved in designing and building e-commerce systems.
- Understand the need to design E-Commerce systems that fully meet the requirements of the intended users.

References

1. Kenneth C. Laundon, Carol Guercio Traver, “E-Commerce”, Pearson India, 2016
2. P T Joseph, S.J., “E-Commerce An Indian Perspective”, PHI, Fifth edition ,2015
3. Whiteley,”e-Commerce Strategies, Technologies and Applications”, McGraw Hill, 2014
4. Tharam Dillon, Henry Chan, “E-Commerce Fundamentals and Applications”, John Wiley & Sons Ltd, 2014

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Introduction to e-Commerce- e-Commerce v/s e-Business, Types of E-Commerce, E-commerce Infrastructure ***Text : 1***	6	15
II	Business Models and Concepts - B2C, B2B, C2C, C2B -Brokerage Model, Aggregator Model, Info-mediary Model, Community Model, Value Chain Model, Manufacturer Model, Advertising Model, Subscription Model, Affiliate Model *Text: 2*	10	20
FIRST INTERNAL EXAM			
III	E-Security: E-Commerce Security Environment, Security Threats, Technology Solutions, SSL, Protecting Networks- Firewalls, Proxy-Servers *Text :1*	8	15
IV	E-Payment: Types of Payment Systems, Credit card E-Commerce Transactions- How an Online Card Transaction works - Credit Card E-Commerce Enablers - Limitations of Online Credit Card Payment Systems, Secure Electronic Transaction Protocol *Text :1*	8	15
V	E-Commerce digital payment systems in B2C-Digital Wallets- Digital Cash -Online stored Value Systems -Digital Credit Card Payment systems - Digital Checking Payment systems - B2B Payment systems *Text :1*	10	20
SECOND INTERNAL EXAM			
VI	E-Marketing: Basic Marketing Concepts, Internet Marketing Technologies, B2C and B2B-Commerce, Marketing and Branding Strategies, Online Market Research *Text :1*	8	15
END SEMESTER EXAM			
QUESTION PAPER PATTERN			

	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA305	**Cryptography and Cyber Security**	**3-1-0-4**	**2016**

Course Objectives

- Provide basic mathematical concepts used in Cryptography.
- Provide basic understanding of various cryptographic algorithms.
- Provide basic understanding of Hashing techniques, Digital Signature schemes and key management techniques.
- Provide basic understanding of crypto currencies and bitcoins
- Provide an understanding of network security implementation at application layer, transport layer, and network layer and the protocols used.

Syllabus

Introduction to Cryptography, Security architecture and classical encryption schemes, Number theory basics, Conventional symmetric key encryption techniques, Public key cryptography, Digital signatures, Message Authentication codes and Hash functions, Crypto currencies and bitcoins, Cyber Security, Email Security, IP Security and Web Security.

Expected Outcome

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

1. *Build cryptosystems using various Symmetric and Asymmetric encryption techniques.*
2. *Apply the concepts of different message authentication and digital signature techniques to applications for ensuring secure transactions.*
3. *Apply security services to applications at Application, Transport and Network layer.*

References

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013.
2. Behrouz A. Forouzan, “Cryptography and Network Security”, Tata McGraw-Hill Publishing(2e 2011)
3. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of India, 2002.
4. Manuel Mogollon, “Cryptography and Security Services – Mechanisms and Applications”, Cybertech Publishing.
5. William R. Cheswick, Steven M. Bellovin, Aviel D. Rubin, “Firewalls and Internet Security” Addison-Wesley

6. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency technologies", Princeton University Press

Suggested MOOC

1. **https://www.coursera.org/learn/crypto**
2. **https://www.coursera.org/learn/cryptocurrency**
3. **https://www.coursera.org/learn/crypto2**

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	**Introduction to Cryptography**: Services, Mechanisms and attacks-Phishing, ransomware, DoS attack, OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).	8	15%
II	**Mathematical Background: Elementary number theory:** Prime numbers, Fermat's and Euler's theorems, Testing for primality, **Modular Arithmetic**: Congruences, Chinese remainder theorem. F**inite fields**: Review of groups, rings and fields; Finite fields of the form GF(p), Polynomial Arithmetic, Finite fields of the form GF(2").Discrete logarithms Euclidean Algorithms.	12	15%
FIRST INTERNAL EXAM			
III	**Conventional Symmetric Key Encryption: Block** ciphers and Stream Ciphers, Modes of operation (ECB, CBC, CFB, OFB), multiple encryption, Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES. **Public key cryptography:** Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.	8	20%
IV	**Hash Functions and MAC**: Properties of hash functions, birthday attack, hash-cash, Message Authentication Code Algorithms, MAC protocols, HMAC, CBC-MAC. **Digital Signatures:** Classification of signature schemes, RSA signature, Digital Signature Standard, one time signature schemes, attacks on Digital Signatures, Blind Signatures.	8	15%
V	**Cryptocurrencies and Bitcoins**: **A Simple Cryptocurrency**: GoofyCoin, ScroogeCoin, **How Bitcoin Achieves Decentralization:** Centralization vs. Decentralization, Distributed consensus, Consensus without identity. **Mechanics of Bitcoin**: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, **How to Store and Use Bitcoins**: Simple Local Storage, Hot and Cold Storage, Splitting and	8	15%

	Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets		
SECOND INTERNAL EXAM			
VI	**Introduction to Cyber Security, E-mail Security:** Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. **IPSecurity:** Overview of IPSec – IPv4 and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange. **Web Security:** SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).	10	20%
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA361	Elective II- Compiler Construction	3-0-1-4	2016

Course Objectives

- To introduce the major concept areas of language translation and compiler design.
- To enrich the knowledge in various phases of compiler and its use, token generation, parsing, creating intermediate codes, code optimization techniques, machine code generation, and use of symbol table.
- To provide practical programming skills necessary for constructing a compiler.

Syllabus

Introduction to compilers and interpreters – Overview of compilation, Issues in compilation – structure of a compiler – compiler writing tools – bootstrapping – notations and concepts for languages and grammars – regular expressions – context free grammar, derivations and parse trees, BNF notations.

Context of a lexical analyzer – construction of lexical analyzer, deterministic and non-deterministic finite automata. Compile time error handling, error detection, reporting, recovery and repair.

Basic parsing techniques – Top down parsing – recursive descent parser, predictive parser simple LL(1) grammar. Bottom up parsers, operator precedence parser, LR grammar, LR(0), SLR(1) parsers.

