Rajagiri College of Social Sciences (Autonomous), Kalamassery

MCA (2 year) Syllabus and Scheme

2020 Admission Onwards

BOARD OF STUDIES (COMPUTER SCIENCE)

RAJAGIRI COLLEGE OF SOCIAL SCIENCES (AUTONOMOUS)

KALAMASSERY, KOCHI, 683104

KERALA, INDIA

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PREFACE

As per the AICTE Approval Handbook for the academic year 2020-2021, the duration of the Master of Computer Applications (MCA) course is Two years from 2020 admission onwards (AICTE Handbook 2020-2021, Section 5.9, Page Number 90).

The Board of Studies (Computer Science) of Rajagiri College of Social Sciences (Autonomous), Kalamassery had drafted a syllabus for the two-year MCA and submitted the same to the Academic Council of Rajagiri College of Social Sciences, Kalamassery for further approval.

The Syllabus has been drafted on the lines of the Credit Score and the Scheme of Evaluation of the PGCSS 2019 Regulations of M G University, Kottayam. The enclosed syllabus is prepared after a detailed analysis of the recent trends in technology, current industry requirements and the latest syllabus of UGC-NET (Computer Science and Applications).

The core subjects of the three-year MCA Syllabus have been retained in the two-year syllabus and the various elective streams offered during the second year focus on the current trends in the industry.

-sd-

Bindiya M Varghese Ph.D
Chairperson,
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Rajagiri College of Social Sciences (Autonomous)

Rajagiri College of Social Sciences (Autonomous) was established as a result of the indefatigable industry and foresight of the CMI. The various axioms of the institution maintain the axiomatic spirit of Rajagiri - 'Relentlessly Towards Excellence'. Rajagiri College of Social Sciences (RCSS) is the eldest child of Rajagiri Vidyapeetham (Rajagiri group of educational institutions). It is located on two picturesque campuses- the Hill Campus at Kalamassery and the Valley campus at Kakkanad in Kochi, in the state of Kerala. RAJAGIRI literally means "The hill of the King" and derivatively it refers to the hillock where Jesus Christ is accepted as the King or the model, as the human embodiment of the virtues of love, truth and justice.

Vision

To become a centre par excellence of learning, unique in experience, value based in its approach, and pioneering in its efforts for enriching and fulfilling LIFE.

Mission

To facilitate comprehensive and integrated development of individuals imbued with righteousness and courage of conviction, to effectively function as social beings

Motto

The College has its motto: *LEARN SERVE EXCEL*

Department of Computer Science

The Department commenced its Master of Computer Applications (MCA) Programme in 2001, Affiliated to Mahatma Gandhi University, Kottayam, Kerala, India, and approved by the All India Council for Technical Education, New Delhi. The programme is designed to meet the ever-growing demand for well qualified and trained computer programmers. The Department has been consecutively rated "Platinum" in every AICTE-CII survey, for its illustrious placement track record and distinctive industry interaction programmes. The various specialisations of the MCA programme at RCSS brings out the students as world class professionals, suitable for the software industry.

Vision

To create technically competent individuals, who are innovative and uphold human values.

Mission

To develop globally recognised competent and innovative IT professionals, committed to lifelong learning, and blended with social commitment through comprehensive programmes.

Master of Computer Applications

The MCA programme of the institute has been designed in line with the mission statement of Rajagiri. The programme adheres strictly to an academic schedule that creates a strong knowledge base in the programme. Students are given training in the current technologies and an in-depth understanding of the current environment through various activities. The activities include extracurricular pursuits and value-added programmes

that foster awareness in contemporary technologies which help in the holistic development of students.

The Rajagiri Immersive Learning Experience Methodology is a pedagogical innovation of the institute. This methodology aims to evolve the Rajagiri student into a socially responsible professional. The Immersive Learning methodology is based on four dimensions – conceptual learning, experiential engagement, executive modelling and corporate competency.

The faculty keep themselves abreast with the latest trends in technology through regular online and onsite /offsite training programmes. Prominent industry professionals and academicians conduct workshops and lectures for the faculty. Faculty are regularly sent for Faculty Development Programmes and other courses to enhance their knowledge base. Rajagiri governance policy encourages a creative and flexible atmosphere where all individuals are respected and valued by the community.

Programme Educational Objectives (PEO) of the MCA Programme

- PEO1 : Graduates of the program will be computer professionals of probity, positive attitude and scientific temper
- PEO2 : Graduates of the program will have sound theoretical knowledge and skill for software development and implementation
- PEO3 : Graduates of the program will possess good communication, technical and innovative skills
- PEO4 : Graduates of the program will have a sense of social awareness

Programme Outcome (PO)

At the end of the Programme, a student will be able to achieve the following programme outcomes:

1. Computational Knowledge:

Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models from defined problems and requirements.

2. Problem Analysis:

Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

3. Design /Development of Solutions:

Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

4. Conduct Investigations of Complex Computing Problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage:

Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

6. Professional Ethics:

Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

7. Life-long Learning:

Recognise the need, and have the ability, to engage in independent learning for continual development as a computing professional.

8. Project management and finance:

Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

9. Communication Efficacy:

Communicate effectively with the computing community, and with society at large, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

10. Societal and Environmental Concern:

Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

11. Individual and Team Work:

Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

12. Innovation and Entrepreneurship

Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Program Specific Objectives (PSO)

PSO1: Data Analytics: Acquire knowledge of Data pre-processing and Data quality, Modelling and design of data warehouses, Algorithms for data mining, skills to design,

analyse and develop algorithms and implement using high-level programming languages and to define and critically analyse mining approaches for various domains.

PSO2: High-Level Programming: Acquire skills to design, analyse and develop algorithms and implement those using high-level programming languages, to maintain web server services required to host a website, Install, configure, design and develop mobile application development tools.

PSO3: Practices and tools in Information Security: Acquire a practical overview of the issues involved in the field of information security and assurance; acknowledge the ethical considerations in all dimensions of information security, and utilize the software tools to explore, rectify or prevent the unauthenticated actions in the domain.

Mapping of PO to PEO

Program Educational Objectives	**PEO1**	**PEO2**	**PEO3**	**PEO4**
Program Outcomes				
PO1: Computational Knowledge		√		
PO2: Problem Analysis			√	
PO3: Design /Development of Solutions	√			
PO4: Conduct Investigations of Complex Computing Problems			√	
PO5: Modern Tool Usage			√	
PO6: Professional Ethics	√			√
PO7: Life-long Learning	√			
PO8: Project management and finance				√
PO9: Communication Efficacy			√	
PO10: Societal and Environmental Concern	√			√
PO11: Individual and Team Work	√			√
PO12: Innovation and Entrepreneurship			√	
PSO1: Data Analytics		√	√	
PSO2: High-Level Programming		√	√	
PSO3: Practices and tools in Information Security		√	√	

Eligibility Criteria

The Eligibility Criteria outlined by AICTE for MCA is as given below

- Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree. OR
- Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).

  Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

Programme Structure and Duration

The duration of the programme shall be 4 semesters. The duration of each semester shall be 90 working days. Odd semesters from June to October and even semesters from November to march.

A student may be permitted to complete the programme, on valid reasons, within a period of 8 continuous semesters from the date of commencement of the first semester of the programme.

The medium of instruction shall be English.

Attendance

The minimum requirement of attendance for each course during a semester for appearing at the end-semester examination shall be 75%. Condonation of shortage of attendance to a maximum of 15 days in a semester subject to a maximum of two times during the whole period of the programme may be granted by the Principal, Rajagiri College of Social Sciences (Autonomous), Kalamassery.

Those who could not register for the examination of a particular semester due to shortage of attendance may repeat the semester along with junior batches, without considering sanctioned strength, subject to the existing Rules of the institution.

A Regular student who has undergone a programme of study under earlier regulation/scheme and could not complete the Programme due to shortage of attendance may repeat the semester along with the regular batch subject to the condition that he has to undergo all the examinations of the previous semesters as per the 2020 Regulations

A student who had sufficient attendance and could not register for fourth semester examination can appear for the end semester examination in the subsequent years with the attendance and progress report from the Principal.

Registration / Duration

A student shall be permitted to register for the programme at the time of admission.

A student who has registered for the programme shall complete the programme within a period of four years from the date of commencement of the programme.

Promotion

A student who registers for a particular semester examination shall be promoted to the next semester.

A student having 75% attendance for each course and who fails to register for examination of a particular semester will be allowed to register notionally and is promoted to the next semester, provided application for notional registration shall be submitted with 15 days from the commencement of the next semester.

Evaluation and Grading

There shall be a Semester Examinations at the end of each semester for all credit courses of duration of 3 hours. A question paper may contain short answer type/annotation and long essay type questions. Different types of questions shall have different weightage.

Evaluation

The evaluation scheme for each course shall contain two parts; (a) End Semester Evaluation (ESE) [External Evaluation] and (b) Continuous Evaluation (CE) [Internal Evaluation]. 25% weightage shall be given to internal evaluation and the remaining 75% to external evaluation and the ratio and weightage between internal and external is 1:3. Both End Semester Evaluation (ESE) and Continuous Evaluation (CE) shall be carried out using direct grading system.

Direct Grading

The direct grading for CE (internal) and ESE (external evaluation) shall be based on 6 letter grades (A+, A, B, C, D and E) with numerical values of 5, 4, 3, 2, 1 and 0 respectively.

Grade Point Average (GPA)

Internal and External components are separately graded and the combined grade point with weightage 1 for internal and 3 for external shall be applied to calculate the Grade Point Average (GPA) of each course. Letter grade shall be assigned to each course based on the categorization detailed the Components of Internal (CE) and External Evaluation (ESE) session.

Internal Evaluation for Regular Programme

The internal evaluation shall be based on predetermined transparent system involving periodic written tests, assignments, seminars, lab skills, records, viva-voce etc.

Components of Internal (CE) and External Evaluation (ESE)

Grades shall be given to the evaluation of theory / practical / project / comprehensive viva-voce and all internal evaluations are based on the Direct Grading System.

There shall be no separate minimum grade point for internal evaluation.
The model of the components and its weightages for Continuous Evaluation (CE) and the End Semester Evaluation (ESE) are shown in below:

For Theory (CE) [Internal]

	Components	Weightage
i.	Assignment	1
ii.	Seminar	2
iii.	Two test papers	2 (1 each)
Total		**5**

(*For test papers all questions shall be set in such a way that the answers can be awarded A+, A, B, C, D, E grade).*

For Theory (ESE) [External]

Evaluation is based on the pattern of question specified as follows.

Questions shall be set to assess knowledge acquired, standard, and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. Due weightage shall be given to each module based on content/teaching hours allotted to each module.

The question setter shall ensure that questions covering all skills are set.
The question shall be prepared in such a way that the answers can be awarded A+, A, B, C, D, E grades.

Sl. No	Type of questions	Weight	Number of questions to be answered
1.	Short Answer type questions	1	10 out of 12
2.	Long essay type questions	4	5 EITHER/OR Questions. (One each from 5 modules)
		5	Total Weightage =30

Pattern of question for practical

The pattern of questions for external evaluation of practical shall be prescribed by the Board of Studies.

For Practical (CE) [Internal]

Components	Weightage
Written /Lab test	2
Lab involvement and record	1
Viva	2
Total	**5**

For Practical (ESE) [External]

Components	Weightage
Written /Lab test	7
Lab involvement and record	3
Viva	5
Total	**15**

For Internship (CE) [Internal]

Components	Weightage
Interim presentation on Internship	2
Internship Interim Report	2
Internship Evaluation at the Organization by Internal Faculty	1
Total	**5**

For Internal (ESE) [External]

Components	Weightage
Final Presentation	3
Internship Final Report	7
Internship Evaluation at the Organization by Organization	5
Total	**15**

Comprehensive viva – voce (CE) [Internal]

Components	Weightage
Comprehensive viva-voce (all courses from first semester to fourth semester)	5
Total	**5**

Comprehensive viva – voce (ESE) [External]

Components	Weightage
Comprehensive viva-voce (all courses from first semester to fourth semester)	15
Total	**15**

All grade point averages shall be rounded to two digits.

To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of external examination.

There shall not be any chance of improvement for internal grade.

External Evaluation

The external examination in theory courses is to be conducted by the Examination Cell at the end of the semester. The answers may be written in English. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation. The external evaluation shall be done immediately after the examination preferably through Centralized valuation.

Photocopies of the answer scripts of the external examination shall be made available to the students on request as per the rules prevailing in the Examination Manual of the College.

The question paper should be strictly on the basis of model question papers set and directions prescribed by the BOS.

Direct Grading System

Direct Grading System based on a 6-point scale is used to evaluate the Internal and External examinations taken by the students for various courses of study.

Grade	Grade Points	Range
A+	5	4.50 to 5.00
A	4	4.00 to 4.49
B	3	3.00 to 3.99
C	2	2.00 to 2.99
D	1	0.01 to 1.99
E	0	0.00

Performance Grading

Students are graded based on their performance (GPA/ SGPA/CGPA) at the examination on a 7-point scale as detailed below:

CGPA	Grade	Indicator
4.50 to 5.00	**A+**	Outstanding
4.00 to 4.49	**A**	Excellent
3.50 to 3.99	**B+**	Very good
3.00 to 3.49	**B**	Good (average)
2.50 to 2.99	**C+**	Fair
2.00 to 2.49	**C**	Marginal (pass)
Upto 1.99	**D**	Deficient (fail)

No separate minimum is required for internal evaluation for a pass, but a minimum C grade is required for a pass in an external evaluation. However, a minimum C grade is required for pass in a course.

A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch.

Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) Calculations. The **SGPA** is the ratio of sum of the credit points of all courses taken by a students in the semester to the total credit for that semester, After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below:

Semester Grade Point Average – SGPA (S_j) = $\sum (C_i \times G_i) / \sum C_i$

(SGPA = Total credit point awarded in a semester / Total credits of the semester)

Where '**S_j**' is the **j^{th}** semester, '**G_i**' is the grade point scored by the student in the **i^{th}** course '**c_i**' is the credit of the **i^{th}** course.

Cumulative Grade Point Average (CGPA) of a Programme is calculated using the formula.

Cumulative Grade Point Average (CGPA) = $\sum (C_i \times S_i) / \sum C_i$

(CGPA = Total credit points awarded in all semesters / Total credits of the programme)

Where 'C_i' is the credits for the i^{th} semester, '**S_i**' is the SGPA for the i^{th} semester. The **SGPA** and **CGPA** shall be rounded off to 2 decimal points.

For the successful completion of semester, a student shall pass all courses and score a minimum **SGPA** of 2.0. However, a student is permitted to move to the next semester irrespective of her/his **SGPA.**

Award Of Degree

The successful completion of all the courses with **'C'** grade within the stipulated period shall be the minimum requirement for the award of the degree.

Credits allotted for Programmes and Courses

Total credit for MCA programme shall be **80**

STAGE WISE ILLUSTRATION OF GRADING

Theory – External – ESE

Maximum weight for external evaluation is 30. Therefore Maximum Weighted Grade Point (WGP) is 150.

