Affiliated to the

UNIVERSITY OF MUMBAI

Program: Bachelor of Science (Computer Science)

Third Year:- Semester V & VI

Choice Based Credit System (CBCS) with effect from the

Academic year 2023-24

A.C. No:

Agenda No:

PROGRAMME OUTCOMES (PO'S)

On completion of the Bachelor of Science the learners should be able to:

PO 1: Develop scientific temper and acquire academic competence in the discipline of choice for the desired professional specialization field as a career.

PO 2: Develop critical understanding of the concepts and effectively relate them at the local, regional and global levels.

PO 3: Explore and analyze the emerging trends in the discipline of choice and associated disciplines

PO 4: Acquire technological and analytical skills needed for industrial support services.

PO 5: Acquire skills like collaboration, communication, entrepreneurship, and independent lifelong learning to overcome challenges ahead.

PO 6: Create awareness on the impact of environment on societal needs & sustainable development and innovate ecofriendly alternatives.

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

On completion of the B.Sc. Computer Science, the learners should be enriched with knowledge and be able to-

PS01: To train the students for software development using different programming languages.

PS02: To develop the skills for problem solving in computing and other relevant disciplines.

PS03: To introduce emerging trends to the students in a gradual way.

PS04: To groom the students for facing the challenges in ICT industry.

Preamble

Information and Communication Technology (ICT) has today become integral part of all industry domains as well as fields of academics and research. The industry requirements and technologies have been steadily and rapidly advancing. Organizations are increasingly opting for open source systems. The students too these days are thinking beyond career in the industry and aiming for research opportunities.

The B.Sc. Computer Science course structure therefore needed a fresh outlook and complete overhaul. A real genuine attempt has been made while designing the new syllabus for this three year graduate course. Not only does it prepare the students for a career in Software industry, it also motivates them towards further studies and research opportunities. In the first year i.e. for semester I & II, basic foundation of important skills required for software development is laid. The syllabus proposes to have four core subjects of Computer science and two core courses of Mathematics-Statistics. All core subjects are proposed to have theory as well as practical tracks. While the Computer Science courses will form fundamental skills for solving computational problems, the Mathematics & Statistics course will inculcate research oriented acumen. The syllabus design for further semesters encompasses more advanced and specialized courses of Computer Science. We sincerely believe that any student taking this course will get very strong foundation and exposure to basics, advanced and emerging trends of the subject. We hope that the students' community and teachers' fraternity will appreciate the treatment given to the courses in the syllabus

The courses are as follows: -

Semester – V		
Course Title	**Credits**	**Lecture/Week**
Artificial Intelligence	4	4
Web Services	4	4
Information and Network Security	4	4
Optimization Techniques	4	4
Skill Enhancement: Software Testing and Quality Assurance	2	2
Computer Science Practical – 11	3	6
Computer Science Practical – 12	3	6
Project Implementation	2	4

Semester – VI		
Course Title	**Credits**	**Lecture/Week**
Wireless Sensor Networks and Mobile Communication	4	4
Ethical Hacking & Cyber Forensics	4	4
Information Retrieval	4	4
Data Science	4	4
Skill Enhancement: Human Computer Interaction	2	2
Computer Science Practical – 13	3	6
Computer Science Practical – 14	3	6
Project Implementation	2	4

N.B.- (i)   The duration of each theory lecture will be of 60 minutes. A course consists of 4 modules. For each module the number of hours allotted are 15. The total number of lecture hours for each course will thus be 60.

For theory component value of One Credit is equal to 15 learning hours.

(ii)   There will be one practical per batch for all but one courses per semester. The duration of each practical will be of 3 hours and for project 4 hours

For practical component the value of One Credit is equal to 30 learning hours.