Syntax directed translation schemes, syntax-directed definitions - S-attributed definitions - L-attributed definitions - bottom-up and top-down translation - type checking - type systems - specification of a type checker - run-time environments - source language issues - storage organization – storage allocation strategies - access to non-local names - parameter passing - symbol tables.

Intermediate codes, translation of assignments, translation of array reference, Boolean expressions, case statements, back patching.
Code optimization, loop optimization and global optimization, sources of sample code generation.

Expected Outcome

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

- Develop lexical rules and grammars for a programming language
- Develop Parser for a programming language.
- Identify and develop code optimization techniques to improve the performance of a program in terms of speed & space.
- Design a compiler for a concise programming language.

References

1. Alfred V Aho and Jeffery D Ullman , Principles of Compiler Design - Techniques and Tools, Pearson Edn, 2nd edn, 2009
2. V Raghavan- Principles of Compiler Design – TMH, 2nd ed,2011
3. Jean Paul Tremblay and Sorenson., The Theory and Practice of Compiler Writing McGraw Hill
4. Principles of compiler design, 2nd ed, Nandini Prasad, Elsevier
5. Kenneth C.Louden, Compiler Construction-Principles and Practice, 2nd Edition, Cengage, 2010.
6. Keith Cooper and Linda Torczon, "Engineering a Compiler", 2nd Edition, Elsevier, 2011
7. Principles of Compiler, A new approach to Compilers including the algebraic methods, Su, Yunlin, Yan, Song Y., SPRINGER

Suggested MOOC

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-035-computer-language-engineering-spring-2010/lecture-notes/
2. http://nptel.ac.in/courses/106108113/

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Compilers – Analysis of the source program – Phases of a compiler – Interpreters –Compiler construction tools– bootstrapping – Compile time error handling, Notations and concepts for languages and grammars – regular expressions – Context of a lexical analyzer –deterministic and non-deterministic finite automata-construction of lexical analyzer. Introduction to Lex //Assignments on Lex programs	9	20
II	Role of the parser –Writing Grammars - Context free grammar, derivations and parse trees, BNF notations. Top Down parsing – Recursive Descent Parsing – Predictive Parsing	8	20
FIRST INTERNAL EXAM			
III	Bottom-up parsing – Shift Reduce Parsing – Operator Precedence Parsing – LR Parsers – SLR Parser. Introduction to Yacc //Assignments on Yacc programs	8	15
IV	Syntax Directed Translation, Intermediate Codes-Syntax Tree- Three Address Codes-Quadruple-Triples- Indirect Triples-comparisons	8	15
V	Translation of Assignment Statements, Translation of Boolean Expressions, Translation of Control flow statements-Backpatching-Symbol Tables-Data Structures	8	15
SECOND INTERNAL EXAM			
VI	Code Optimization- Sources-Loop Optimization-DAG representation-Construction-Global data Flow analysis Issues in the design of code generator – A simple Code Generator	9	20
END SEMESTER EXAM			
QUESTION PAPER PATTERN			

	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA363	Elective II- IPR and Cyber Law	3-0-1-4	2016

Course Objectives

- To understand various intellectual property rights
- To understand the procedure for applying copyright, patents.
- Learn the legalities of intellectual property to avoid plagiarism and other IPR related crimes like copyright infringements.
- To understand various cybercrimes.
- To understand the information technology act.
- To understand various penalties related to cybercrimes.

Syllabus

Fundamentals of IPR - Patents - Trademarks - Copyright - Industrial Designs - Geographic Indications - Trade Secret and software copyright - cyber law - Information Technology Acts and Punishments

Expected Outcome

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

- Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IPs.
- Recognize the crucial role of IPs in organizations of different industrial sectors for the purposes of product and technology development.
- Identify activities which constitute IP infringements and the remedies available to the IPs owner and describe the steps to be taken to prevent infringement of proprietary rights in products and technology development.
- Evaluate the effectiveness of cyber-security, cyber-laws and other countermeasures against cybercrime and cyber warfare.
- Analyse and assess the impact of cybercrime.
- Understand the structure, mechanics and evolution of the Internet in the context of emerging crime threats and technological and other trends in cyberspace.

References

1. Dr. R. Radhakrishnan and Dr. S. Balasubramanian, " Intellectual Property Rights: Text and Cases", Excel Books
2. Harish Chander, " Cyber Law and IT Protection", PHI Learning Pvt.Ltd
3. D.Bainbridge, "Introduction to Computer Law", Pearson Education
4. Rohas Nagpal, "Cyber Crime & Corporate Liability", CCH, 2008

Suggested MOOC

1. http://www.ficciipcourse.in/index.php
2. https://onlinecourses.nptel.ac.in/noc16_hs08/preview

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	**Fundamentals of IPR-** Introduction – Intellectual property – Need for protection of intellectual property – WIPO – Intellectual property rights and development – Rationale of protection – TRIPS Agreement – **Patents** – Introduction – Patentable and Non-patentable Invention – Types of patent applications – Guidelines for registration of patent – patent filing – grant of patent – types of patent documents *Text :1*	8	15
II	**Trademarks** – Introduction – Guidelines for registration – Requirements for filing trademarks – Trademark Infringement – Protection of trademarks – **Copyright –** Introduction – Rights conferred by copyright – registration – ownerships – terms – transfer of copyrights – copyright infringement – databases and copyright *Text :1*	8	20
FIRST INTERNAL EXAM			
III	**Industrial Designs** – Introduction – Need for protection of design – requirements for registration of designs – Design Act,2000 – Duration of registration of design – application procedure – **Geographic Indications –** Introduction – Filing – Granting – Protection of geographic indications *Text :1*	8	15
IV	**Trade Secret –** definition – discovering and protecting of trade secret – **Software Copyright** – Introduction – Need of software copyright – classification of software according to copyright – software auditing – copyright notice – transfer of copyright *Text :1*	8	15
V	Cyber law - Need for cyber laws - Historical perspective - cyberspace - deception by squatting in cyberspace - protection of copyright on cyberspace - infringement of copyright on cyberspace - linking, hyperlinking and framing - ISP in cyberspace - cyberspace and protection of patents in India. *Text :2*	8	15
SECOND INTERNAL EXAM			

VI	Information Technology Act and Punishments- Introduction to IT Act 2000- Amendments on IT Act - Violation of the right of privacy in cyberspace/internet-punishment for violation of privacy, breach of confidentiality and privacy under IT act- Terrorism on cyberspace- overview of cybercrimes-offences by intermediaries- offences related to protected system- offences of misrepresentation-punishment for Abetment and Attempt to commit offences under the IT act. *Text :2*	10	20
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA365	Elective II- Cyber Forensics	3-1-0-4	2016

Course Objectives

- To understand the fundamentals of computer forensics
- To introduce computer security administrators to computer forensics.
- To understand about computer forensics tools.
- To understand about data acquisition.
- To perform computer forensic analysis, e-mail investigations, image file recovery.
- To perform cloud forensics.