Type of question	Qn. No's	Grade Awarded	Grade point	Weights	Weighted Grade Point
Short Answer	1	A+	5	1	5
	2	-	-	-	-
	3	A	4	1	4
	4	C	2	1	2
	5	A	4	1	4
	6	A	4	1	4
	7	B	3	1	3
	8	A	4	1	4
	9	B	3	1	3
	10	-	-	-	-
	11	A	4	1	4
	12	A+	5	1	5
Long Essay	13a	-	-	-	-
	13b	A+	5	4	20
	14a	-	-	-	-
	14b	B	3	4	12
	15a	A	4	4	16
	15b	-	-	-	-
	16a	A+	5	4	20
	16b	-	-	-	-
	17a	-	-	-	-
	17b	B	3	4	15
			Total	**30**	**121**

Calculation :
Overall Grade of the theory paper = Sum of weighted Grade Points / Total weight

121 / 30 = 4.03 = Grade A

Practical – Internal – CE

Maximum weight for Internal Evaluation is 5. Therefore, Maximum Weighted Grade Point (WGP) is 25.

Components	Weight (W)	Grade Awarded	Grade Point (GP)	WGP = W x GP	Overall Grade of the course
Written / Lab test	2	A	4	8	WGP / Total weight = 17/5 = 3.40
Lab involvement & record	1	A+	5	5	
Viva	2	C	2	4	
Total	**5**			**17**	**B**

Comprehensive viva-voce – External - ESE

Maximum weight for External Evaluation is 15. Therefore, Maximum Weighted Grade Point (WGP) is 75.

Components	Weight (W)	Grade Awarded	Grade Point (GP)	WGP = W x GP	Overall Grade of the course
Comprehensive Viva - voce	15	A	4	60	WGP / Total weight = 60 / 15 = 4
Total	**15**			**60**	**A**

Evaluation Third stage

Semester Grade Point Average (SGPA)

Course code	Credits (C)	Grade Awarded	Grade points (G)	Credit Points (CP = C x G)
01	5	A	4.25	21.25
02	5	A	4.00	20.00
03	5	B+	3.80	19.00
04	2	A	4.40	8.80
05	3	A	4.00	12.00
TOTAL	20			81.05
SGPA	**Total credit points / Total credits = 81.05 /20 = 4.05 = Grade A**			

Bridge Courses

#	Course Name	Hours
1	Programming concepts using C language	14
2	Basic Mathematics and Statistics	6
3	Digital Logic and Computer Organization	4
4	Basic Principles of Management	4
5	Skill and Personality Development Workshop	4 Full Working Days
	Evaluation after Bridge Course	2 Hour Theory Exam and 3 Hour Lab Exam

Semester Courses

Semester I

Code	Course Name	Type	Hours			Exam	Credit
			Lecture	**Tutorial**	**Practical**	**(hours)**	
MCA101	Probability, Statistics and Computational Mathematics	Core	3	1	0	3	3
MCA102	Data Structures using C	Core	3	1	0	3	3
MCA103	Database Management System with SQL/PL-SQL	Core	3	1	0	3	3
MCA104	Data Communications and Computer Networks	Core	3	1	0	3	3
MCA105	Operating Systems with Linux as Case study	Core	3	1	0	3	3
MCA106	Data Structures Lab	Lab			4	3	2
MCA107	DBMS Lab	Lab			4	3	2
	Semester 1 : Total Credits	**19**					

Semester II							
Code	**Course Name**	**Type**	**Hours**			**Exam**	**Credit**
			Lecture	**Tutorial**	**Practical**	**(hours)**	**Total**
MCA201	Operations Research	Core	3	1	0	3	3
MCA202	Java Programming	Core	3	1	0	3	3
MCA203	Advanced Software Engineering	Core	3	1	0	3	3
MCA204	Design and Analysis of Algorithms	Core	3	1	0	3	3
MCA205	Artificial Intelligence	Core	3	1	0	3	3
MCA206	Web Technology Lab	Lab			6	3	3
MCA207	Java Programming Lab	Lab			4	3	2
	Semester 2 : Total Credits	**20**					

Semester III							
Code	**Course Name**	**Type**	**Hours**			**Exam**	**Credit**
			Lecture	**Tutorial**	**Practical**	**(hours)**	
MCA301	Business Management and Financial Accounting	Core	3	1	0	3	3
MCA302	Theory of Computation and Compilers	Core	3	1	0	3	3
MCA303	Data Mining	Core	3		1	3	3
MCA304	Information Security	Core	3	1	0	3	3
MCA3XX	Elective-I	Elective	3	1	2	3	4
MCA306	Data Analytics using Python	Lab	2		2	3	3
MCA307	Android	Lab	2		2	3	3
	Semester 3 : Total Credits	**22**					

Semester IV							
Code	**Course Name**	**Type**	**Hours**			**Exam**	**Credit**
			Lecture	**Tutorial**	**Practical**	**(hours)**	
MCA 401	Parallel Programming using OpenMP	Core	3	1		3	3
MCA 4XX	Elective-II	Core	3	1	2	3	4
MCA 403	Comprehensive Viva-Voce	Exam					2
MCA 404	Internship		40 Working days				10
	Semester 4: Total Credits	**19**					
	Grand Total Credits for MCA	**80**					

Elective Courses

Specialization Stream 1		Specialization Stream 2		Specialization Stream 3	
Data Science		**Advanced Programming**		**Computer Security**	
Code	**Course Name**	**Code**	**Course Name**	**Code**	**Course Name**
Pool1 (MCA 305)					
MCA311	Deep Learning	MCA321	AngularJS framework	MCA331	Ethical Hacking
MCA312	Big Data Analytics	MCA322	Microsoft .NET Framework using C#	MCA332	Web and Database Security
Pool 2 (MCA 402)					
MCA413	R Programming	MCA423	Flutter Using DART	MCA433	Cyber Forensics
MCA414	Data Visualization	MCA424	Struts, Hibernate and Spring	MCA434	Block-Chain Technology

Value Added Courses

A student must complete and get certified in a value-added course offered by the College from time-to-time, in order to fulfil the course completion.

BRIDGE COURSES

Programming concepts using C language

- Work with primitive types and expressions
- Understanding the basic structure of a C Program, the main function and using standard I/O
- Understand C Character Set and Tokens, Data Types, Variables and Constants
- Work with Operators and Expressions
- Control the flow of Program using Conditional statements and Loops
- Work with Built-in Functions and User Defined Functions with arguments, Passing arguments By Value and By Reference
- Work with Arrays and Strings
- Understand and Implement Pointers, Pointer to an array, Array of pointers, Pointers and functions
- Defining Structures and Union
- Data File Handling
- Debug C programs effectively

Basic Mathematics and Statistics

- Set theory
  Sets and their representations; The empty set; finite and infinite sets; equal and equivalent sets; subsets; power set; universal set; Venn diagrams; complement of a set operation on sets; applications of sets.
- Mathematical Logic
  Basic Logical connections; Conjunction; Disjunction; Negation; Negation of Compound Statements; Truth tables. Tautologies; Logical Equivalence; Applications.
- Modern algebra
  Binary Operation; Addition Modulo n; Multiplication modulo n
- Matrices and Determinants
  Definition of a matrix; Operations on matrices; Square Matrix and its inverse; determinants; the inverse of a matrix
- Basics Statistics
  Measures of central Tendency; Standard Deviation; Discrete series. variance.

Digital Logic and Computer Organization

- **Computer Evolution**: Brief history of Computer, Classification of Computer, Structure of a Computer System, Arithmetic Logic Unit, Control Unit, Bus Structure, Von Neumann Architecture. Bootstrapping.
- **Number systems** - Decimal, Binary, Octal, Hexadecimal conversion from one to another, Basic Arithmetic Operations: Integer Addition and Subtraction, Signed numbers, Binary Arithmetic, 1's and 2's Complement Arithmetic, Fixed and Floating point numbers, Floating point representation.,
- **Digital Logic**: Logic gates, Boolean Algebra, Basic theorem and Properties of Boolean algebra. Basic concepts on Combinational Circuits and Sequential circuits

- **Control Unit Design**: Basic Concepts - Instruction execution cycle - sequencing of control signals
- **Memory Organization**: Characteristics of Memory Systems, Main Memory, Types of Random-Access Memory and ROM, Organization, Static and dynamic memories. Understanding Cache Memory and Virtual Memory
- **Input / Output Organization**: Accessing I/O devices – Understanding Programmed I/O, Interrupt I/O and Direct memory access (DMA)

Basic Principles of Management

- Introduction to principles of management: Planning, organising, staffing, Budgeting, Controlling.
- Scope of IT applications in management, and its benefits
- Socioeconomic environment and information systems, and its impact
- Strategic role of IT in organisations
- Critical success factors as its role in implementing IT applications
- Case studies of successful / failed IT applications

SEMESTER I

MCA101 Probability, Statistics and Computational Mathematics

Course Code	MCA101	**Course Title**	Probability, Statistics and Computational Mathematics
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Mathematics
Syllabus			
I	**Probability Theory**: Sample space, Events, Different approaches to probability, Addition and multiplication theorems on probability, Independent events, Conditional probability, Bayes Theorem.		
II	**Random variables and Distribution**: Random variables, Probability density functions and distribution functions, Marginal density functions, Joint density functions, mathematical expectations, moments and moment generating functions. Discrete probability distributions - Binomial, Poisson distribution, Continuous probability distributions- uniform distribution and normal distribution.		
III	**Basic Statistics** :Measures of central tendency: - mean, median, mode; Measures of dispersion: Range, Mean deviation, Quartile deviation and Standard deviation; Moments, Skewness and Kurtosis, Linear correlation, Karl Pearson's coefficient of Correlation, Rank correlation and linear regression.		
IV	**Mathematical Logic**: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.		
V	**Counting, Mathematical Induction**: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction.		
REFERENCE BOOKS:			
Fundamentals of statistics: S. C. Gupta, 6thRevised and enlarged edition April 2004, Himalaya Publications			
Fundamentals of Mathematical Statistics- S.C.Gupta ,V.K.Kapoor. Sultan Chand Publications.			
Introduction to Mathematical Statistics -Robert V. Hogg &Allen T. Craig. Pearson education			
Discrete Mathematical Structures with Applications to Computer Science by J. P. Tremblay and R. P. Manohar, Tata McGraw-Hill, 2001.			
C. L. Liu, Elements of Discrete Mathematics, 2nd Edition, Tata McGraw-Hill, 2000.			
COURSE PRE-REQUISITES:			
Bridge Course in Mathematics.			
COURSE OBJECTIVES:			
To understand the concept of probability, statistics and computational mathematics and it uses in computer science problems.			
COURSE OUTCOMES:			
CO. No	**Course Outcome description**		

MCA101.1	To gain fundamental understanding of Probability, conditional probability and Bayes theorem.
MCA101.2	Understand and describe various probability distributions
MCA101.3	To apply the concept of statistics in real life problems.
MCA101.4	To gain fundamental understanding of mathematical logic.
MCA101.5	To have the concept of counting and mathematical induction.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCA101.1	2	2	1	2									2		
MCA101.2	2	2	1										2		
MCA101.3	2	3		3									2		
MCA101.4	2	3		3											
MCA101.5	2	2	1	2											

MCA102 Data Structures using C

Course Code	MCA102	**Course Title**	Data Structures using C
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Computing

Syllabus

I	**Introduction:** Data Structures, Data Types, Structure. **Arrays:** Polynomial Representations, Polynomial addition, Polynomial Multiplication and sparse matrices **Stack:** Definition and concepts, Operations on stacks. Application of stacks- Infix to postfix conversion, Evaluation of Arithmetic Expression.
II	**Queue:** Representation of queue, circular queue and double ended queue.Priority queue: implementation by array using Heap Sort **Dynamic Memory Allocation Functions:**malloc, calloc, realloc and free **Linked List:** Operations – insertion, searching, removing, updating, sorting and reversing. **Polynomial:** Representations, Addition, Multiplication using Linked List.
III	**Linear Data Structures:** Linked stacks, Linked queues, Circular Linked List and Double Ended Queue, Doubly Linked List and Circular doubly linked list. **Non-Linear Data Structures:** Trees, Graphs. **Graph:** Representation of Graph on Computer: Adjacency matrix and adjacency list, merits and demerits of graph representation **Searching:** Linear Search, Binary Search
IV	**Trees:** Basic terminology, binary trees, binary search tree **Binary search tree:** Insertion, Deletion, searching and Traversal - in-order, pre-order and post-order. Threaded Binary Tree: Operations

	Balanced Trees: AVL Tree: properties, insertion, deletion and rotations
V	**Advanced Data Structures:** Red black tree: properties. **B-Trees:** Data Structure on secondary storage, Definition of B trees, Basic operations on B Trees – searching, creating an empty node, splitting a node in B Tree, Inserting a key in to B Tree and Deleting a Key from a B Tree **Definition and Structure:** B+ Trees **Data Structure for Disjoint Sets:** Disjoint set operation, linked list representation of disjoint sets, Disjoint-set forests

REFERENCE BOOKS:

Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest

Fundamentals of data structures – Ellis Horowitz and SartajSahni (Galgotia , 1994)

Fundamentals of computer algorithms- Ellis Horowitz, SartajSahni, SanguthevarRajeshekharan (Universities Press , 2007)

Data Structure using C & C++ b, Tannenbaum and Augustine,prentice hall.

Data Structures – a pseudocode approach with C –Richard F Gilberg, Behrouz A Forouzan, Thomson Learning, 2 Edn., Cengage Learning C2005

Data Structures and program design – R. L Kruse (Prentice Hall of India),C2001

COURSE PRE-REQUISITES:

Bridge Course in C

COURSE OBJECTIVES:

1. To introduce the concept of linear and nonlinear data structures.
2. To implement the concepts using arrays and linked list
3. To apply it to advanced data structures.

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA102.1	To differentiate the linear and nonlinear data structures
MCA102.2	Implement the various kinds of sorting and searching techniques.
MCA102.3	To implement the concept of nonlinear data structures using arrays and linked list.
MCA102.4	Familiarize the concept of advanced data structures like red black trees, avl trees etc. .
MCA102.5	Implement the concept of balancing a tree and the rotations to do it.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCA102.1	3						1				2	2		2	
MCA102.2			3				1				2	2		2	
MCA102.3	3		2				1				2	2		2	
MCA102.4			3				1				2	2		2	
MCA102.5			2				1				2	2		2	

Course Code	MCA103	**Course Title**	Database Management Systems with SQL/PL-SQL
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Computing
Syllabus			
I	**Module 1: Introductory concepts of DBMS** Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- levels, Mappings, Database, users and DBA Relational Model : Structure of relational databases, Domains, Relations, Entity-Relationship model Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema		
II	**Module 2: Relational Database design** Functional Dependency – definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD-dependency preservation, BCNF, Multivalued dependency, 4NF, Join dependency and 5NF		
III	**Module 3: SQL Concepts** Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries,correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. transaction control commands – Commit, Rollback, Savepoint		
IV	**Module 4: PL/SQL** Introduction to PL/SQL, PL/SQL Identifiers, Control Structures, Composite Data Types, Explicit Cursors, Stored Procedures and Functions, Triggers, Compound, DDL, and Event Database Triggers		
V	**Module 5: Transaction Management** Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems, Locking mechanism, solution to concurrency related problems, deadlock, , two-phase locking protocol, Isolation, Intent locking		

REFERENCE BOOKS:	
Database Management Systems – Raghu Ramakrishnan and Johannes Gehrke, Third Edition, McGraw Hill, 2003	
Database Systems: Design , Implementaion and Management, Peter Rob, Thomson Learning, 7Edn.	
Concept of Database Management, Pratt, Thomson Learning, 5Edn.	
Database System Concepts – Silberchatz, Korth and Sudarsan, Fifth Edition, McGraw Hill, 2006	
The Complete Reference SQL – James R Groff and Paul N Weinberg	
COURSE PRE-REQUISITES:	
Basic Computer Knowledge	
COURSE OBJECTIVES:	
1. Understand and successfully apply logical database design principles, including E-R diagrams and database normalization. 2. To introduce the basic concepts including the structure and operation of the relational data model along with integrity constraints 3. Construct simple and moderately advanced database queries using Structured Query Language (SQL). 4. To understand the design of a database system using normalization 5. Understand the concept of a database transaction and related database facilities, including concurrency control, backup ,recovery, locking protocols, Security and Integrity.	
COURSE OUTCOMES:	
CO. No	**Course Outcome description**
MCA103.1	Understand and successfully apply logical database design principles, E-R diagrams.
MCA103.2	Have good understanding of the relational data model.
MCA103.3	Gain ability to write database queries using SQL.
MCA103.4	To gain ability in writing PL/SQL Code and process the data.
MCA103.5	Understand the concept of database transactions, concurrency control, backup, recovery, locking protocols, Security and Integrity.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA103.1		2	1											1	
MCA103.2		2	1											1	
MCA103.3		2	1											1	
MCA103.4		3			1									1	
MCA103.5		2	1											1	

MCA104 Data Communications and Computer Networks

Course Code	MCA104	**Course Title**	Data Communications and Computer Networks
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core
Syllabus			
I	Introduction: Data Communications, Computer Networks, Network Layering- OSI reference Model, TCP-IP Protocol Suite. Physical Layer:Data and Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data rate Limits. Digital-to-Digital Conversion, Analog-to-Digital Conversion, Digital-to-Analog Conversion, Analog-to-Digital Conversion		
II	Physical Layer: Transmission and Switching Transmission Modes, Transmission media- Guided, unguided media. Multiplexing, Switching-Circuit Switching, packet switching		
III	Data Link Layer: Nodes and Links, Link-Layer Addressing, error Detection and Correction- Block coding, Cyclic Codes, Checksum, Forward Error Correction, Simple, Stop-and-wait, Go-back-N, Selective Repeat Media Access Control: Random Access-ALOHA, CSMA, CSMA/CD, CSMA/CD, Controlled Access, Channelization-FDMA, TDMA, CDMA		
IV	Network Layer: Services, Routing Algorithms: Distance Vector, Link State, Path Vector, and Unicast Routing Algorithms.		
V	Multicasting Basics: Addresses, Delivery at Data Link Layer, Multicast Forwarding, Two Approaches to Multicasting. IP Addressing, Classes, Subnetting.		
REFERENCE BOOKS:			
Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013.			
Andrews. Tanenbaum, "Computer Networks" , 5th edition . Prentice-Hall.			
William Stallings, "Data and Computer Communication", 8th edition			
COURSE PRE-REQUISITES:			
Basic Knowledge in Computer Hardware and Networks			
COURSE OBJECTIVES:			
1. To give idea of basics of Data communication and Computer Networks. The first part of the course emphasis on fundamentals of Data and Signal and Encoding Standards and detail about the physical layer and transmission modes. 2. To give an overview of communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.			
COURSE OUTCOMES:			
CO. No	**Course Outcome description**		
MCA104.1	Build an understanding of the fundamental concepts and reference models of data communications and Computer Networks		

MCA104.2	Train the students in basics of Data communications and transmission media.
MCA104.3	Familiarize the student with the basic taxonomy and protocols used in the Data Link layer of OSI reference Model
MCA104.4	Introduce the student to advanced networking concepts like wired and wireless protocols, and routing algorithms
MCA104.5	Build an understanding of IP addressing and multicasting

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA104.1	3	1			3										1
MCA104.2	3	3			2										1
MCA104.3	3	3			2										1
MCA104.4	3	3			2										1
MCA104.5	3	2			2										1

MCA105 Operating Systems with Linux as Case study

Course Code	MCA105	**Course Title**	Operating Systems with Linux as Case study
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core

Syllabus

I	**File System concepts**, Access methods, Allocation methods, Directory systems, File protection. **Disk Management** - Disk scheduling, Disk management, Disk reliability. **Linux:**History of Linux: Linux Operating System Layers, The Linux Shell Process: (parent and child processes), Files and Directories (File Structure and directory structure), Linux Basic commands: pwd, cd, mkdir, rm, mv, touch,man,cp,locate, echo, cat, touch, ls, cut, paste and other basic shell management commands
II	**Memory Management** Memory Management, Memory partitioning, Swapping, Paging, Segmentation, Virtual memory, Demand paging, Page replacement algorithms, Allocation algorithms **Linux Commands:** df, du, tar,zip, uname, chmod, head, tail,sort, grep, sudo privileges, top, free, vmstat, and other memory related commands. Installation of Linux OS
III	**Process Management and Concurrency management** Process and Thread Management, Concept of process and threads, Process states, Process management, Context switching, Multithreading, Concurrency Control, Concurrency and Race Conditions

	Linux: process related commands: fork, exec, ps, kill,nice, foreground process, background process
IV	**Concurrency Management** Semaphores, Classical IPC problems and solutions. Deadlock, Characterization, Avoidance and Prevention, Detection, Recovery **Linux:** Shell variables, redirection, filters Shell Scripting,
V	**Protection and case STUDY: LINUX** Access matrix, Implementation of access matrix, Revocation of access rights. **Linux OS** – Administering Users and Groups: Administering User Accounts, Working with Group Accounts, Understanding the Root Account, installing packages

REFERENCE BOOKS:

Silberschatz, Galvin, and Gagne, "Operating System Concepts", Eighth Edition, Wiley Publication, 2011.

Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.

Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004

Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.

Milan Milenkovic, "Operating Systems: Concept and Design", 2nd Edition, 2001.

"Linux Command Line and Shell Scripting Bible (English) 2nd Edition", Wiley Publication.

Richard Petersen, "Linux: The Complete Reference", Sixth Edition, 2007

COURSE PRE-REQUISITES:

Basic Computer Knowledge

COURSE OBJECTIVES:

1. To provides a comprehensive introduction to understand the underlying principles, techniques and approaches used in operating systems.

2. To understand how OS, manage resources such as memory, peripherals, and schedule CPU time and learn how applications communicate with the user and the underlying hardware.

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA105.1	Elaborate the understanding of an operating system by giving emphasis on the file systems and Hard Disk Management.
MCA105.2	Comprehend the primary memory control and interaction of an operating system.
MCA105.3	Understand the concept of Process Management and Inter Process communication Component of an Operating System

MCA105.4	Realize the importance and the implementation of protection mechanism used by an operating system
MCA105.5	Learn the concepts of operating system through experimental practice using Linux operating system

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MCA105.1			3												
MCA105.2	1		3												
MCA105.3	2		3												
MCA105.4			3												
MCA105.5			1		2										

MCA106 Data Structures Lab

Course Code	MCA106	**Course Title**	Data Structures Lab
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	2	**Domain**	Computing

Syllabus

I

1. Program to represent Searching procedures (Linear search and Binary search)
2. Program to represent sorting procedures (Selection, Bubble , Insertion)
3. Polynomial addition using array
4. Polynomial multiplication using array
5. Program to represent sparse matrix manipulation using arrays.
6. Program to allocate two dimensional arrays dynamically.
7. Program to demonstrate the use of realloc().
8. Represent Graph using array
9. Stack using array
10. Reverse a string using stack
11. Implement Queue using array
12. Circular Queue using array
13. Double ended queue using array

II

1. Program to represent Singly Linked List.
2. Program to represent Doubly Linked List.
3. Program to represent Circular Linked List.
4. Polynomial addition using Linked List.
5. Polynomial multiplication using linked list.
6. Implement a linked stack
7. Program to represent Queue using linked list
8. Represent a graph using linked list.
9. Program for Conversion of infix to postfix.
10. Program for Evaluation of Expressions.
11. Program for binary search tree using recursion.

	12. Program to represent Binary search Tree Traversals without recursion

REFERENCE BOOKS:

Fundamentals of Data Structures in C by Horowitz, Sahni and Anderson-Freed.

Data Structures Through C in Depth by S.K Srivastava, Deepali Srivastava.

Data Structures Using C Aaron M. Tenenbaum

Data Structures Using C, Reema Thareja

COURSE PRE-REQUISITES:

MCA102

COURSE OBJECTIVES:

1. To develop programs to implement the concept of data structures
2. To implement the concepts of data structures using arrays and linked list
3. To implement the concepts of advanced data structures

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA106.1	To implement the linear data structures like arrays, linked list.
MCA106.2	To implement the various kinds of sorting and searching techniques.
MCA106.3	To implement the concept of stacks using arrays and linked list.
MCA106.4	To implement the concept of queues using arrays and linked list.
MCA106.5	To implement the concept of nonlinear data structures like graphs and trees.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA106.1	3		3				1				2	2		2	
MCA106.2	3		3				1				2	2		2	
MCA106.3	3		2				1				2	2		2	
MCA106.4	3		2				1				2	2		2	
MCA106.5			2				1				2	2		2	

MCA107 DBMS Lab

Course Code	MCA107	**Course Title**	DBMS Lab
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	2	**Domain**	Computing

Syllabus

I	INTRODUCTION TO SQL Data Definition, Constraints, and Schema Changes, Data Types Create Schema

	Create Table Drop Table Alter Table Drop a Column (An Attribute)
II	BASIC QUERIES IN SQL Aliases, * and Distinct, Empty Where-Clause Unspecified Where-Clause Use of Distinct Set Operations Nesting of Queries
III	THE EXISTS FUNCTION Explicit Sets Nulls in SQL Queries Aggregate Functions Grouping The Having-Clause Substring Comparison
IV	ARITHMETIC OPERATIONS Order by Specifying Updates in SQL– Insert, Delete, Update
V	SQL TRIGGERS Views in SQL Procedures, Functions, Cursors DB Connectivity to any Front End platform

REFERENCE BOOKS:

Database Management Systems – Raghu Ramakrishnan and Johannes Gehrke, Third Edition, McGraw Hill, 2003

Database Systems: Design , Implementation and Management, Peter Rob, Thomson Learning, 7Edn.

Concept of Database Management, Pratt, Thomson Learning, 5Edn.

Database System Concepts – Silberchatz, Korth and Sudarsan, Fifth Edition, McGraw Hill, 2006

The Complete Reference SQL – James R Groff and Paul N Weinberg

COURSE PRE-REQUISITES:

MCA 103

COURSE OBJECTIVES:

- To provide hands on exposure to creating databases
- To develop logic and basic programming skills using SQL language to join tables and provide the best possible results.

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA107.1	To design, create and alter relational tables and include integrity constraints
MCA107.2	To insert , delete and update records in a table
MCA107.3	Gain ability to write data retrieval queries, subqueries using SQL.
MCA107.4	To write queries for joining multiple tables.

MCA107.5	To implement the concept of triggers, procedures and functions using PL/SQL.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MCA107. 1		3	1		1									1	
MCA107. 2		3			1									1	
MCA107. 3		3	2		1									1	
MCA107. 4		3	2		1									1	
MCA107. 5		3	2											1	

SEMESTER II

MCA201 Operations Research

Course Code	MCA201	**Course Title**	Operations Research
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Mathematics
Syllabus			
I	Linear programming problems - Mathematical formulation, graphical method of solution, simplex method		
II	Duality in linear programming problems, dual simplex method, sensitivity analysis, transportation and assignment problems, Traveling salesman Problem.		
III	Game theory Introduction, two-person zero-sum games, some basic terms, the maxmini-minimax principle, games without saddle points-Mixed Strategies, graphic solution of 2 * n and m*2 games, dominance property. CPM & PERT- project scheduling, critical path calculations, Crashing.		
IV	Queueing theory -basic structure of queuing systems, roles of the Poisson and exponential distributions, classification of queues basic results of M/M/1: FIFO systems, extension to multi-server queues.		
V	Simulation: simulation concepts, simulation of a queuing system using event list,pseudo random numbers, multiplication congruential algorithm, inverse transformation method, basic ideas of Monte-Carlo simulation.		
REFERENCE BOOKS:			
Taha.H.A ,operation Research : An Introduction, McMilan publishing Co., 1982. 7th ed.			
Ravindran A, Philips D.T &Solbery.J.J, Operations Research: Principles and practice, John Wiley & Sons, New York, 1987.			
Frank S. Budnick, Dennis Mcleavey and Richard Mojena, Principles of Operations Research for Management. All India Traveler Book seller, Delhi.			
Gillet.B.E., Introduction to Operations Research - A Computer oriented algorithmic approach, McGraw Hill, 1987.			

Hillier.F.S&Liberman.G.J, operation Research, Second Edition, Holden Day Inc, 1974.

COURSE PRE-REQUISITES:

Familiarity with Linear Algebra , MCA 101

COURSE OBJECTIVES:

To introduce the students how to use variables for formulating complex mathematical models in management science, linear programming, game theory, queuing theory and simulation.

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA201.1	Formulate a real-world problem as a mathematical programming model.
MCA201.2	Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand.
MCA201.3	Solve specialized linear programming problems like the transportation and assignment problems
MCA201.4	Understand the basic concept of game theory and queuing theory.
MCA201.5	Understand the network analysis techniques and Simulation.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MCA201.1	2	1													
MCA201.2			2												
MCA201.3	2		1												
MCA201.4		2	1												
MCA201.5		2		2											

MCA202 Java Programming

Course Code	MCA 202	**Course Title**	Java Programming
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Computing
Syllabus			
I	Basics of Java: Java - What, Where and Why?, History and Features of Java, Internals of Java Program, Difference between JDK,JRE and JVM, Internal Details of JVM, Variable and Data Type, Unicode System, Naming Convention. OOPS Concepts: Advantage of OOPs, Object and Class, Method Overloading, Constructor, static variable, method and block, this keyword, Inheritance (IS-A), Aggregation and Composition(HAS-A), Method Overriding, Covariant Return Type, super keyword, Instance Initializer block, final keyword, Runtime Polymorphism, static and Dynamic binding, Abstract class and Interface, Downcasting with instanceof operator ,Package and Access Modifiers, Encapsulation, Object class, Object Cloning, Java Array, Call By Value and Call By Reference		
II	Core java Features: String Handling, Exception Handling, Nested classes, Packages and Interfaces. Multithreaded Programming – synchronization, Input/Output – Files – Directory ,Utility Classes, Generics, Generic Class, Generic methods.		
III	Serialization: Serialization & Deserialization, Serialization with IS-A and Has-A, Transient keyword. Networking: Socket Programming, URL class, Displaying data of a web page, InetAddress class, DatagramSocket and DatagramPacket, Two way communication		
IV	JDBC: - Overview, JDBC implementation, Connection class, Statements, Catching Database Results, handling database Queries. Error Checking and the SQLExceptionClass , The SQLWarning Class, JDBC Driver Types, ResultSetMetaData, Using a Prepared Statement, Parameterized Statements, Stored Procedures, Transaction Management. Collection: Collection Framework, ArrayList class, LinkedList class, ListIterator interface, HashSet class		
V	Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers, adapter classes and Menus. Swing: Basics of Swing, JButton class, JRadioButton class, JTextArea class, JComboBox class, JTable class, JColorChooser class, JProgressBar class, JSlider class, Displaying Image, JMenu for Notepad, Open Dialog Box		

	Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling.