Syllabus

Computer forensics fundamentals - Types of computer forensics technology - Data recovery - Evidence collection and data seizure - Computer image verification and authentication - Reconstructing past events

Expected Outcome

- Identify and need for computer forensics
- Describe the computer forensic technology
- Illustrate the process of data recovery
- Determine various aspects of collecting and preserving computer evidence
- Assess the authenticity of evidences and forensic identification.
- Estimate various ways to handle files, evidence related data and network forensics scenarios.

References

1. John R Vacca,"Computer Forensics computer crime scene investigation ", Firewall Media, 2009 Edition Reprint 2012.
2. Bill Nelson, Amelia Phillips, Christopher Steuart , "Guide to Computer Forensics and Investigations", Cengage Learning, Fifth Edition 2010.
3. Marjie T. Britz, "Computer Forensics and Cyber Crime", Pearson Third Edition 2013.
4. Marie - Helen Maras "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning, Second Edition 2015.

Suggested MOOC

1. **http://www.open.edu/openlearn/futurelearn/cyber-security**
2. **http://www.cyberdegrees.org/resources/free-onlinecourses/.**

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	**Computer forensics fundamentals:** Introduction: What is computer forensics? - Use of computer forensics in law enforcement - Computer forensics assistance to human resources /employment proceedings - Computer forensics services - Benefits of professional forensics methodology - Steps taken by computer forensics specialists.	8	15
II	**Types of computer forensics technology:** Types of military computer forensics technology, Types of law enforcement in Computer forensic technology, Types of business computer forensic technology. Occurrence of cyber crime - Cyber detectives - Computer forensics investigative services. *//Lab exercises may be given for (use any open source tools):* *1. Investigating NTFS Drive using DiskExplorer.* *2. Viewing contents of a forensic image*	8	15
FIRST INTERNAL EXAM			
III	**Data recovery:** Introduction of Data recovery - Data back-up and recovery - The role of back- up in data recovery - The data-recovery solution. *//Lab exercises may be given for (use any open source tools):* *1. File Recovery.* *2. Data Recovery.*	8	15
IV	**Evidence collection and data seizure**: Why collect evidence?, Collection options - Obstacles - Types of evidence - The rules of evidence - Volatile evidence - General procedure - Collection and archiving - Methods of collection - Artifact - Collection steps. Preserving the digital crime scene - Computer evidence processing scene - Legal aspects of collecting forensic evidence. *// Lab Exercises may be given for (use any open source tools):* *1. Gathering evidences* *2. Viewing files of various formats*	10	20

V	**Computer image verification and authentication:** Special needs of evidential authentication - Practical consideration - Practical implementation. Electronic document discovery :a powerful new litigation tool. Forensics identification and Analysis of technical surveillance devices. *// Lab Exercise may be given for (use any open source tools):* *1. Identifying image file format.* *2. Analyzing images for hidden messages.*	8	15
SECOND INTERNAL EXAM			
VI	**Reconstructing past events:** How to become a digital detective - Useable file formats - Unusable file formats - Converting files. Network forensics scenario - A technical approach - Destruction of e-mail - Damaging computer evidence. *// Lab Exercises may be given for (use any open source tools):* *1. Cracking password using any password recovery tool.* *2. Recovering deleted emails using the recover my email utility* *Note : Students may be introduced to penetration testing tools like metasploit, Penetration Testing Distribution Kali linux, network protocol analyzers like wireshark etc as part of the course.*	10	20
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2.The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA367	**Elective II- Internet of Things**	**3-1-0-4**	**2016**

Course Objectives

- Understand the main concepts and features of the IoT paradigm
- Describe different architectures for managing IoT platforms
- Insight on trust, security, and privacy in IoT environments
- Describe data management techniques applied to the IoT environment
- Understand the key enablers and solutions to enable practical IoT systems

Syllabus

IoT ecosystem concepts and architectures - IoT enablers and solutions - IoT data and knowledge management - IoT reliability, security, and privacy - IoT applications

Expected Outcome

- At the end of the course, students should be able to understand the concepts and features of IoT Paradigm with a good understanding on different IoT architectures and how it is practically managed.

References

1. Rajkumar Buyya; Amir Vahid Dastjerdi , “Internet of Things”, Morgan Kaufmann, 2016
2. Peter Waher, “Learning Internet of Things”, Packt Publishing, 2015
3. S. Sitharama Iyengar; Nandan Parameshwaran; Vir V. Phoha; N. Balakrishnan; Chuka D. Okoye, “Fundamentals of Sensor Network Programming: Applications and Technology”, Wiley, December 14, 2010
4. Robert Stackowiak (Author), Art Licht (Author), Venu Mantha (Author), Louis Nagode (Author), “Big Data and The Internet of Things: Enterprise Information Architecture for A New Age” , Apress, 2015

Suggested MOOC

1. https://www.coursera.org/specializations/internet-of-things
2. http://web.mit.edu/professional/digital-programs/courses/IoT

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Overview of Internet of Things - Open source semantic web infrastructure for managing IoT resources in the Cloud - Device/Cloud collaboration framework for intelligence applications	10	20
II	Introduction to Fog Computing: principles, architectures, and applications - TinyOS - NesC	6	15
FIRST INTERNAL EXAM			
III	Programming frameworks for Internet of Things - Virtualization on embedded boards as enabling technology for the Cloud of Things - Micro Virtual Machines (MicroVMs) for Cloud-assisted Cyber-Physical Systems (CPS)	8	15
IV	Stream processing in IoT: foundations, state-of-the-art, and future directions - A framework for distributed data analysis for IoT	8	15
V	Security and privacy in the Internet of Things- Internet of Things—robustness and reliability - Governing Internet of Things: issues, approaches, and new paradigm - TinyTO: two-way authentication for constrained devices in the Internet of Things - Obfuscation and diversification for securing the internet of things (IoT)	10	20
SECOND INTERNAL EXAM			
VI	Applied Internet of Things - Internet of Vehicles and applications - Cloud-Based Smart-Facilities Management Creating a simple sensor project - Preparing Raspberry Pi - Interfacing the hardware - Internal representation of sensor values- Persisting data -Creating the actuator project - Creating a controller	8	15
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - Part A and Part B. Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in Part B to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus**.**		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA369	Elective II- Python Programming	3-1-0-4	2016

Course Objectives

- To develop proficiency in the Python Programming Language.
- To be able to understand the various data structures available in Python programming
- To be able to do testing and debugging of code written in Python.
- To implement OOPs concept using Python
- To be able to develop web based applications using Python

Syllabus

Introduction to Python, Data Types and Operations, Decision Making, Functions, Modules & Packages, File Handling, Object Oriented Programming, Exception Handling and Regular Expressions, Database Programming, GUI Programming, Web Development and Web Frameworks.