REFERENCE BOOKS:

JAVA The Complete Reference- Patrick Naughton and Herbert Schidt.- fifth Edition Tata McGraw Hill.

The Complete reference J2SE - Jim Keogh – Tata McGraw Hills

Programming and Problem Solving With Java, Slack, Thomson Learning, 1Edn.

Java Programming Advanced Topics, Wigglesworth, Thomson Learning, 3Edn.

Java Programming, John P. Flynt , Thomson Learning, 2Edn.

Ken Arnold and James Gosling, The Java Programming language, Addison Wesley, 2nd Edition, 1998

Patrick Naughton and Herbert Schidt. The Complete Reference, JAVA fifth Edition Tata McGraw Hill.

Maydene Fisher, Jon Ellis, Jonathan Bruce; JDBC API Tutorial and Reference, Third Edition, Publisher: Addison-Wesley

Thinking java – Bruce Eckel – Pearson Education Association

COURSE PRE-REQUISITES:

MCA102, MCA 106

COURSE OBJECTIVES:

1. To understand and comprehend object-oriented programming concepts using Java
2. To provide a comprehensive coverage of Internet programming using java.
3. To achieve the designing of platform independent applications

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA202.1	Ability to solve problems using only pure object-oriented concepts
MCA202.2	Make decision to solve a problem using package, library and threads Handling Errors and Exceptions
MCA202.3	Able to develop networking applications
MCA202.4	Ability to design and develop database applications
MCA202.5	Design and develop software solutions

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA202.1	2	2	1								2			2	
MCA202.2	2	2	1		2						2			2	
MCA202.3	2	2	2								2			1	
MCA202.4	2	2	2		2						2				

MCA202.5	2	2	2		2			1			2			3	

MCA203 Advanced Software Engineering

Course Code	MCA203	**Course Title**	Advanced Software Engineering
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core
Syllabus			
I	**Introduction to Software Engineering**, Process Models, Understanding Requirements **Agile methodology**- Agile – Primer, Manifesto, Characteristics, Daily Stand-up, Definition of Done, Release Planning, Iteration Planning, Product Backlog		
II	**Requirements Modelling**- Analysis, UML Models, Data Modelling, Class-Based Modelling, Webapps **Design Concepts**- Design Model, Software Architecture- Styles- Design, Component Level Design- Class based Components, User-Interface Design- Interface Analysis, Interface design, WebApp Design		
III	**Software Quality Assurance**, Software Testing Strategies, Testing Applications- Conventional-Object-oriented- Web,		
IV	**Project Management Concepts**- Process Metrics, Estimation, Scheduling, Risk Management, Maintenance and re-engineering		
V	DevOps - JUnit - git - github - Docker - Containers - Continuous Integration - Selenium - HTTP loadtestingtool-Designpatterns.		
REFERENCE BOOKS:			
Software Engineering, a Practitioner's Approach- Roger S Pressman 7th Edition, Tata Mc-Graw Hill Publishing Co. Ltd.			
Software Engineering – Ian Somerville 9th Edition, Pearson Education			
An Integrated Approach to Software Engineering- Pankaj Jalote 3rd edition, Narosa Publishing House			
Fundamentals of Software Engineering- Ghezzi, Jazayer's and Mandriolli 2nd Edition, PHI			
Software Engineering principles & Practice- Waman S Jawadekar 2nd Edition, Tata Mc-Graw Hill Publishing Co. Ltd.			
Software Project Management: Pankaj Jalote, Pearson Education			

Software Project Management –A Unified Framework: Walker Royce, Pearson Education.

Software Project Management –S A Kelkar .Prentice Hall India

SeleniumSimplified, secondedition.

COURSE PRE-REQUISITES:

Basic Knowledge in Computer Science Programming

COURSE OBJECTIVES:

1. Knowledge of basic Software Engineering methods and practices, and their appropriate application
2. A general understanding of software process models.
3. An understanding of software requirements and the SRS document.
4. An understanding of design concepts and different software architectural styles.
5. An understanding of implementation issues such as modularity and coding standards.
6. An understanding of approaches to verification and validation including static analysis, and reviews. and software testing approaches
7. An understanding of software evolution and related issues such as version management.
8. An understanding on quality control and how to ensure good quality software.
9. An understanding on quality control and how to ensure good quality software.
10. An understanding of the role of project management including planning, scheduling, risk management, etc.
11. Understanding the latest tools in Software engineering

COURSE OUTCOMES:

CO. No	**Course Outcome description**
MCA203.1	To analyse, design and manage the development of a computing-based system, using different process models
MCA203.2	To understand the design methodology available for software engineering practice
MCA203.3	To understand software testing and quality assurance techniques at the module level, and understand these techniques at the system level

MCA203.4	To understand the project management concepts
MCA203.5	To use various Developmental platforms , testing tools etc used in SE

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCA203.1	2	3	2					2	3					1	
MCA203.2	2	2			2			2						1	
MCA203.3		2			2			2						1	
MCA203.4						1			2		3			1	
MCA203.5						1			3		2			1	

MCA204 Design and Analysis of Algorithms

Course Code	MCA204	**Course Title**	Design and Analysis of Algorithms
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Computing
Syllabus			
I	**Introduction**: Algorithm, Concepts in performance analysis – space complexity and time complexity, Asymptotic Notations **Sorting**: Analysis of - Bubble sort, Selection sort and Insertion sort **Searching**: Analysis of - Linear Search, Binary Search and Interpolation Search. **Hashing Techniques**: Different hashing functions, methods for collision handling.		
II	**Divide and Conquer Strategy:** General method, Finding the maximum and minimum, Analysis of Binary search, Quick sort and Merge sort **Branch and Bound**: Travelling Sales Man Problem **Backtracking**: The 8 queen's problem, sum of subsets.		
III	**Dynamic Programming**: Introduction, Drawback of Recursion, Elements of Dynamic Programming, Matrix Chain Multiplication and Longest Common subsequence **Greedy Algorithms**: Huffman Codes, Activity Selection Problem, Elements of Greedy Strategy, 0-1 knapsack problem, fractional knapsack problem		
IV	**Graph Algorithms**: Breadth First Search, Depth First Search. DFS: Strongly Connected Components and Topological Sort Minimum Spanning tree: Kruskal and Prims algorithms, Shortest path: Single Source Shortest path (Dijkstra's Algorithm) and all pair shortest path		
V	**Number Theoretic Algorithms**: Strassen's matrix multiplication.		

	NP Hard and NP Complete Problems: Basic concepts, non-deterministic algorithm, class of NP- hard and NP- complete **Approximation Problems**: Basic terminology, vertex coloring problem – different approximation algorithms, travelling sales man problem.

REFERENCE BOOKS:

Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest

Fundamentals of algorithms – Gilles Brassard, Paul Bratley (PHI),C1996

Introduction to the design and analysis of algorithms – AnanyLevitin (Pearson),2011

Design & Analysis of Algorithms-A A Puntambekar

COURSE PRE-REQUISITES:

MCA205

COURSE OBJECTIVES:

1. Learn and understand the fundamental algorithms and analyse the performance.
2. Understand the fundamental algorithmic design strategies.
3. Learn how to develop efficient algorithms for simple computational tasks and reasoning about the performance and correctness of them.

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA204.1	Understand and use asymptotic notations to analyse the performance of basic algorithms
MCA204.2	Identify, analyse and evaluate various Algorithm Design Strategies and solve Problems: Divide and Conquer, Branch and Bound, Backtracking strategies
MCA204.3	Identify, analyse and evaluate various Algorithm Design Strategies and solve Problems: Dynamic programming, Greedy Strategy
MCA204.4	Identify, analyse and evaluate various Graph Algorithm s and Solve Problems
MCA204.5	Understand the basic concept of Number Theory and related Algorithms, NP Hard and NP Complete Problems and Approximation Problems

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MCA204. 1		3		2										1	
MCA204. 2		3	3	2										1	
MCA204. 3		3	3	2										1	
MCA204. 4		3	1	2										1	
MCA204. 5		1		2										1	

MCA205 Artificial Intelligence

Course Code	MCA205	**Course Title**	Artificial Intelligence
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core
Syllabus			
I	**Module 1:** Introduction - Overview of AI applications. Introduction to representation and search. The Propositional calculus, Predicate Calculus, Using Inference Rules to produce Predicate Calculus expressions, Application – A Logic based financial advisor.		
II	**Module 2:** Introduction to structure and Strategies for State Space search, Graph theory, Strategies for state space search, Using the State Space to Represent Reasoning with the Predicate calculus (Sate space description of a logical system, AND/OR Graph). Heuristic Search : introduction, Hill-Climbing and Dynamic Programming, The Best-first Search Algorithm, Admissibility, Monotonicity and informedness, Using Heuristics in Games.		
III	**Module 3:** Building Control Algorithm for Statespace search – Introduction, Production Systems, The blackboard architecture for Problem solving. Knowledge Representation – Issues, History of AI representational schemes, Conceptual Graphs, Alternatives to explicit Representation, Agent based and distributed problem solving.		
IV	**Module 4:** Strong Method Problem Solving – Introduction, Overview of Expert System Technology, Rule Based Expert system, Model -Based, Case-Based and Hybrid Systems (Introduction to Model based reasoning, Introduction to Case Based Reasoning, Hybrid design), Introduction to Planning. Reasoning in Uncertain Situation – introduction, logic based Adductive Inference. Introduction to PROLOG , Syntax for predicate Calculus programming, ADTs, A production system example.		
V	**Module 5:** Machine Learning: Symbol Based – Introduction, Frame – work. The ID3 Decision tree Induction algorithm. Inductive bias and Learnability, Knowledge and Learning,		

	Unsupervised learning, Reinforcement Learning, Machine Learning : Connectionist – Introduction, foundations, Perceptron learning. Machine learning: Social and emergent: Models, The Genetic Algorithm, Artificial Life and Social based Learning.

TEXT/REFERENCE BOOKS:

George F Luger, Artificial Intelligence – Structures and Strategies for Complex problem solving, 5thEdn, pearson.

E. Rich, K. Knight, S B Nair, Artificial intelligence, 3rdEdn, McGraw Hill.

S. Russel and p. Norvig, Artificial intelligence – A Modern Approach, 3rdEdn, Pearson

D W Patterson, introduction to Artificial Intelligence and Expert Systems, PHI, 1990

Nilsson N.J., Artificial Intelligence - A New Synthesis, Harcourt Asia Pvt. Ltd.

COURSE PRE-REQUISITES:

MCA 101

COURSE OBJECTIVES:

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA205.1	Understand the various underlying concepts in Artificial Intelligence
MCA205.2	Acquire the knowledge of search techniques used in Artificial Intelligence
MCA205.3	Acquire the concepts of knowledge representation
MCA205.4	Analyse and design a real-world problem for implementation and understand the dynamic behaviour of a system.
MCA205.5	Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MCA205.1	3	2													
MCA205.2	3	2													
MCA205.3	3	2													
MCA205.4	3	2	2	2											
MCA205.5	3	2	2	2											

MCA206 Web Technology Lab

Course Code	MCA206	**Course Title**	Web Technology Lab
Course Type	Core	**Contact Hours**	6 Hours per Week
Credit	3	**Domain**	Computing
Syllabus			
I	HTML Basics, CSS, Javascript, Ajax, Json, XML, PhP Basics		
II	Laravel- Installation Application Structure Configuration Routing Middleware Namespaces Controllers		
III	Request Cookie Response Views Blade Templates Redirections Working with Database Errors & Logging Forms Localization Session Validation File Uploading Sending Email Ajax Error Handling Event Handling		
IV	Facades Contracts CSRF Protection Authentication Authorization Artisan Console Encryption Hashing Artisan Commands		
V	Development of web-based application with Database connectivity		
COURSE OUTCOMES:			
CO. No	**Course Outcome description**		
MCA206.1	To become familiar with client server architecture and able to develop a web application using various technologies.		

MCA206.2	To understand and develop a web-based application using a framework concept
MCA206.3	To gain the skills and project-based experience needed for entry into web application and development careers.

CO-PO AND CO-PSO MAPPING

	PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	P010	PO1 1	PO12	PSO 1	PSO2	PSO3
MCA206.1	1	2	3				2					2		1	
MCA206.2	2	2	3				2					3		1	
MCA206.3	2	2	3				3					3		1	

MCA207 Java Programming Lab

Course Code	MCA207	**Course Title**	Java Programming Lab
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	2	**Domain**	Computing

Syllabus

I	• Program to illustrate class, objects and constructors • Program to implement overloading, overriding, polymorphism etc.
II	• Program to implement the usage of packages • Program to create user defined and predefined exception • Program for handling file operation • Directory manipulation in java
III	• Implement the concept of multithreading and synchronization • Program to implement Generic class and generic methods • Socket programming to implement communications • Broadcasting program using UDP protocol • Program for downloading web pages from the internet using URL.
IV	• Program to implement JDBC in GUI and Console Application
V	• Applet program for passing parameters • Applet program for loading an image and running an audio file • Program for event-driven paradigm in Java • Event driven program for Graphical Drawing Application • Program that uses Menu driven Application

TEXT/REFERENCE BOOKS:

JAVA The Complete Reference- Patrick Naughton and Herbert Schidt.- fifth Edition Tata McGraw Hill.

The Complete reference J2SE - Jim Keogh – Tata McGraw Hills
Programming and Problem Solving With Java, Slack, Thomson Learning, 1Edn.
Java Programming Advanced Topics, Wigglesworth, Thomson Learning, 3Edn.
Java Programming, John P. Flynt , Thomson Learning, 2Edn.
Ken Arnold and James Gosling, The Java Programming language, Addison Wesley, 2nd Edition, 1998
Patrick Naughton and Herbert Schidt. The Complete Reference, JAVA fifth Edition Tata McGraw Hill.
Maydene Fisher, Jon Ellis, Jonathan Bruce; JDBC API Tutorial and Reference, Third Edition, Publisher: Addison-Wesley
Thinking java – Bruce Eckel – Pearson Education Association

COURSE PRE-REQUISITES:

MCA206

COURSE OBJECTIVES:

1. To Achieve an understanding of object-oriented programming concepts using Java
2. To provide a comprehensive coverage of Internet programming using java.
3. To achieve the designing of platform independent applications

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA207.1	Ability to solve problems using only pure object-oriented concepts
MCA207.2	Make decision to solve a problem using package, library and threads Handling Errors and Exceptions
MCA207.3	Able to develop networking applications
MCA207.4	Ability to design and develop database applications
MCA207.5	Design and develop software solutions

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MCA207.1	2	2	1											2	
MCA207.2	2	2	1		2									2	
MCA207.3	2	2	2											1	
MCA207.4	2	2	2		2										
MCA207.5	2	2	2		2			1						3	

SEMESTER III

MCA301 Business Management and Financial Accounting

Course Code	MCA301	**Course Title**	Business Management and Financial Accounting
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core
Syllabus			
I	Module 1: **Introduction to management Principles** Definition - Management - Role of managers - Organization and the environmental factors – Trends and Challenges of Management in Global Scenario. PLANNING Nature and purpose of planning - Planning process - Types of plans – Objectives - - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making		
II	Module 2: **Organizing, Directing and Controlling Business** Nature and purpose of organizing - Organization structure - Formal and informal groups organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - - Performance Appraisal. Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity. Process of controlling - Types of control - Budgetary and non-budgetary control.		
III	Module 3: **Introduction to Accounting** Meaning and definition of Accounting, Systems of book-keeping, Objectives of accounting, Users of accounting information, Basic terminologies. Accounting Principles- Accounting Concepts and Conventions, Accounting Standards, Accounting process-Double Entry System-Journal, Ledger, Trial balance.		
IV	Module 4: **Sub division of Journal**- Cash Book, Purchase Book, Sales Book, Purchase Returns Book, Sales Returns Book, Journal Proper-Bank Reconciliation Statement		

V	Module 5: Final Accounts of Sole Proprietorship Concerns- Trading Account, Profit and Loss and Balance Sheet (with adjustments)

REFERENCE BOOKS:

MANAGEMENT: TASKS, RESPONSIBILITIES, PRACTICES By Peter Drucker
Principles Of Business Management, Arun Kumar, Rachana Sharma
Principles of management: process and behavior, Daniel A. Wren, Dan Voich
Accounting Basics: Complete Guide, Michael Celender
Basic Accounting By Rajni Sofat
Accounting Basics: The Simple Guide for Beginners, Andrew P.C.
Principles & Practice of Management –T.N.Chabra
Principles of Management, R N Gupta, S.Chand& Company Ltd.
Organizational Behavior, S.S Khanka, S.Chand& Company Ltd
Principles of Management, L M Prasad, Sultan Chand Publications

COURSE PRE-REQUISITES:

Basic Knowledge of a Business System

COURSE OBJECTIVES:

- To understand the role of a manager and the operations involved in a Business environment.
- To help the students to develop cognizance of the importance of accounting in
- organization financial statements
- To enable students to synthesize accounts related information and evaluate options for most logical and optimal solutions

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA301.1	To understand the basic principle of Management
MCA301.2	To comprehend how to organize, direct and control the various aspects of Business
MCA301.3	To understand the underlying terminologies in Accounting
MCA301.4	To know and process the trial Balance in accounting
MCA301.5	To understand the how to process the final accounts and report

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA301.1						3	3	3	3		3				
MCA301.2						3	3	3	3		3				
MCA301.3								3				2			
MCA301.4								3				2			
MCA301.5								3				2			

MCA302 Theory of Computation and Compilers

Course Code	MCA 302	**Course Title**	Theory of Computation and Compilers
Course Type	Core	**Contact Hours**	4 Hours per Week

Credit	3	**Domain**	Professional Core
Syllabus			
I	Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox, Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non Regular Languages.		
II	Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Context Free Grammars; Properties of Context Free Language.		
III	Introduction to compiling:- Compilers, Analysis of a source program, the phases of a compiler, Lexical analysis:-The role of the lexical analyser, Input buffering, specification of tokens, Recognition of tokens.		
IV	Syntax analysis: - the role of the parser, Top down parsing, Bottom up parsing, syntax directed translation, syntax directed definition, Construction of Syntax Tree, LL parsers, Operator precedence grammar, LR(0) , SLR parser, LALR(1) parser.		
V	Intermediate code generation-postfix notation, syntax tree, three-address code, basic blocks and flow graph, Back patching, Code optimization: - The principal sources of optimization, optimization of basic blocks, loops in flow graphs, Peephole optimization Code Generations: - Issues in the design of a code generator		
REFERENCE BOOKS:			
Peter Linz, An Introduction to Formal Languages and Automata, Third Edition, Jones and Bartlett, 2001.			
Introduction to Automata Theory, Languages, and Computation By John E. Hopcroft,Rajeev Motwaniand Jeffrry D Ullman.			
Compilers Pinciples, Techniques and Tools- Alfred VAho, Ravi Sethi, Jeffrry D Ullman			
Steven S Muchnik, "Advanced Compiler Design and Implementation", Morgan Kaufmann			
COURSE PRE-REQUISITES:			
Knowledge in Programming languages.			
COURSE OBJECTIVES:			
To understand the basic mathematical model of computation and the working of a compiler.			
COURSE OUTCOMES:			
CO. No	**Course Outcome description**		
MCA302.1	Demonstrate knowledge of basic mathematical models of computation and describe how they relate to formal languages.		
MCA302.2	Understanding the concept of pushdown automata and context free grammar.		
MCA302.3	Understand the phases of a compiler.		
MCA302.4	Understand various parsing techniques.		

MCA302.5	To apply the design and implementation of parsers.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
MCA302.1	3						1				2	2		2		
MCA302.2			3				1				2	2		2		
MCA302.3	3		2				1				2	2		2		
MCA302.4			3				1				2	2		2		
MCA302.5			2				1				2	2		2		

MCA303 Data Mining

Course Code	MCC303	**Course Title**	Data Mining
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core

Syllabus

I	**Introduction** Data Warehousing, Multidimensional Data Model, OLAP Operations, Introduction to KDD process, Data mining, Data mining -On What kinds of Data, Data mining Functionalities, Classification of Data Mining Systems. **Data Preprocessing** Data Cleaning, Data Integration and Transformation, Data Reduction, Data discretization and concept hierarchy generation
II	**Exploring Data and Visualization Techniques** General Concepts, Techniques, Visualizing Higher Dimensional Data, Tools **Association Analysis** Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods:Apriori Algorithm, generating association Rules from Frequent Item sets, Improving the Efficiency of Apriori. Mining Frequent item-sets without Candidate Generation, Evaluation of Association Patterns, Visualization. A Case Study on Association using Orange Tool
III	**Classification** Introduction to Classification and Prediction, Classification by Decision Tree Induction: Decision Tree induction, Attribute Selection Measures, Tree Pruning, Bayesian Classification: Bayes' theorem, Naïve Bayesian Classification, Rule Based Algorithms: Using If - Then rules of Classification, Rule Extraction from a Decision Tree, Rule Induction Using a Sequential Covering algorithm, K- Nearest Neighbour Classifiers, Support Vector Machine. Evaluating the performance of a Classifier, Methods for comparing classifiers, Visualization. A Case Study on Classification using Orange Tool
IV	**Prediction**

	Linear Regression, Nonlinear Regression, Other Regression-Based Methods **Cluster Analysis I**: Basic Concepts and Algorithms Cluster Analysis, Requirements of Cluster Analysis' Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods: k-Means and k- Medoids, From K-Medoids to CLARANS A Case Study on Clustering using Orange Tool.
V	**Cluster Analysis II:** Hierarchical Method: Agglomerative and Divisive Hierarchical Clustering. Comparison of data mining methods. Applicability of data mining methods for different scenarios. Considerations for mining unstructured data.
TEXT/REFERENCE BOOKS:	
R	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, 'Introduction to Data Mining'
R	Data Mining Concepts and Techniques – Jiawei Han and MichelineKamber, Second Edition, Elsevier, 2006
R	G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
R	Making sense of Data: A practical guide to exploratory Data Analysis and Data Mining-Glenn J Myatt
COURSE PRE-REQUISITES:	
MCA101, MCA 104	
COURSE OBJECTIVES:	
1. Acquire knowledge in Data mining and warehousing 2. Learn the different techniques for discovery of patterns hidden in large data sets and their Visualizations 3. Learn data mining tasks such as classification, estimation, prediction, affinity grouping and clustering.	
COURSE OUTCOMES:	
CO. No	**Course Outcome description**
MCA303.1	To introduce the students, the basic concepts and techniques of Data mining and Warehousing and data pre-processing.
MCA303.2	Understand association mining algorithms for discovery of frequent item patterns in large data sets and their Visualizations
MCA303.3	Understand classification analysis algorithms for discovery and generation of rules in large data sets and their Visualizations
MCA303.4	Understand basic and advanced clustering analysis algorithms and Visualizations in Data Mining.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P010	PO11	PO12	PSO 1	PSO 2	PSO 3
MCA303.1	3	2		1									2		
MCA303.2	1	1		1									1		
MCA303.3	1	1		1									1		

MCA303.4	1	1		1									1		

MCA304 Information Security

Course Code	MCA304	**Course Title**	Information Security
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core
Syllabus			
I	Mathematical Foundations of Information Security - Abstract Algebra Fundamentals of Abstract Algebra : Groups, Rings, Fields, Modular Arithmetic, Euclidean Algorithm, Finite Fields of the form GF(p),Polynomial Arithmetic, Finite Fields of the form GF(2n)		
II	Mathematical Foundations of Information Security - Number Theory Introduction to Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms		
III	Private Crypto – Systems. Introduction to Cryptography, Classical Encryption techniques, Block Ciphers and Data Encryption Standard. Advanced Encryption Standard, Multiple Encryption and Triple DES, Block Cipher Modes of operation, Stream Ciphers and RC4, Confidentiality using Symmetric Encryption,		
IV	Public Cryptosystems Public-Key Cryptography and RSA Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography		
V	Authentication and hash functions Authentication requirements - Authentication functions - Message Authentication Codes - Hash Functions, Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm - Authentication Protocols - Digital Signature Standard		
TEXT/REFERENCE BOOKS:			
K.H. Rosen," Elementary Number Theory", Addison-Wesley, ISBN 0-441-57889-1			
Elementary Number Theory William Stein October 2005			
Introduction to Modern Cryptography Mihir Bellare1 Phillip ogaway May 11, 2005			
Handbook of applied cryptography, by A. Menezes, P. Van Oorschot, and S. Vanstone, CRC Press, 1996.			
Stallings, W., Cryptography and Network Security. Principles and Practice, 4th edition, Prentice Hall.			
COURSE PRE-REQUISITES:			
MCA101, MCA104			
COURSE OBJECTIVES:			
1. To understand the fundamentals of Cryptography 2. To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.			

3. To understand the various key distribution and management schemes.	
COURSE OUTCOMES:	
CO. No	**Course Outcome description**
MCA304.1	Understand the basics of abstract algebra and modular arithmetic.
MCA304.2	Understand the applications of number theory in security.
MCA304.3	Encrypt and decrypt messages using block ciphers.
MCA304.4	Understand the working of RSA algorithm and Diffie-Hellman key exchange.
MCA304.5	To be familiar with authentication and hash functions.

CO-PO AND CO-PSO MAPPING

	PO 1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	P010	PO1 1	PO12	PSO 1	PSO2	PSO3
MCA304.1	3							2				1			2
MCA304.2	1							3				2			2
MCA304.3								3				2			2
MCA304.4	2											3			2
MCA304.5								3				3			2

MCA306 Data Analytics using Python

Course Code	MCA 306	**Course Title**	Data Analytics using Python
Course Type	Core	**Contact Hours**	6 Hours per Week
Credit	3	**Domain**	Computing
Syllabus			
I	**Data Types and Data Structures** Introduction to Python: - using the Python interpreter, Overview of programming in Python, Expressions and Variables-String Operations. Python Data Structures: lists & Tuple –Sets - Dictionaries. Programming Fundamentals: Conditions and Branching- Loops-Functions: formal arguments, variable-length arguments.		
II	**Classes, files and modules** Introduction to Classes and Objects: -classes, class attributes, instances, instance attributes, binding and method invocation, inheritance, polymorphism, Built-in functions for classes and instances. Files and input/output, reading and writing files, methods of file objects, using standard library functions, dates and times Exceptions, detecting and handling exceptions.		
III	**Database and web programming** Python database application programmer's interface (DB- API), connection and cursor objects, Type objects and constructors, python database adapters.		

	Creating simple web clients, introduction to CGI, CGI module, building CGI applications.
IV	**Introduction to Data Science using Python** Python libraries: Numpy- Scikit- Pandas-Matplotlib. - Data Visualization. Importing Datasets: Importing and Exporting Data in Python- Basic Insights from Datasets. Data cleansing and pre-processing: Identify and Handle Missing Values. Summarizing the Data Frame: Descriptive Statistics- Basic of Grouping- ANOVA- Correlation
V	**Model Development and Evaluation** Regression Models: Linear Regression (SLR & MLR) - Logistic Regression-Decision Tree- Random Forest. Clustering Techniques: K means clustering – Apriori algorithm. Model Evaluation: Over-fitting, Under-fitting.

REFERENCE BOOKS:

Core Python Programming by Wesley J. Chun, 2nd Edition , Pearson Education

An Introduction to Python by Guido Van Russom, Fred L.Drake, Network Theory Limited.

Beginning Python: From Novice To Professional By Magnus Lie Hetland, Second Edition Apress

Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython ,2nd edition, Wes McKinney, O'Reilly Media (2017)

Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems ,Aurélien Géron, O'Reilly Media (2017)

Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly Media (2015)

COURSE PRE-REQUISITES:

Basic Knowledge in Python Programming and data science, MCA101, MCA102

COURSE OBJECTIVES:

1. To provide an understanding of programming concepts using Python
2. To learn the underlying concepts of Data science and implement using python

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA306.1	Understand the data types and structures in python
MCA306.2	Ability to understand object oriented programing concepts and write programs in python. Handling Errors and Exceptions
MCA306.3	Ability to design and develop database applications
MCA306.4	Ability to solve data analysis problems using python

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCA306.1	3													1	
MCA306.2			2		3									1	

MCA306.3			2									2		
MCA306.4		2	2		3							2		

MCA307 Android

Course Code	MCA 307	**Course Title**	Android
Course Type	Core	**Contact Hours**	6 Hours per Week
Credit	3	**Domain**	Computing
Syllabus			
I	Mobile Computing & Development Introduction: Mobile system architecture and development challenges The Android Platform: Android SDK Features, Introduction to the development Framework, Android Development Tools, Android Application Life Cycle, Activity, Service, Intent, MVC and User Interfaces Application Structure: AndroidManifest.xml, uses-permission & uses-sdk, Resources & R.java, Assets, Layouts &Drawable Resources, Activities and Activity lifecycle		
II	Android Graphical User Interface: Linear Layout, Relative Layout, Table Layout, Grid View, Tab Layout, List View, Custom List View Element, Fragments, Time and Date, Images and media, Composite, AlertDialogs , Toast, Popup Menus:- Option menu , Context menu, Sub menu, menu from xml, menu via code, Application Menu, ActionBar, ActionBar& Tabs, View Pager, Action Bar & View Pager		
III	Intents – Explicit Intents, Implicit intents, intents and broadcast receivers, intent filters, Adapters and Widgtes:- ArrayAdapters, BaseAdapters, ListView and ListActivity, Custom listview, GridView using adapters, Gallery using adapters Notifications: Broadcast Receivers, Services and notifications, AlarmsThreads:- Threads running on UI thread (runOnUiThread), Worker thread, Handlers & Runnable, AsynTask (in detail)		
IV	Databases and Content Providers:- SQLite Databases: Basics of SQLite DB, Various Data Types, SQLite Queries, Adding / Updating / Deleting Contents of SQLite Content Providers:- SQLite Programming, SQLiteOpenHelper, SQLiteDatabse, Cursor, Content providers ,Defining and using content providers, Example- Sharing database among two different applications using content providers Reading and updating Contents, Reading bookmarks		
V	Advanced Features:Live Folders, Using sdcards, XML Parsing, JSON Parsing, Maps, GPS, Location based Services, Accessing Phone services (Call, SMS, MMS), Network connectivity services		

	Hardware Sensors:- Sensors and Sensor Managers, Monitoring device movement and orientation, Environmental sensors

REFERENCE BOOKS:

Professional Android 4 application development – Reto Meier

Android Wireless Application Development By Lauren Darcey and Shane Conder, Pearson Education, 2nd ed.