Expected Outcome

- Ability to design algorithmic solution to problems.
- Ability to convert algorithms to Python programs.
- Ability to design modular Python programs using functions.

References

1. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016
2. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley, 2015
3. Jeeva Jose & P.SojanLal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Publishers, New Delhi, 2016
4. Downey, A. et al., "How to think like a Computer Scientist: Learning with Python", John Wiley, 2015

Suggested MOOC

1. **https://archive.org/details/MIT6.00SCS11**
2. **https://www.coursera.org/course/pythonlearn**
3. **http://www.learnerstv.com/Free-Computer-Science-Video-lectures-ltv163-Page1.htm**
4. **https://www.coursera.org/learn/python-databases**

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Introduction to Python: Features of Python, How to Run Python, Identifiers, Reserved Keywords, Variables, Input, Output and Import Functions, Operators Data Types: Numbers, Strings, List, Tuple, Set, Dictionary, Data Type Conversions. Decision Making, Loops, Nested Loops, Control Statements, Types of Loops	8	15%
II	Function Definition, Function calling, Function arguments, Lambda Functions, Recursive Functions Modules & Packages: Creating Modules, import Statement, Locating Modules, Namespaces and Scope, Packages, Date and Time Modules. Exception Handling: Built-in Exceptions, Handling Exceptions, Exception with arguments, Raising an Exception, User-defined Exception, Assertions in Python.	9	15%
FIRST INTERNAL EXAM			
III	File Handling, Object Oriented Programming: Class definition, Creating objects, Encapsulation, Data hiding, Inheritance, Method overriding, Polymorphism.	8	20%
IV	Regular expressions: Introduction, match() function, search() function, search and replace, regular expression modifiers, regular expression patterns, Character classes, special character classes, repetition cases, findall() method, compile() method. Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database, Exception Handling in Databases	9	20%
V	GUI Programming: Tkinter introduction, Tkinter and Python Programming, Tk Widgets, Tkinter examples Web Development: Python Web clients tools, Web Clients, Web Servers, Web Services.	8	15%
SECOND INTERNAL EXAM			

VI	Web Frameworks : Introduction to Django, Projects and Apps in Django, The Python Application Shell, The Django Administration App, Creating an App using Django. Introduction to SciPy (https://www.scipy.org), NumPy (http://www.numpy.org), matplotlib (https://matplotlib.org). A micro project/programming assignment should be given as part of the course. Assignments may be given in machine learning using resources available at scikit-learn.org. Note : Python may be taught effectively using ***IPython*** (https://ipython.org) using Jupiter notebook, which provides an interactive web based platform for programming.	9	15%
	END SEMESTER EXAM		
	QUESTION PAPER PATTERN		
	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA371	Elective II- Social Network Analysis	3-1-0-4	2016

Course Objectives

- To provide students with essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

Syllabus

Introduction to Social Network Analysis - Social Media Examples - Electronic Sources for Network Analysis - Mathematical Representations of Social Networks - Modelling and Aggregating Social Network Data - Semantic based Social Network Analysis - Case Studies

Expected Outcome

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

- Understand the importance of social media and networks
- Enhance analytical skills for analyzing social media and networking data
- Create real - life case studies using social media data

References

1. Peter Mika, "Social Networks and the Semantic Web", Springer, 2007
2. Hansen, Derek, Ben Shneiderman, Marc Smith, "Analyzing Social Media Networks with NodeXL: Insights from a Connected World", Morgan Kaufmann, 2011
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994
4. Christina Prell, "Social Network Analysis: History, Theory and Methodology", SAGE Publications Ltd, 2012

Suggested MOOC

1. http://nptel.ac.in/courses/106106146
2. https://www.politaktiv.org/documents/10157/29141/SocNet_TheoryApp.pdf
3. https://www.mooc-list.com/course/social-network-analysis-coursera

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Introduction to Social Network Analysis - Network Analysis - Key Concepts and Measures in Network Analysis - Global Structure of Networks, Macro Structure of Social Networks, Personal Networks Relevant Portions from Text 1	8	15
II	Social Media Examples: Asynchronous Threaded Conversation - Synchronous Conversation - World Wide Web - Collaborative Authoring - Blogs and Podcast - Social Sharing - Electronic sources for network analysis - Electronic discussion networks - Blogs and online communities - Web based networks. Text 2 and Text 1	10	20
FIRST INTERNAL EXAM			
III	Mathematical Representations of Social Networks - Notations for Social data - Graph Theoretic Notation, Sociometric Notation, Algebraic Notation - Sets of Actors Text 1	8	15
IV	Modelling and Aggregating Social Network Data : Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Representing identity - Determining equality - Reasoning with instance equality- Evaluating Smushing Text 1	10	20
V	Developing social-semantic applications : Building Semantic Web applications with social network features - The generic architecture of Semantic Web applications - Sesame - Elmo - Flink : the social networks of the Semantic Web community - Features of Flink. Text 1	10	15
SECOND INTERNAL EXAM			
VI	Social Media Network Analysis Case Studies - Email - Twitter - Visualizing and Interpreting Facebook Networks - YouTube: Contrasting Patterns of Interaction and Prominence. Text 2	8	15
END SEMESTER EXAM			

QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - **Part A and Part B.** **Part A** will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. **Part B** will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in **Part B** to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA381	**Elective III- Cloud Computing**	**3-1-0-4**	**2016**

Course Objectives

- Understand the main concepts and features of Cloud Computing
- Understand when enterprises should choose Cloud Services
- Understand current cloud providers and the offerings
- Understand cloud services and its applications

Syllabus

Introduction to Cloud Computing - The Value Proposition of Cloud computing - Using Cloud Platforms - Exploring Cloud Infrastructures - Details of Cloud Services and its Applications - Using the Mobile Cloud

Expected Outcome

- At the end of the course, students should be able to understand the basics of Cloud computing and be able to would be able to understand different cloud offering and its applications.