Beginning Android Application Development By Wei-Meng Lee, Wrox Publication

Unlocking Android Developer's Guide By Frank Ableson and Charlie Collins and Robi Sen, Manning Publication Co.

COURSE PRE-REQUISITES:

MCA104, MCA304

COURSE OBJECTIVES:

1. To create apps based on android platforms
2. To create apps based on multimedia and internet application
3. To achieve the designing of platform independent applications
4. To access and work with databases under the Android operating system

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA307.1	Able to develop simple apps
MCA307.2	Able to develop apps based on different types of menus
MCA307.3	Make decision to solve a problem using package, library and threads Handling Errors and Exceptions
MCA307.4	Ability to design and develop database applications
MCA307.5	Able to design and develop mobile applications works with internet applications

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCA307.1			1		3						2			2	
MCA307.2			1		3						2			2	
MCA307.3			2								2			1	
MCA307.4			2		3						2			3	
MCA307.5			2		3						2			3	

SEMESTER IV

MCA401 Parallel Programming using OpenMP

Course Code	MCA401	**Course Title**	Parallel Programming using OpenMP
Course Type	Core	**Contact Hours**	4 Hours per Week
Credit	3	**Domain**	Professional Core
Syllabus			
I	Parallel Architectures Interconnection Networks- 2D Mesh-Binary Tree-Hyper Tree-Butterfly Network-Hyper Cube Network-Shuffle-Exchange Network, Multicomputers- Asymmetrical-Symmetrical, Flynn's Taxonomy- SISD, SIMD, MISD, MIMD. Pipelining, Multi Core Architectures.		
II	Parallel Algorithm Design Task/Channel Model, Foster's Design Methodology, Boundary Value Problem, Finding the maximum, n-body problem, Parallelism- Data Level, Instruction level, Thread Level, Cache Coherence-Directory based Protocol.		
III	Shared Memory Model in parallel Programming, Fork-Join Concept, OpenMP- Pragma- Parallel for-private-firstprivate-lastprivate-critical-reduction-inverting loop-conditionally executing loop-scheduling loop- single-nowait-section, omp_get_thread_num, omp_get_num_threads Sieve of Eratosthenes, Matrix vector multiplication		
IV	Message passing Model, MPI, MPI_Init, MPI_Finalize, MPI_comm_rank, MPI_comm_Size, MPI_reduce, MPI_Wtime, MPI_Circuit satisfiability. Performance Analysis- Speedup and efficiency, Amdahl's Law, Gustafson-Barsis's Law, Karp-Flat Metric, Isoefficiency Metric		
V	Basics of CUDA- introduction to GPU, heterogeneous computing, Introduction to CUDA Threads.		
REFERENCE BOOKS:			
Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.			
Michael J Quinn, Parallel programming in C with MPI and OpenMP, Tata Macgraw Hill, 2003.			
John L. Hennessey and David A. Patterson, " Computer architecture – A quantitative approach", Morgan Kaufmann/Elsevier Publishers, 4th. Edition, 2007.			
David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture: A hardware/ software approach" , Morgan Kaufmann/Elsevier Publishers, 1999.			
Parallel Programming with MPI By Peter S. Pacheco			
Using MPI: Portable Parallel Programming with the Message-Passing Interface, By William Gropp, Ewing Lusk, Anthony Skjellum			

Web R	https://www.tutorialspoint.com/cuda/index.htm
Web R	https://www.nvidia.com/docs/IO/116711/sc11-cuda-c-basics.pdf

COURSE PRE-REQUISITES:

MCA102, MCA103

COURSE OBJECTIVES:

To give an overview of

1. modern parallel computer architectures and parallel processing techniques and their applications from basic concepts to state-of-the-art computer systems.
2. fundamentals, design complexity, power, and reliability at all levels
3. basic parallel programming concepts using OpenMP, MPI and CUDA

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA401.1	To comprehend the working of the parallel architectures
MCA401.2	To parallel solve complex problems using task/channel model
MCA401.3	To implement shared memory model in parallel programs
MCA401.4	To implement Message passing model in parallel programs.
MCA401.5	To learn and implement Basic programs in CUDA

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA401.1	1		1	2											
MCA401.2	2		1	3											
MCA401.3	2		1												
MCA401.4			1	3	3										
MCA401.5			1	3											

MCA403 Comprehensive Viva Voce

Course Code	MCA403	**Course Name**	Comprehensive Viva Voce
Course Type	Viva Voce	**Contact Hours**	Nil
Credit	2	**Domain**	Professional Core

Will be conducted at the end of Semester. A comprehensive Viva based on subjects learned during the course, by Internal Examiner for internal Evaluation and by an external Examiner

MCA404 Internship

Course Code	MCA404	**Course Name**	Internship
Course Type	Core	**Contact Hours**	8 Weeks (40 Working Days)
Credit	10	**Domain**	Professional Core/ Experiential Learning

Course Description

The MCA Internship Course allows MCA students to gain practical experience in the workplace before receiving their Graduation Degrees. The student identifies companies willing to hire him/her on a full-time basis for an 8-week period (minimum required) during their last semester.

Responsibilities of an Intern

- Work closely with teams at the workplace to facilitate the rapid development of high-quality applications which may include:
  - Develop quality software and web applications
  - Analyze and maintain existing software applications
  - Design & implement highly scalable, testable code
  - Discover and fix programming bugs
  - Contribute to the design strategy of the UI and UX of the platform

Internship Guidelines:

- Step 1: Request Letter/ Email from Internship Coordinator of the college should go to industry to allot various slots of 8 weeks as internship periods for the students. Students request letter/profile/ interest areas may be submitted to industries for their willingness for providing the training.
- Step 2: Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email to the Internship Coordinator
- Step 3: Students on joining Training at the concerned Industry / Organization, submit the Joining Report/Letters / Email.
- Step 4: Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization/ through Online Interactions and Evaluation Report of the students is submitted in department office with the consent of Industry persons
- Step 5: Students will submit training report after completion of internship along with the Attendance Log to the Internship Coordinator.
- Step 6: Training Certificate to be obtained from industry and a copy to be submitted to the Office of the Coordinator.
- Step 7: Assessment of the Internship Outcomes through a Comprehensive Viva and extensive evaluation of the Internship Report.

INTERNSHIP REPORT GUIDELINES

Every student is required to write an Internship report upon completion of their internship and required to submit **two copies** (student copy + department copy in pdf) of the report to Internship Coordinator (along with certificate given by the company) for final evaluation and awarding of Credit Scores. Before submitting the

report to the Internship Coordinator, the student required to go through multiple rounds of revision in collaboration with the department internship mentor/coordinator/supervisor.

The Internship Report serves multiple purposes:

- Help the student develop written communication skills.
- Serve as an archival record of the internship experience.
- Give the student an opportunity to reflect on the professional aspects of the internship
- experience and the skills that were learned.
- Allow the student to describe the science content of the internship.
- Have the student to reflect on the initial goals of the internship and how they were (or were not) achieved during the internship.

Text Format in the report:

- Cambria 12 or similar, with 1.5 line spacing.
- Margins 1.5" left and 1" all other side.

Binding & report length:

- Soft binding & report length of minimum 20 pages with one side printing with a designed Cover Page

General information:

- Student is eligible for internship evaluation if only if he/she completed 8 weeks of internship training. (Minimum of 40 Working days)

EACH INTERNSHIP REPORT WILL FOLLOW THE FORMAT DESCRIBED:

- **Title Page**
- **College certificate Page**
- **Internship certificate provided by the internship institution**
- **Acknowledgement**
- **Executive summary/Abstract** (2 pages)
  A paragraph each on:
  - The company
  - The problem or opportunity
  - Methodology
  - Key parts of the report & your findings and solutions provided in the report.
  - Benefits to the company/institution through your report.
- **Index**
  List of the contents of the internship report and where they can be found in the report.
- **Learning Objectives/Internship Objectives**
  A single page that lists the original objectives of the internship.
- **Weekly overview of internship activities**
- **Introduction** (2 or 3 pages)
  The introduction should include a description of the internship site and the scope of the work completed during the internship. This Section may include a detailed explanation of the Organization and their scope of Work. It may include background information necessary to understand the work completed during the internship.
- **Internship Discussion**

This section contains a discussion of the internship and should address the following points:

- How the objectives achieved?
- What skills (scientific and professional) were learned during the internship?
- Results/observations/work experiences get in the internship company.
- What challenges did you experience during the internship?

- **Conclusion**
- **Bibliography**
  Include references to books, articles, reports referred to in the report.

Note: A handbook with the formats of Certificate and Details will be given at the start of Semester IV.

COURSE OUTCOMES:

CO. No	**Course Outcome description**
MCA404.1	Assist the student's development of employer-valued skills such as teamwork, communications and attention to detail.
MCA404.2	Expose the student to the environment and expectations of performance on the part of Software Analysts/developers in professional practice, private/public companies or government entities.
MCA404.3	Enhance and/or expand the student's knowledge of a particular area(s) of Software Engineering
MCA404.4	Expose the student to professional role models or mentors who will provide the student with support in the early stages of the internship and provide an example of the behaviours expected in the intern's workplace.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCA404.1		2	2		3	3		2			3	1			
MCA404.2		2	2		3	3		2			3	1			
MCA404.3		2	2		3	3					3	1			
MCA404.4		2	2		3	3			2		3	1			

Elective Courses

The Elective Courses are offered in specialization tracks focused on three major domains

1. Data Science
2. Advanced Programming
3. Computer Security

Elective courses are offered through Semester 3 and Semester 4 as MCA3XX and MCA4XX respectively. The Specializations are offered as two pools for each semester. The courses are offered through majority selection by the students in consensus with the department, approved by the Dean of Computer Science.

Data Science

MCA311 Deep Learning

Course Code	MCA311	**Course Title**	Deep Learning
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Data Science
Syllabus			
I	Introduction to Deep Learning Why Deep Learning? What is a neural network? -Basics: Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm. Backpropagation, Multi-layer Perceptrons		
II	Introduction to Tensorflow, simple ML examples. Basic operations, constants, variables, Control dependencies, Data pipeline, TensorBoard, Linear and Logistic Regression, Tensorflow's Optimizers, tf.data-Birth rate - life expectancy, MNIST dataset		
III	Loss Functions and Optimization, Image features, Optimization, stochastic gradient descent, Convolutional Neural Networks, Convnet in TensorFlow- image classification Solving a problem with CNNs on Tensorflow.		
IV	Recurrent Neural Networks, Language modelling Image captioning, Soft attention Back propagation through time, Long Short-Term Memory, LSTMs, Bidirectional RNNs, Solving a problem with RNNs on Tensorflow		
V	Practical: • Introduction to TensorFlow • TensorFlow Basic Syntax • TensorFlow Graphs		

	• TensorFlow - A Neural Network • TensorFlow Regression Example • TensorFlow Classification Example • CNN Implementation • CNN MNIST Code • Introduction to RNN Section • Manual Creation of RNN

REFERENCE BOOKS:

Goodfellow, Y. Bengio, A. Courville, Deep Learning, MIT Press, 2016. http://www.deeplearningbook.org.

K. P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Neural Networks and Deep Learning by Michael Nielsen, Online

Hands-On Machine Learning with Scikit-Learn and TensorFlow, by Aurélien Géron

COURSE PRE-REQUISITES:

MCA303

COURSE OBJECTIVES:

- To develop a clear understanding of the motivation for deep learning
- To design intelligent systems that learn from complex and/or large-scale datasets
- To apply deep learning to practical problems using Tensor Flow

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA311.1	To understand basic concepts of Deep Learning
MCA311.2	To learn Tensor flow and basic functionalities
MCA311.3	To solve problems using convolutional neural networks
MCA311.4	To understand recurrent Neural Networks
MCA311.5	To practically implement the deep learning algorithms using Tensor flow.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCA311.1	1	2		3	3								3		
MCA311.2	1	2		3	3								3		
MCA311.3	1	2		3	3								3		
MCA311.4	1	2		3	3								3		
MCA311.5	1	2		3	3								3		

MCA312 Big Data Analytics

Course Code	MCA312	**Course Title**	Big Data Analytics
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Data Science
Syllabus			
I	INTRODUCTION TO BIG DATA		

	Introduction to BigData Platform – Traits of Big data - Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions – ReSampling - Statistical Inference - Prediction Error.
II	DATA ANALYSIS Regression Modelling - Multivariate Analysis - Bayesian Modelling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning And Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods.
III	MINING DATA STREAMS Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.
IV	FREQUENT ITEMSETS AND CLUSTERING Mining Frequent Itemsets - Market Based Model – Apriori Algorithm – Handling Large Data Sets in Main Memory – Limited Pass Algorithm – Counting Frequent Itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering High Dimensional Data – CLIQUE And PROCLUS – Frequent Pattern based Clustering Methods – Clustering in Non Euclidean Space – Clustering for Streams and Parallelism.
V	FRAMEWORKS AND VISUALIZATION MapReduce – Hadoop, Hive, MapR , Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Analytics Applications - Analytics using Statistical packages-Approaches to modeling in Analytics – correlation, regression, decision trees, classification, association intelligence from unstructured information-Text analytics
REFERENCE BOOKS:	
Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.	
Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.	
Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.	
Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007	

Pete Warden, "Big Data Glossary", O'Reilly, 2011.
COURSE PRE-REQUISITES:
MCA303
COURSE OBJECTIVES:
1. To introduce students, the concept and challenge of big data (3 V's: volume, velocity, and variety). 2. To teach students in applying skills and tools to manage andanalyse the big data.
COURSE OUTCOMES:

CO. No	**Course Outcome description**
MCA312.1	Understand the concept and challenge of big data and whyexisting technology is inadequate to analyse the big data;
MCA312.2	Collect, manage, store, query, and analyse various form of bigdata
MCA312.3	Gain hands-on experience on large-scale analytics to solvesome open big data problems by understanding and mining data streams
MCA312.4	Understand the impact of big data for business decisions andstrategy using advanced clustering techniques
MCA312.5	Understand the concepts of frameworks and techniques to visualize the output

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO11	PO12	PSO 1	PSO 2	PSO 3
MCA312. 1	1	2		3	3								3		
MCA312. 2	1	2		3	3								3		
MCA312. 3	1	2		3	3								3		
MCA312. 4	1	2		3	3								3		
MCA312. 5	1	2		3	3								3		

MCA413 R Programming

Course Code	MCA413	**Course Title**	R Programming
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Data Science
Syllabus			
I	**Introduction to R** Introduction to R and Familiarization of R Studio, Basic components in R Studio. R Syntax and programming - Variables & Operators, Vectors, List, Matrices & Arrays, Factors, Data Frames & Functions Reading data using R - Basic read write operations. Exploratory functions to cover Summary & Structure of		

	data, Measures of central tendency and measures of dispersion.
II	**Data Handling and Visualization** Functions used for cleaning data - handling messy data and missing data – Basic charts and their purpose - pie, bar and histogram. Boxplot, Scatterplot. Understanding ggplot2 package, Functions in ggplot2 Quickplot
III	**Supervised Learning & Unsupervised Learning** Supervised modelling technique. Family of Regressions SLR, BLR, MLR Modelling, Decision Tree- Random Forest. Unsupervised modelling techniques Clustering Concept – K Means Clustering, Association Rules- ARM Concept – Apriori.
IV	**Applied Analytics - HR & Operation** HR Analytics: Understanding role of analytics in HR Function, Understanding KPI's that needs to be modelled. Case Study Operations Analytics: Understanding role of analytics in Operations Analytics – Introduction- Distribution channel development Case Study
V	**Applied Analytics - Finance & Marketing** Finance Analytics: Understanding role of analytics in finance. Customer profiling using clustering techniques Case Study Marketing Analytics: Understanding analytics in marketing. Case Study

REFERENCE BOOKS:

1 Hands-On Programming with R by Grolemund and Garrett

2 Beginning R: The Statistical Programming Language by Mark Gardener

3 R for Everyone: Advanced Analytics and Graphics by Jared P. Lander

4 Applied Predictive Analytics: Principles and Techniques for The Professional Data Analyst by Dean Abbott

5 Predictive Marketing: Easy Ways Every Marketer Can Use Customer Analytics and Big Data by Omer Artun and Dominique Levin

6 HR Analytics: Understanding Theories and Applications by Dipak Kumar Bhattacharyya.

COURSE PRE-REQUISITES:

MCA303

COURSE OBJECTIVES:

To Implement the Algorithms and predictive analytics using R

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA413.1	To get a basic understanding of R and the various ways to create scripts and programs in R

MCA413.2	To understand some of the key constructs in R for data handling
MCA413.3	To understand and appreciate how to summarize large volumes of data effectively by appropriate use of charts of different types
MCA413.4	Understand how to use R for real-life applications, in major domains like HR, Operations, Finance and Marketing

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MCA413. 1	1	2		3	3								3		
MCA413. 2	1	2		3	3								3		
MCA413. 3	1	2		3	3								3		
MCA413. 4	1	2		3	3								3		

MCA414 Data Visualization

Course Code	MCA414	**Course Title**	Data Visualization
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Data Science

Syllabus

I	Computational Statistics and Data Visualization, Data Visualization and Theory, Presentation and Exploratory Graphics, Graphics and Computing, Statistical Historiography Good Graphics –Introduction, Content, Context and Construction, Presentation Graphics and Exploratory Graphics, Presentation (What to Whom, How and Why), Choice of Graphical Form, Graphical Display Options, Higher-dimensional Displays and Special Structures, Scatterplot Matrices (Sploms), Parallel Coordinates, Mosaic Plots, Small Multiples and Trellis Displays, Time Series and Maps
II	Complete Plots, Sensible Defaults, Customization-Setting Parameters, Arranging Plots, Annotation, Extensibility-Building Blocks, Combining Graphical Elements, 3-D Plots, Speed, Output Formats, Data Handling Data and Graphs, Graph Layout Techniques- Force-directed Techniques, Multidimensional Scaling, The Pulling Under Constraints Model, Bipartite Graphs Graph

	Drawing, Hierarchical Trees, Spanning Trees, Networks, Directed Graphs, Treemaps.
III	High-dimensional Data Visualization Introduction, Mosaic Plots, Associations in High-dimensional Data, Response Models, Models, Trellis Displays, Definition, Trellis Display vs. Mosaic Plots,Visualization of Models, Parallel Coordinate Plots, Geometrical Aspects vs. Data Analysis Aspects, Limits Multidimensional Scaling Proximity Data, Metric MDS , Non-metric MDS , Example: Shakespeare Keywords, Procrustes Analysis, Unidimensional Scaling, INDSCAL, Correspondence Analysis and Reciprocal Averaging, Large Data Sets and Other Numerical Approaches
IV	**Tableau.** Introduction- Environmental setup, Design Flow, File Types, Data Types. Data Sources- Custom Data View, Extracting Data, Field operations, Metadata, Data Joining and Blending, Worksheets- Adding, renaming, reordering Worksheet, Pages Workbook Calculations- Operators, functions, Calculations, LOD Expressions.
V	Sort and Filters- Sorting, Quick filtering, Context filtering, Condition filtering, Filter operations, Charts, Advanced tableau, Tableau — Bar Chart, Line Chart, Multiple Measure Line Chart, Pie Chart, Crosstab, Scatter Plot, Bubble Chart, Bullet Graph, Box Plot. Dashboard, Forecasting
REFERENCE BOOKS:	
Handbook of Data Visualization by Chun-houh Chen, Wolfgang Härdle, Antony Unwin	
The Functional Art by Alberto Cairo	
The Visual Display of Quantitative Information by Edward R. Tufte	
Learning tableau by Joshua N. Milligan	
Tableau Dashboard Cookbook by Jen Stirrup	
Handbook of Data Visualization by Chun-houh Chen, Wolfgang Härdle, Antony Unwin	
COURSE PRE-REQUISITES:	
MCA303	
COURSE OBJECTIVES:	
To introduce students to data visualization including both the principles and techniques. To learn and use Tableau	
COURSE OUTCOMES:	
CO. No	**Course Outcome description**

MCA414.1	To understand the basics of data visualization and statistics used for Data Visualization
MCA414.2	To plot various Data visualization tools
MCA414.3	To understand high- dimensional Data visualization
MCA414.4	To learn to use Tableau Software

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MCA414. 1	1	2		3	3								3		
MCA414. 2	1	2		3	3								3		
MCA414. 3	1	2		3	3								3		
MCA414. 4	1	2		3	3								3		

MCA321 AngularJS Framework

Course Code	MCA321	**Course Title**	AngularJS Framework
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Advanced Programming
Syllabus			
I	Introduction: Angular JS, MVC Architecture, Conceptual Overview, setting up the Environment, First Application and Understanding ng attributes. Structure of the Application. Introduction to Angular Concepts – Modules, Components, Services and Routing Expressions and Data Biding: Number and String Expressions, Object Binding and Expressions, Working with Arrays, Forgiving Behaviour and Understanding Data binding		
II	Working with Directives: Conditional Directives, Styles Directives, Mouse and Keyboard Events Directives Controllers: Understanding Controllers, Programming Controllers & $scope object, Adding Behaviour to a Scope Object, Passing Parameters to the Methods, Having Array as members in Controller Scope, Nested Controllers and Scope Inheritance, Multiple Controllers and their scopes		
III	Filters: Built-In Filters, Uppercase and Lowercase Filters, Currency and Number Formatting Filters, OrderBy Filter, Filter Filter, Creating Custom Filter Forms: Using Simple Form, Working with Select and Options, Input Validations, Using CSS classes, Form Events, Custom Model update triggers, Custom Validations. Reactive Forms, Template Driven Forms and Dynamic Forms		
IV	Modules: Introduction, Module Loading and Dependencies, Recommended Setup of Application and Creation vs Retrieval Services: Understanding Services, Developing Creating Services, Using a Service, Injecting Dependencies in a Service Ajax in AngularJS: $http Service, $q Service, Ajax Impl using $http and $q Service		
V	Angular and Database Connectivity: MySql and MongoDB. CRUD Operations.		

	Routing: Introduction to SPA, Creating HTML Templates and Configuring Route Provider. Animation: ngAnimate Module, CSS transforms, CSS transitions, Applying animations, and Directives supporting animation

REFERENCE BOOKS:

AngularJS By Brad Green, Shyam Seshadri Publisher: O'Reilly Media

Professional Angularjs : A Concise Approach (Valeri Karpov, Diego Netto)

AngularJS Directives (Alex Vanston)

Ng-Book - The Complete Book on Angularjs (Ari Lerner)

Web R	https://www.w3schools.com/angular/
Web R	https://www.tutorialspoint.com/angularjs/index.htm
Web R	https://angular.io/

COURSE PRE-REQUISITES:

Please write the Java Course No

COURSE OBJECTIVES:

To give an overview of

1. Reduce the amount of code you write to build rich user interface applications.
2. Increase the reliability and maintainability of UI by using data binding.
3. Retrieve data from back end server, manipulate it and display it with ease.
4. Modularize your code with the custom services and directives.
5. Providing two ways binding of data.
6. Create Single Page Applications (SPA).

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA321.1	To implement applications using AngularJS frame Work
MCA321.2	Applying the frame work in real applications
MCA321.3	To implement filters in applications
MCA321.4	To apply the services and modules in applications
MCA321.5	Applying the framework to solve complex problems

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MCA321.1	2	2									2			3	
MCA321.2	2	2									2			3	

MCA321.3	2	2									2			3	
MCA321.4	2	2									2			3	
MCA321.5	2	2									2			3	

MCA322 Microsoft .NET Framework using C#

Course Code	MCA322	**Course Title**	Microsoft .NET Framework using C#
Course Type	Core	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Advanced Programming
Syllabus			
I	.NET Framework: Introduction, Common Language Runtime (CLR) , MSIL, The .NET Framework Class Library Introduction to C#: structure of a c# program, data types, operators, decision making branching and looping, arrays. Object oriented programming: Encapsulation, Inheritance, Polymorphism, Properties and indexers, Interfaces, Structures, Enumeration, Namespaces and Access specifiers, Partial classes, Partial methods, Delegates and Events, Attributes and Reflection.		
II	Advanced .NET: String Handling. Generics, Generic Class, Generic methods, Assemblies –private and shared Assemblies, GAC, exception handling, Multithreaded Programming, synchronization, Input / Output – Files –reading and writing– Directory manipulation. Data Base Connectivity: ADO.NET Architecture, Understanding the ConnectionObject, Building the Connection String, Understanding the CommandObject, Understanding DataReaders, Understanding DataSets and DataAdapters, DataTable, DataColumn, DataRow, Differences between DataReader Model and DataSet Model, Understanding the DataViewObject, Working with System.Data.OleDb, Using DataReaders, Using DataSets, Working with SQL.NET, Using Stored Procedures		
III	IO, Object serialization and Remoting: System.IO, Streams, TextWriter, TextReader, BinaryWirter, BinaryReader, Serialized Object Persistence and formatters, binary formatter, soap formatter, Remoting- Distributed Applications, COM/DCOM in Distributed Environment, Drawbacks of DCOM, .NET Remoting – New distributed environment, Advantages & Disadvantages, . Implementing a Simple Remoting Client and Server. Network programming: Socket programming, TCP/IP, UDP		
IV	Windows Programming: Using Textbox, Button, CheckBox, RadioButtons, ComboBox, GroupBox etc., Event handling, Handling mouse and keyboard events, Using menus and multiple windows, Adding a Tab-Control, Anchoring Controls, ListView and TreeView controls, Building an ImageList and add them to the ListView, Using details inside the ListView, Attaching a Context Menu, Adding a TreeView, Creating window services. DataBae: Windows Database Connectivity		

V	Web Applications: Introduction to Web Applications, Understanding architecture ASP.NET, Creating ASP.NET Pages – Web Forms, Working with web controls – Button, Textbox etc. , Postback and ViewState concepts, State Management – Cookies, Sessions and Applications, Validation controls, FileUpload, AdRotator, MultiView, Calendar etc. Web Database Connectivity: sqldatasoruce-insert, delete, update, report generation. Concept of Master pages and web services.

REFERENCE BOOKS:

C# 2012 Programming, Covers .Net 4.5, Black Book

Professional .NET programming - wrox publication

Professional ASP.NET 4.5 in C# - Jason N. Gaylord (Author), Christian Wenz (Author), Pranav Rastogi (Author), Todd Miranda (Author),

Professional C# Web Services: Building .NET Web Services with ASP .NET and• .NET Remoting - Zach Greenvoss and Christian Nagel

COURSE PRE-REQUISITES:

MCA102, MCA105

COURSE OBJECTIVES:

1. To Achieve an understanding of the goals and objectives of the .NET Framework
2. To provide a working knowledge of the C# programming language
3. To achieve an understanding of how to use forms to develop GUI programs under .NET

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA322.1	Ability to solve problems using only pure object oriented concepts and frameworks
MCA322.2	Ability to design and develop database applications
MCA322.3	Able to develop networking and distributed applications
MCA322.4	Ability to design GUI applications
MCA322.5	Design and develop Web applications

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA322.1			1											2	
MCA322.2			1		2									2	
MCA322.3			2											1	
MCA322.4			2		2										
MCA322.5			2		2			1						3	

MCA423 Flutter Using DART

Course Code	MCA423	**Course Title**	Flutter Using DART
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Advanced Programming

Syllabus

I	DART programming – Introduction, Setting up the Environment, structure of the program and execution.