Text Book

1. Peter Waher, “Cloud Computing Bible”, John Wiley & Sons Publishing, 2011

Reference Books

1. Michael Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", John Wiley & Sons Publishing, 2014
2. Jothy Rosenberg; Arthur Mateos, “The Cloud at Your Service: The when, how, and why of enterprise cloud computing”, Manning Publications , 2010

Suggested MOOC

1. https://www.coursera.org/specializations/cloud-computing
2. http://ocw.mit.edu/courses/sloan-school-ofmanagement/15-768-management-of-services-conceptsdesign-and-delivery-fall-2010/lecture-notes/

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Defining Cloud Computing - Cloud Types- Characteristics of Cloud Computing - Open Standards - Value of Cloud for Enterprises - Understanding Cloud Architectures - Understanding Services and Applications by Type - IaaS vs. PaaS vs. SaaS	8	15
II	Virtualization Technologies - Load Balancing and Virtualization- Hypervisors - Machine Imaging - Porting Applications- Capacity Planning - Baselines and Metrics - Network Capacity - Scaling - Exploring Platform as a Service - Using Google Web Services	8	15
FIRST INTERNAL EXAM			
III	Using the prominent cloud services - Google Cloud Services - Amazon Web Services - Microsoft Cloud Services - Google Cloud Services - Demonstration/Tutorial on exploring cloud services on either Amazon/Azure/Google Cloud platform	8	15
IV	Managing the Cloud - Cloud Management Products - Industry Standards - Understanding Cloud Security - Securing the Cloud - Establishing Identity and Presence	8	20
V	Understanding Service Oriented Architecture - Moving Applications to the Cloud - Working with Cloud-Based Storage - Working with Productivity Software - Using Webmail Services - Communicating with the Cloud - Using Media and Streaming	10	20
SECOND INTERNAL EXAM			
VI	Working with Mobile Devices - Smartphones accessing cloud services - Cloud Mobile Web Service - Service Types - Service Discovery - Microservice architecture	8	15
END SEMESTER EXAM			

QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - Part A and Part B. Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in Part B to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA383	Elective III- Human Computer Interaction	3-1-0-4	2016

Course Objectives

- Acquire the knowledge and skills needed to create highly usable software systems.
- Obtain the objective of the basics of human and computational abilities and limitations.

Syllabus

Usability Engineering Concepts - Interaction basics - Interaction Designs - Socio - Organizational Issues and Stakeholder Requirements - Modelling Rich Interaction

Expected Outcome

- Understand basic concepts of Usability Engineering
- Understand the fundamental aspects of interaction and designing the interaction
- Understand basic concepts of Dialog Designing aspects in Human Computer Interaction
- Understand the aspect of Rich Context Modelling

References

1. Alan Dix, Janet Finlay, ”Human Computer Interaction” ,Third Edition,Pearson Education
2. Preece J. , Rogers Y, Sharp H.,”Human Computer Interaction, Addison - Wesley,1994.
3. Martin.G.Helander, Thomas .k .Landauer, “Handbook of Human Computer Interaction”, Second Edition , Elsevier 1997
4. B.Shneiderman, “ Designing The User Interface” Addison Wesley 2000

Suggested MOOC

1. http://nptel.ac.in/courses/106103115/3

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Introduction- User-Centered System Design , Human Computer Interaction (HCI) - HCI as Process - Relationship Between the HCI and Human Dialogue - Goals of HCI - Purpose of HCI - Interaction and Interactivity - Factors in HCI Design.	8	15
II	Usability - Concepts of Usability - Usability Criteria - Usability Specifications – Conclusion.	8	15
FIRST INTERNAL EXAM			
III	The interaction - Introduction - Models of interaction - Frameworks and ERGONOMICS - Interaction Styles - Interactivity - The Context of the Interaction - Experience , Engagement and Fun	10	20
IV	Interaction Design Basics - Introduction- The process of Design - User Focus- Scenarios - Navigation Design - Iteration and prototyping	10	20
V	Socio - Organizational Issues and Stakeholder Requirements - Capturing Requirements, Dialog- Dialog Design Notations - Diagrammatic Notations	8	15
SECOND INTERNAL EXAM			
VI	Modelling Rich Interaction-Introduction - Status Event Analysis - Rich Contexts - Rich Contexts	8	15
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - Part A and Part B. Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in Part B to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA385	**Elective III- Bioinformatics**	**3-1-0-4**	**2016**

Course Objectives

- To enable the students to understand scope of Bioinformatics
- To understand popular bioinformatics database
- To learn Fundamentals of Databases and Sequence alignment
- To learn Genomics and Gene Recognition
- To study predictive methods using DNA and Protein Sequences

Syllabus

Introduction to bioinformatics and molecular biology: Databases tools and their uses, Data searches and Pairwise Alignments, Molecular Phylogenetic, Genomics and Gene Recognition, Protein and RNA structure Prediction

Expected Outcome

- At the end of the course, Students will be comfortable to formulate solutions to problems in the field of bioinformatics.

References

1. Dan. E. Krane and M. L. Raymer, “Fundamental Concepts of Bioinformatics”, Pearson Education, 2003.
2. Attwood T. K. and D. J. Parry-Smith, “Introduction to Bioinformatics “, Pearson Education, 2003.
3. Neil C Jones and Pavel A Pevzner,” An Introduction to Bioinformatics Algorithms”, MIT Press, 2004.
4. David W Mount, “Bioinformatics- Sequence and Genome Analysis “, 2/e, Cold Spring Harbor Laboratory Press, New York, 2004.
5. Jean-Michel and Cedric Notredame, “Bioinformatics – A beginners guide”, Wiley India, 2010
6. Bryan Bergeron, M.D, “Bioinformatics Computing”, Pearson Education, 2015.

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	**Introduction to bioinformatics and molecular biology:** What is Bioinformatics? Why is Bioinformatics important? Central Dogma of Molecular Biology: Proteins- Structure, Protein Folding and Protein functions, DNA and RNA structure – Nucleic Acid structure and function, Genetic Code, Genes and Evolution	8	15
II	**Biological Databases and DNA sequence data repositories** Importance of databases -Biological databases-primary sequence databases, Composite protein sequence databases- Secondary databases- nucleic acid sequence databases -Composite Protein pattern databases - structure classification databases – DNA sequence databases - specialized genomic resources- analysis packages	8	15
FIRST INTERNAL EXAM			
III	**Data searches and Pairwise Alignments:** Dot plots, Simple Alignments, Gaps, Scoring Matrices Dynamic Programming: The Needleman and Wunsch Algorithm, Global and Local Alignments- Semi global alignments- The Smith-Waterman algorithm , Database Searches, Multiple sequence alignments	10	20
IV	**Molecular Phylogenetic:** Introduction, Advantages, Phylogenetic Trees, Distance Matrix methods, Maximum likelihood approaches, Multiple sequence alignments **Molecular visualization tools:** Sequence viewers (Artemis, SeqVISTA), 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol) and Anatomical visualization tools. //Tutorials may be given to familiarize the tools like Rasmol, Chime etc	10	20
V	**Genomics and Gene Recognition:** General introduction to Gene expression in prokaryotes and eukaryotes- Prokaryotic Genomes – Gene structure, GC content, Gene Density, Eukaryotic Genomes- Gene structure, GC content, Gene Density - Gene Expression, Transposition	8	15
SECOND INTERNAL EXAM			

VI	**Protein and RNA structure Prediction:** Amino Acids, Polypeptide Composition, Protein Structures, Algorithms for protein folding, Structure prediction, Predicting RNA secondary structures	8	15
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - Part A and Part B. Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in Part B to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA387	Elective III- Computer Graphics	3-1-0-4	2016

Course Objectives

- Provide a comprehensive introduction to the basic hardware and software elements of computer graphics.
- Provide a thorough explanation of computer graphics techniques such as geometric transformation, projections, hidden surface elimination, illumination models and 3D rendering.
- Provide an insight into graphics applications and multimedia components.

Syllabus

Introduction: What is Computer Graphics? Basic Raster Graphics: Scan conversion, filling, and clipping Geometric Manipulation: Transformations, Matrices, Homogeneous Coordinates. Elementary 3D Graphics: Plane projections, Vanishing points, Specification of a 3D view. Visibility: Image and object precision, z-buffer algorithms, area based algorithms. Rendering: Lighting, Radiosity, Raytracing

Expected Outcome

At the end of the course, Students will be able to

1. Describe underlying graphic hardware, architecture, graphic primitives and their attributes and apply algorithms for implementing (drawing) these primitives.
2. Develop applications applying mathematical concepts of geometric transformations, polygon filling and clipping in 2 dimensions.
3. Compare the different types of projections of 3D objects and the methods to identify visible surfaces of those projected images, rendering them using illumination models.

References

1. Donald Hearn and M. Pauline Baker, "Computer Graphics – C Version", Pearson Education, 2nd Edition
2. Sinha, Udai, "Computer Graphics", TMH, 2010
3. David F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill
4. F.S. Hill., "Computer Graphics Using Open GL", Prentice Hall, 2001
5. S. Feiner, J. Foley, A. Van Dam, R. Hughes, "Computer Graphics, Principles and Practice", Addison Wesley, 1990.
4. John F. Koegel Buford, "Multimedia systems", Pearson Education/Addison Wesley.
5. Tay Vaughan, "Multimedia making it works", TMH, 6th Ed.2004
6. William M. Newman and Robert F. Sproull, "Principles of Interactive Computer Graphics", McGraw Hill
7. Desai**, "Computer Graphics", PHI**

Suggested MOOC

1. http://nptel.ac.in/courses/106106090
2. http://www.learnerstv.com/Free-Computer-Science-Video-lectures-ltv046-Page1.htm

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Basic concepts in Computer Graphics - Types of Graphic Devices - Video Display Devices-Graphic monitors and Workstations, Interactive Graphic inputs-Hard Copy Devices-Graphic Software - Basic Raster Scan - Random Scan Systems - Line Drawing Algorithms - Circle Generation Algorithms - Scan Conversion - solid area scan conversion - polygon filling.	**9**	**20**
II	Two dimensional transformations - Homogeneous coordinate systems - matrix formulation and concatenation of transformations - Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window -to-viewport coordinate transformation; clipping operations – point, line, and polygon clipping algorithms	**9**	**20**
FIRST INTERNAL EXAM			
III	Introduction to graphics in three dimension, Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations – Polygon meshes- Curved Lines and surfaces- Quadric surfaces- Blobby objects.	**8**	**15**
IV	Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Vanishing points, Clipping-Graphical User Interfaces. Introduction to multimedia systems.	**8**	**15**
V	Spline representations – introduction to Bezier curves and surfaces -B-Spline curves and surfaces - 3D transformations - Translation, Rotation, Scaling, composite transformations**.**	**8**	**15**

SECOND INTERNAL EXAM			
VI	Hidden surface elimination- z-buffer algorithms, area based algorithms. Light sources – basic illumination models -Properties of light-Lighting, Radiosity, Raytracing-Shading	**8**	**15**
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - Part A and Part B. Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in Part B to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA389	**Elective III- Parallel and Distributed Computing**	**3-1-0-4**	**2016**

Course Objectives

- To learn Parallel and Distributed Computing from a programmer's perspective
- To understand the difference among various parallel programming models
- To study the process of ranking the super computers**.**

Syllabus

Introduction, Shared memory model (Thread based) - OpenMP, Shared memory model (Thread based) - CUDA, Shared memory model (Process based) : System V, Distributed Model - MPI, Hybrid Model : OpenMP + MPI, Data Parallel Model (PGAS) : UPC, Measuring the Performance, The Linpack Benchmark

Expected Outcome

- Analyse a problem, find out the scope of parallelising it and to write parallel programs
- The ability to convert existing serial programs to parallel ones, if possible
- Applying various programming models in solving the problems

References

1. Advanced Computer Architecture: Parallelism, Scalability, Programmability (Second Edition) Tata McGraw-Hill Education Pvt. Ltd., 2010 By Kai Hwang, Naresh Jotwani
2. Distributed and Cloud Computing - From Parallel Processing to the Internet of Things 1st Edition By Kai Hwang, Jack Dongarra and Geoffrey Fox
3. UPC: Distributed Shared Memory Programming By Tarek El-Ghazawi, William Carlson, Thomas Sterling, Katherine Yelick