	Introduction: Variables, Data Types, Operators, Decision Making, Loops, Numbers, Strings, Boolean and functions. List , Map, Symbol, Rune, Enumerations and Functions
II	Object oriented Programming using DART – class, object, Constructor, Interface and Inheritance. Getters and Setters. Advanced DART Concepts: Collection, Generics, Packages, Exceptions, Debugging, Libraries, Asynchronous operation and Concurrency.
III	Flutter – Introduction, Features, Advantages and disadvantages of flutter. Installation – Windows platform Application – Creation of Simple Application in Android Studio. Architecture of Flutter Application – Widgets, Concept of States, and layers
IV	Widgets - Material widgets , Cupertino widgets, Layout widgets and State maintenance widgets Layouts – Single Child Layout Widgets, Multiple Child Widgets Advanced Layout Application and Introduction to Gestures ,
V	Flutter State management and Flutter Animation Flutter Database Concepts. Flutter Internationalization
REFERENCE BOOKS:	
Beginning App Development with Flutter by Rap Payne	
Beginning Flutter: A Hands On Guide to App Development by Marco L. Napoli	
Flutter for Beginners by Alessandro Biessek	
Flutter in Action by Eric Windmill	
Programming Flutter by Carmine Zaccagnino	
Web R	https://dart.dev/
Web R	https://flutter.dev/
Web R	https://www.tutorialspoint.com/flutter/index.htm
COURSE PRE-REQUISITES:	
MCA307	
COURSE OBJECTIVES:	
To create apps based on android or ios platforms To create apps based on multimedia and internet application To make a platform independent app.	
COURSE OUTCOMES:	
CO. No	**Course Outcome description**
MCA423.1	Able to understand the DART programming langugae
MCA423.2	Able to develop simple apps
MCA423.3	Make decision to solve a problem using package, library and threads Handling Errors and Exceptions

MCA423.4	Ability to design and develop database applications
MCA423.5	Able to design and develop mobile applications works with internet applications

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PS01	PS02	PS03
MCA423.1			1		3									2	
MCA423.2			1		3									2	
MCA423.3			2											1	
MCA423.4			2		3									3	
MCA423.5			2		3									3	

MCA424 Struts, Hibernate and Spring

Course Code	MCA424	**Course Title**	Struts, Hibernate and Spring
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Advanced Programming

Syllabus

I	Introduction to Struts MVC Architecture - Framework Application Flow, Components Model, View and Controller, Building a simple web application using struts. Struts Validator - Introduction to validator plugin, Using different types of validators, Configuring the application, Applying validators, Building custom validators, Declarative exception handling Framework - Struts Tiles Framework, Introduction to tiles framework, Building tiles configuring struts-config.xml file creating the template page Struts2 Action - Action Interface, ActionSupport class
II	Basics of Hibernate - Hibernate Introduction, Hibernate Architecture, Understanding First Hibernate application Hibernate Application - Hibernate with annotation, Hibernate Web application, Hibernate Generator classes, Hibernate Dialects Hibernate Logging - Hibernate with Log4j 1, Hibernate with Log4j 2 Inheritance Mapping - Table per Hierarchy, Table per Hierarchy using Annotation, Table Per Concrete, Table Per Concrete using Annotation, Table Per Subclass, Table Per Subclass using Annotation
III	Collection Mapping - Mapping List, One-to-many by List using XML, Many to Many by List using XML, One To Many by List using Annotation, Mapping Bag, One-to-many by Bag, Mapping Set, One-to-many by Set, Mapping Map, Many-to-many by Map, Bidirectional Lazy Collection Component Mapping, Association Mapping - One-to-one using Primary Key, One-to-one using Foreign Key
IV	Transaction Management

	HQL, HCQL, Named Query Hibernate Caching - First Level Cache, Second Level Cache Integration - Hibernate and Struts, Hibernate and spring
V	Basics of Spring - What is Spring, Spring Modules, Spring Application IOC container Dependency Injection - Constructor Injection, CI Dependent Object, CI with collection, CI with Map, CI Inheriting Bean, Setter Injection, SI Dependent Object, SI with Collection, SI with Map, CI vs SI, Auto wiring, Factory Method Spring with ORM- Spring with Hibernate, Spring with JPA SpEL- SpEL, Operators in SpEL, variable in SpEL ,Web Integration- Spring with Struts2

REFERENCE BOOKS:

Beginning Apache Struts - Arnold Doray

Struts: The Complete Reference Book

Mastering Jakarta Struts

Struts in Action - Ted Husted, Cedric Dumoulin, George Franciscus, David Winterfeld

Just Spring Integration - Madhusudhan Konda

Spring Data - Mark Pollack, Oliver Gierke

COURSE PRE-REQUISITES:

MCA202, MCA 203

COURSE OBJECTIVES:

To acquire knowledge in MVC architecture
To develop enterprise applications using Frameworks
To Familiar with Hibernate and Transactions in SQL

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA424.1	Facilitate understanding of the Model-View-Controller (MVC) design pattern and how it is best applied to Java Web application development with respect to a scenario.
MCA424.2	Ability to map entities and attributes using modern tools
MCA424.3	Create different types of persistent classes and Map java inheritance hierarchy with database tables using various mapping techniques
MCA424.4	Fetch data effectively from database using traditional SQL and Hibernate Query Language
MCA424.5	Ability to provide computational solutions for real life problems

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MCA424. 1	1	2	2												
MCA424. 2					3										
MCA424. 3			2												
MCA424. 4	1				2										
MCA424. 5											3	2	2		3

MCA331 Ethical Hacking

Course Code	MCA331	**Course Title**	Ethical Hacking
Course Type	Specialization	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Computer Security
Syllabus			
I	**Hacking Concepts** Hacking vs. Ethical Hacking, Effects of Hacking on Business, Who is a Hacker? Hacker Classes, Hacktivism, Hacking Phases. Types of Attacks-Types of Attacks on a System, Operating System Attacks, Misconfiguration Attacks, Application-Level Attacks, Examples of Application-Level Attacks, Shrink Wrap Code Attacks. Footprinting **Concepts-Footprinting Terminology,** What is Footprinting?, Why Footprinting?, Objectives of footprinting, WHOIS Footprinting- WHOIS Lookup, WHOIS Lookup Result Analysis, WHOIS Lookup Tool: SmartWhois, WHOIS Lookup Tools, WHOIS Lookup Online Tools. DNS Footprinting, Extracting DNS Information, DNS Interrogation Tools, Network Footprinting, Locate the Network Range, Determine the Operating System. Traceroute-Traceroute Analysis, Traceroute Tools.		
II	**Enumerations and System Hacking** Enumeration Concepts- What is Enumeration? Techniques for Enumeration, Services and Ports to Enumerate. NetBIOS Enumeration-NetBIOS Enumeration, NetBIOS Enumeration Tool: SuperScan, Hyena, Enumerating User Accounts, Enumerate Systems Using Default Passwords System Hacking: Goals-CEH Hacking Methodology (CHM),CEH System Hacking Steps, Cracking Passwords- Password Cracking, Password Complexity, Password Cracking Techniques, Types of Password Attacks, Passive Online Attack: Passive Online Attack: Eavesdropping, Passive Online Attacks: Man-in-the-Middle and Replay Attack		
III	**Trojan, Virus and Worms** Trojan Concepts- What is a Trojan? Communication Paths: Overt and Covert Channels Purpose of Trojans, What DTrojan Creators Look For? Indications of a Trojan Attack, Windows Services Monitoring Tool: Windows Service Manager (SrvMan), Windows8 Startup Registry Entries, Startup Programs Monitoring Tool: Starter, Startup Programs Monitoring Tool: Security AutoRun, Startup Programs Monitoring Tools Virus Concepts- Introduction to Viruses, Virus and Worm Statistics, Stages of Virus Life, Working of Viruses: Infection Phase, Working of Viruses: Attack Phase, Why Do People Create Computer Virus, Indications of Virus Attack, Virus Analysis: DNSChanger, Types of Viruses		

	Computer Worms-How Is a Worm Different from a Virus?, Worm Analysis: Stuxnet, Worm Maker: Internet Worm Maker Thing
IV	**Web Application hacking** Introduction to Web Applications, Web Application Components, How Web Applications Work?, Web Application Architecture, Analyze Web Applications, Analyze Web Applications: Identify Entry Points for User Input, Analyze Web Applications: Identify Server-Side Technologies, Analyze Web Applications: Identify Server-Side Functionality, Session Attacks: Session ID Prediction/ Brute-forcing, Cookie Exploitation: Cookie Poisoning, Authorization Attack Schemes, Authorization Attack, HTTP Request Tampering, Authorization Attack: Cookie Parameter Tampering
V	**SQL Injection and Android Hacking** SQL Injection Concepts-SQL Injection, SQL Injection Threats, What is SQL Injection?, SQL Injection Attacks SQL Injection Tools: BSQLHacker,SQL Injection Tools: Marathon Tool Android Vulnerabilities, Android Rooting, Rooting Android Phones using SuperOneClick, Rooting Android Phones Using Superboot, Android Rooting Tools, Session Hijacking Using DroidSheep, Android-based Sniffer: FaceNiff, Securing Android Devices, Google Apps Device Policy

REFERENCE BOOKS:

ABCD OF HACKING: The Beginner's guide by Shashank Pai K

Computer Hacking Beginners Guide: How to Hack Wireless Network, Basic Security and Penetration Testing, Kali Linux, by Alan T. Norman

Hacking: The Art of Exploitation, by Jon Erickson

The Hacker Playbook 2: Practical Guide To Penetration Testing by Peter Kim
Hash Crack: Password Cracking Manual (v2.0) 2nd Edition, by Joshua Picolet

The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws 2nd Edition by Dafydd Stuttard , Marcus Pinto

COURSE PRE-REQUISITES:

MCA 304

COURSE OBJECTIVES:

1. Identify and analyse the stages an ethical hacker requires to take in order to compromise a target system.
2. Identify tools and techniques to carry out a Hacking
3. Critically evaluate security techniques used to protect system and user data.
4. Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system.

COURSE OUTCOMES:

CO. No	**Course Outcome description**
MCA331.1	Understand and apply concepts of Ethical hacking and footprinting
MCA331.2	To know the basics of System hacking and enumerations
MCA331.3	Differentiate the concepts of Trojans, viruses and worms
MCA331.4	To understand the vulnerabilities of web applications and monitor the hacks

MCA331.5	To understand SQL injections and Android Hacking

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA331.1	1			1											2
MCA331.2	1			2											2
MCA331.3			1	2		1									3
MCA331.4			1	2											3
MCA331.5			1	2											3

MCA332 Web and Database Security

Course Code	MCA 332	**Course Title**	Web and Database Security
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Computer Security

Syllabus

I	Introduction to Web Applications and Security, Profiling, Hacking Web Servers, the Threats – Classes of threats, the Hacker's Workbench, Cryptography and the Web, Digital Identifications.
II	Privacy- protecting techniques, privacy- protecting technologies, Backups and antitheft. Web Server Security – Host security for servers
III	Securing web applications. Protecting an organization – Network layout, safe hosts in a hostile environment, Intrusion detection.
IV	Introduction to Database, Levels of Database Security - Human level, network/user interface, database application program, database system, operating system, and physical level, Authentication and Password Security, Application Security – SQL Injection.
V	Securing Database-to-Database Communication, Trojans, Encryption, Passwords in scripts, insider/outsider attacks, users, programmers, super users, information leakage.

REFERENCE BOOKS:

Joel Scambray, Mike Shema, Caleb Sima, Hacking Exposed Web Applications, Second Edition

Simson Garfinkel, Gene Spafford, Web Security, Privacy & Commerce, Second Edition

Mike Shema, HackNotes(tm) Web Security Pocket Reference

Matt Bishop, "Computer Security: Art and Science", Pearson Education.

Fundamentals of Database Systems (3rd Ed.) - R.Elmasri, S. Navathe

An Introduction to database systems (5th Ed.) - C. J. Date

Database system concepts – H. Korth , A. Silberschatz

Implementing Database Security & Auditing – Ron Ben Vatan

Security of Data and Transaction- Vijay Atluri, PierangelaSamarati

Computer Security Lab Manual, Vincent J. Nestler, Wm. Arthur Conklin, Gregory B.

COURSE PRE-REQUISITES:

MCA104

COURSE OBJECTIVES:	
To understand the application of security concept to database technology and web technology.	
COURSE OUTCOMES:	
CO. No	**Course Outcome description**
MCA332.1	Learn the Web application architecture, its components and potential security weaknesses.
MCA332.2	To impart knowledge about securing web application.
MCA332.3	Learn the levels of database security and SQL injection.
MCA332.4	Understand information leakage and securing database to database communication.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3	PSO4
MCA332.1																2
MCA332.2	1									1						2
MCA332.3	1															2
MCA332.4										1						2

MCA433 Cyber Forensics

Course Code	MCA 433	**Course Title**	Cyber Forensics
Course Type	Elective	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Computer Security
Syllabus			
I	Over View of Computer Forensics Technology- Computer Forensics Fundamentals- Type of Computer Forensics Technology- Type of Vendor and Computer Forensics Services		
II	Duplication and preservation of Digital Evidence-Computer image verification and Authentication		
III	Computer Forensics Analysis- Discovery of Electronic Evidence-Identification of data Reconstructing Past events		
IV	Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, investigating network Traffic, Investigating Web attacks, Router Forensics. Cyber forensics tools and case studies		
V	Counter measure: Information warfare- Surveillance tool for Information warfare of the Future-Advanced Computer Forensics		
REFERENCE BOOKS:			
Computer Forensics: Computer Crime Scene Investigation (Networking Series) By John R. Vacca-Charles River Media.			
Hacking Exposed Computer Forensics, Second Edition : Computer Forensics Secrets & Solutions By Aaron Philipp, David Cowen, Chris Davis- McGraw-Hill Osborne Media			
Kenneth C.Brancik “Insider Computer Fraud” Auerbach Publications Taylor & Francis Group–2008.			
ChristofPaar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners, 2nd Edition, Springer’s, 2010			
Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, 2009			

Computer Forensics: Investigating Network Intrusions and Cyber Crime (EcCouncil Press Series: Computer Forensics), 2010
COURSE PRE-REQUISITES:
MCA302
COURSE OBJECTIVES:
1. Understand the fundamentals of computer forensics 2. Understand the legal aspects of forensics 3. Understand the relationship between IT and forensics
COURSE OUTCOMES:

CO. No	**Course Outcome description**
MCA433.1	Interpret and appropriately apply the laws and procedures associated with identifying, acquiring, examining and presenting digital evidence.
MCA433.2	Create a method for gathering, assessing and applying new and existing legislation and industry trends specific to the practice of digital forensics.
MCA433.3	Employ fundamental computer theory in the context of computer forensics practices.
MCA433.4	Adhere to the ethical standards of the profession and apply those standards to all aspects of the study and practice of digital forensics.
MCA433.5	Evaluate the effectiveness of available digital forensics tools and use them in a way that optimizes the efficiency and quality of digital forensics investigations

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA433.1	2	3	2												2
MCA433.2	2	2	3												2
MCA433.3	3														1
MCA433.4	1					3				1					3
MCA433.5	1	2			3										2

MCA434 Block-Chain Technology

Course Code	MCA434	**Course Title**	Block-Chain Technology
Course Type	Core	**Contact Hours**	6 Hours per Week
Credit	4	**Domain**	Information Security
Syllabus			
I	**Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.		
II	**Blockchain**: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward,		

	Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.
III	**Distributed Consensus**: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin
IV	**Cryptocurrency Regulation**: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.
V	**Practical**: Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles.

REFERENCE BOOKS:

Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System

DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.

Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

COURSE PRE-REQUISITES:

Computer security basics.

COURSE OBJECTIVES:

Integrate ideas from blockchain technology into your own projects.

COURSE OUTCOMES:

CO. No	Course Outcome description
MCA434.1	To understand the basics of hash function and digital signature.
MCA434.2	To demonstrate how blockchain system works.
MCA434.3	To understand consensus mechanism in blockchain.
MCA434.4	To understand the working of cryptocurrency.
MCA434.5	Interact with a blockchain system.

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
MCA434.1	3						1				2	2			2
MCA434.2			3				1				2	2			2
MCA434.3	3		2				1				2	2			2
MCA434.4			3				1				2	2			2
MCA434.5			2				1				2	2			2

RCSS

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