Suggested MOOC

1. https://computing.llnl.gov/tutorials/parallel_comp/
2. http://www.openmp.org/wp-content/uploads/OpenMP3.1.pdf
3. http://docs.nvidia.com/cuda/cuda-c-programming-guide/
4. https://docs.oracle.com/cd/E19683-01/816-5042/svipc-41256/index.html
5. http://mpi-forum.org/docs/mpi-3.0/mpi30-report.pdf
6. http://upc.lbl.gov/publications/upc-lang-spec-1.3.pdf
7. http://www.gccupc.org/gnu-upc-info/binary-release
8. https://www.top500.org/lists/2016/11/download/TOP500_201611.xls
9. https://www.top500.org/green500/

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	**Introduction:** Need for Parallelism, Speedup - Amdahl's law, Gustafson's law *Classifications*: a) Flynn's classification b) Classification based on Memory Architectures - Shared Memory - UMA, NUMA, Distributed Memory, Hybrid. c) Classification based on Programming models - Shared (Thread based and Process based), Distributed, Hybrid model, Data Parallel model(PGAS)	6	15
FIRST INTERNAL EXAM			
II	***Shared memory model (Thread based)* - OpenMP** Important Directives - parallel, for, sections, single, parallel for, parallel sections, master, critical, barrier, atomic, ordered. Runtime Library Routines: omp_set_num_threads, omp_get_num_threads, omp_get_thread_num, omp_get_num_procs, omp_set_nested, omp_get_nested, omp_set_schedule, omp_get_wtime, omp_get_wtick. Clauses: default, shared, private, firstprivate, lastprivate, copyin, copyprivate. Writing an OpenMP program to find mean deviation of an array. Compiling with gcc -fopenmp.	10	20
III	***Shared memory model (Thread based)* - CUDA** Kernels and host-device communication. Shared and constant memory Library routines and constructs: cudaMemcpy , cudaMalloc, cudaFree , atomicAdd, cudaGetDeviceCount, cudaSetDevice,__syncthreads, __shared__, dim3,CUDA_SUCCESS. Programs to compute square and cube, synchronicity and performance. GPU coding restrictions	10	15

	Shared memory model (Process based) : **System V** shm functions **-** shmget,shmat,shmctl,shmdt		
IV	***Distributed Model*** **- MPI** Message Data, Message Envelope Basic MPI Functions: MPI_Init, MP_Comm_rank and MPI_Finalize Point-to-Point Communication: Blocking Send and Receive, Non Blocking Communication - Communication Initiation, Communication Completion Collective Communication: MPI_Barrier, MPI_Bcast, MPI_Scatter, MPI_Gather, MPI_Reduce, MPI_Scan, MPI_Allgather, MPI_Alltoall, MPI_Allreduce Writing an MPI program to find mean deviation, Compiling and executing with mpicc and mpirun (Use openmpi/mpich) ***Hybrid Model :*** **OpenMP + MPI -** Writing a MPI-OpenMP program to find mean deviation. Compiling with mpicc -fopenmp and executing with mpirun	10	20
V	***Data Parallel Model (PGAS) :*** **UPC** Basic Concepts: Thread, Shared object, Private object, affinity, shared access, local access, collective, phase Translation environment - Threads environment, Execution environment - Program startup, Program termination, Program execution Predefined identifiers - THREADS, MYTHREAD Declarations - Type qualifiers - The shared and reference type qualifiers, layout qualifier, Array Declarators Important statements: Barrier statements - upc_notify, upc_wait, upc_barrier, upc_fence, Collective Iteration - upc_forall Writing a UPC program to find mean deviation. Using gnu UPC compiler.	10	15
SECOND INTERNAL EXAM			

VI	**Measuring the Performance:** FLOPS, Calculating Theoretical peak of a Microprocessor, Interconnection networks - Gigabit Ethernet and Infiniband (comparison only). **The Linpack Benchmark** - Solving Linear Equations, LU Decomposition, Ranking from top500.org, Important fields - Rmax, Rpeak, Nmax, Nhalf, MFlops/Watt, Energy efficient ranking - green500.	8	15
END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - Part A and Part B. Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in Part B to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLIMCA391	**Elective III- Artificial Intelligence**	**3-1-0-4**	**2016**

Course Objectives

- Study the techniques of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concept of Expert Systems.

Syllabus

Introduction to AI and Production Systems, Search Strategies, Game playing, Knowledge Representation Structures, Knowledge representation using Logic, Planning, Learning, Expert systems, Fuzzy Logic

Expected Outcome

- Ability to design Algorithms using AI techniques to solve problems that are otherwise intractable.
- Ability to design and develop expert systems

Text Books

1. Kevin Night and Elaine Rich,"Artificial Intelligence (SIE)", Mc Graw Hill-2008.
2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.

References

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.

Suggested MOOC

1. **https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/lecture-videos/**
2. **http://nptel.ac.in/courses/106105077/**

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	*Introduction to AI and Production Systems:-* AI-Problem formulation, Problem Definition -Production systems, Control strategies, Problem characteristics, Production system characteristics , Example AI Problems (8 Puzzle problem, Missionary Cannibals Problem, Crypt arithmetic Problems, block world Problem)	8	15
II	*Search Strategies :* - Blind search strategies -Depth First Search, Breadth First Search, Best First Search, Iterative Deepening Search, Heuristic Search strategies- Admissible Heuristics and examples - Simple Hill Climbing and Steepest Ascending Hill Climbing, Simulated Annealing , A* algorithm	8	15
FIRST INTERNAL EXAM			
III	*Game playing :* Two Player Zero Sum Games, Modelling Two Player Zero Sum Games as search problems, Min-Max Algorithm, Optimising Min Max Algorithm using $\alpha - \beta$ cut off *Knowledge Representation Structures :* Frames, Sematic Networks and Conceptual Dependencies, Graph Databases.	8	15
IV	*Knowledge representation* using Logic : - First Order Predicate Logic (FOPL), Well Formed Formula(WFF) in FOPL,Inference rules for FOPL, The Clause Form and conversion of WFFs to Clause Form, Resolution-Refutation – Example problems	8	15
V	*Planning :-* Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. *Learning :-*Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning	10	20
SECOND INTERNAL EXAM			

VI	*Expert systems :–* Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells. *Fuzzy Logic:* - Fuzzy Variables ,Fuzzy Sets and Fuzzy Set Operations, Typical Examples using Fuzzy Sets	10	20

END SEMESTER EXAM			
QUESTION PAPER PATTERN			
	There will be two parts in the Question paper - Part A and Part B. Part A will have 8 short answer questions of 3 marks each (8 X 3 M = 24 M). There will be no choice questions. Part B will have 6 essay questions one from each module of 6 marks each, with an alternative choice question from the same module (6 x 6M=36M).The maximum number of sub part questions in Part B to be limited to 2. The total marks assigned to questions in Part A (Short answer) and Part B (Essay) together from a single module, not to exceed the marks assigned to that module specified in the course plan in the syllabus.		

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA341	**SEMINAR**	**0-0-2-2**	**2016**

Course Objectives

To enable the students to gain knowledge in any of the technically relevant current topics on computer science/information technology/research, and acquire the confidence in presenting the topic and preparing a report.

Syllabus

Guidelines

The student shall undertake detailed study on a technically relevant current topic in computer science/information technology under the supervision of a faculty member, by referring articles published in reputed journals/conference proceedings. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. The topic shall be presented in the class taking a duration of 15-20 minutes.
The report and slides for presentation shall be prepared using free typesetting software such as LATEX. A committee consisting of three/four faculty members shall evaluate
the seminar presentation.

Following guidelines shall be used for the assessment of Seminar.

Scope and relevance of topic	– 20%
Quality of presentation slides	– 10%
Presentation skills	– 30%
Knowledge in the topic	– 20%
Report	– 20%

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA351	**MINI PROJECT**	**0-0-8-2**	**2016**

Course Objectives

- To apply the software engineering principles on a real software project
- Develop a software product using the Agile methodology.

References

1. Alistair Cockburn, “Agile Software Development: The Cooperative Game”, Addison Wesley, 2nd Edition (2006).
2. Andrew Hunt, David Thomas, “The Pragmatic Programmer: From Journeyman to Master”, Pearson India, 1st Edition (2008).
3. Ken Schwaber, Mike Beedle, “Agile Software Development with Scrum”, Pearson (2008).
4. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, Addison Wesley Professional, 1st Edition (2008).
5. Mike Cohn, “User Stories Applied: For Agile Software Development”, Addison Wesley, 1st Edition, (2004).
6. Pressman, R.S., “Software Engineering: A Practitioner's Approach”, McGraw Hill SE, 7th Edition, (2010).
7. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Prentice Hall Imprint, Pearson Education, 2nd Edition (2002).
8. Rod Stephens, “Beginning Software Engineering”, Wrox Series, Wiley India Pvt Ltd (2015).
9. RyPress “Ry's Git Tutorial” (Free e-book)

Suggested MOOC

1. Introduction to DevOps(https://www.edx.org/course/introduction-devops-microsoft-dev212x)

Week	Schedule
I	Familiarisation with build tools. Familiarisation with an IDE (Eclipse, NetBeans,...), that support build tools and git. Selection of Topic, Formation of Development Team, Feasibility analysis.
II	Topic Approval, Meeting of Development Team including Scrum Master with Product Owner. Informal, preliminary discussions of requirements. Creating user stories in the rough record. Commencement of the Project.
III	Identifying modules, Initial Design of Database & UI. Starting Test Driven Development. Creating an empty git repository by Scrum Master / one member of the Development team. Setting permission to other members. Pushing the first version of the Project along with a Readme file containing contact details of team members. Using Branch for individual members. Merging with Master.
IV	First Scrum Review. (Here onwards, the Scrum reviews are conducted on every other week)
VII	Project Presentation - Interim Evaluation to be based on Git History
XIII	Project Presentation - Final Evaluation to be based on Git History
XIV	Submission of Project Report, with Rough Record

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA352	**PROJECT AND VIVA-VOCE**	**0-0-30-12**	**2016**

Course Objectives

- To apply the software engineering principles on a real software project
- Develop a software product using the Agile methodology.

Note:

Identify Real projects - Any project useful to the Society. The project must be done in house. The student has to spent the time in the lab for project work. Attendance as per MCA regulations is applicable for appearing for the final viva-voce. However the evaluation committee can give consent to students in exceptional cases to do their project in Industry which has real live projects. Local industries and training Institutes which offer live projects should not be permitted.

Students, individually have to do a project approved by their faculty Supervisor. Project evaluation weights shall be as follows:-For convenience the marks are allotted as follows.

Project Progress evaluation details

- *Total Marks for the Final Project: 100*
- *Project evaluation by the supervisor/s : 30 Marks*
- *Presentation & evaluation by the Committee : 40 Marks*
- *Evaluation by the External expert : 30 Marks*

The project assessment board shall consist of the following members.

- *Chairman: Head of the Department*
- *Members: Project supervisor/s of the student*
- *One faculty member from the Department*
- *One faculty member from a sister Department*
- *An external expert, either from an academic/research institute or Industry*

A faculty/technical staff should act as the Scrum Master of each Project team. The Customer or a Senior faculty is the Product Owner.

Frequent meetings are highly encouraged, at the convenience of the Scrum Master. Should not exceed 15 minutes. Ensure meetings once in three days. A sprint is two weeks, so ensure biweekly reviews. A review should not exceed 30 minutes. A demo to the Product Owner is compulsory in each review.

Use git for Version control.

Follow Test Driven Development. Bugzilla or an equivalent tool may be used for bug tracking.

The student should keep a rough record. Divide it into 4 parts. Product Backlog, Database & UI Design, Testing & Validation and details of Versions. Make dated entries to the corresponding part, as the project progresses. The Corrections and comments from Product Owner/Scrum Master should be clearly indicated with the Date.

Project presentations may be conducted for Internal Assessment. They should also serve as supplement to Scrum reviews. The evaluation board may consist of other faculty members/technical staff. A maximum of 2 Presentations are allowed. Scrum reviews should not be sacrificed for presentations.

Students must be encouraged to publish their work in journals and due credit to be given to the students for this.

Latex or an equivalent tool should be used for preparing Presentations and Project Report.

Week	Schedule
I	Selection of Topic, Feasibility analysis.
II	Topic Approval, Meeting of student and Scrum Master with Product Owner. Informal, preliminary discussions of requirements. Creating user stories in the rough record. Commencement of the Project.
III	Identifying modules, Initial Design of Database & UI. Starting Test Driven Development. Creating an empty git repository by Scrum Master / Student. Pushing the first version of the Project along with a Readme file containing contact details of team members. Using Branch for individual members. Merging with Master.
IV	First Scrum Review. (Here onwards, the Scrum reviews are conducted on every other week)
VII	Project Presentation - Interim Evaluation to be based on Git History
XII	Project Presentation - Final Evaluation to be based on Git History
XIII	Submission of Project Report, with Rough Record