(iii)   Thus in a week, a student will study 18 hours of theory and 16 hours of practical for semester

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Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) **Details of Continuous Assessment (CA)**

   25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	Class Test/Research Paper Review/ Assignment/ Presentation/ Mini Project	15 marks
Component 2 (CA-2)	Assignment/ presentation/mini project, etc	10 marks

   Minimum 2 component of Continuous Assessment need to be conducted per course.

b) **Details of Semester End Examination**

   • **Core Component**

   75% of the total marks per course. Duration of examination will be two and half hours.

Que. No.	Description	Marks	Total Marks
1	Subjective questions based on Module I (3/4)	15	20
2	Subjective questions based on Module II (3/4)	15	20
3	Subjective questions based on Module III (3/4)	15	20
4	Subjective questions based on Module IV (3/4)	15	20
5	Subjective questions based on Module I/II/III/IV (3/4)	15	20
	Total	**75**	100

   • **Skill Enhancement Component**

   75% of the total marks per course. Duration of examination will be two and half hours.

Que. No.	Description	Marks	Total Marks
1	Subjective questions based on Module I (3/4)	20	25
2	Subjective questions based on Module II (3/4)	20	25
3	Subjective questions based on Module III (3/4)	20	25
4	Subjective questions based on Module I/II/III (3/4)	15	20
	Total	**75**	**95**

Evaluation for practical papers

In the Practical exams, there will be 20% assessment for the journal and laboratory work and 80% as term end component to be conducted as a semester end exam per course. For each course there will be one examiner per batch who will evaluate the practical.

Signature   Signature   Signature

HOD   **Approved by Vice-Principal**   **Approved by Principal**

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Program: Bachelor of Science (Computer Science)		Semester: V	
Course: Artificial Intelligence		Course Code: USMACS501	
Teaching Scheme		**Evaluation Scheme**	
Lecture (Hours per week)	**Credit**	**Continuous Assessment (CA)**	**Semester End Examinations (SEE)**
04	4	25%	75%

Learning Objectives:
- Artificial Intelligence (AI) and accompanying tools and techniques bring transformational changes in the world. This course aims to introduce the learner to this interesting area.
- It also aims to train students to provide AI based solutions to real-world problems

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Explore fundamentals of AI and problem-solving algorithms

CO2: Implement AI models and reasoning based on probabilistic reasoning

CO3: Build decision making models based on statistical & reinforcement learning

Outline of Syllabus: (per session plan)		
Module	**Description**	**No of hours**
1	Fundamentals of AI and Problem solving algorithms	15
2	Game Playing & Symbolic AI	15
3	Probabilistic Reasoning based AI	15
4	Statistical & Reinforcement learning	15
	Total	**60**

Module	Topic	No. of Hours/Credits 60/4
1	**Fundamentals of AI and Problem solving algorithms**	**15**
	What Is AI: Foundations, History and State of the Art of AI. Intelligent Agents: Agents and Environments, Nature of Environments, Structure of Agents.	**6**
	Problem Solving by searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.	**7**
	Iterative Improvement Algorithms: Hill Climbing and simulated annealing, Genetic Algorithms	**2**
2	**Game Playing & Symbolic AI**	**15**
	Game Playing: Overview and Example Domain, Min-max Search, Adding Alpha-Beta Cutoffs.	**3**
	First Order Predicate Logic -Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information	**12**
3	**Probabilistic Reasoning based AI**	**15**
	Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Belief Networks, Efficient Representation of Conditional Distribution, Exact inference in Bayesian network, Approximate inference in Bayesian network	**8**
	Probabilistic Reasoning over Time: Time and uncertainty, Inference in temporal models, Hidden Markov Models, Dynamic Bayesian Networks	**7**
4	**Statistical & Reinforcement learning**	**15**
	Complex Decisions: Sequential Decisions Problem, Value Iteration, Policy Iteration	**3**
	Statistical Learning: Learning with Complete Data, Learning with Hidden variables	**3**
	Reinforcement learning: Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, Applications of Reinforcement Learning.	**9**

RECOMMENDED READING:
ESSENTIAL READING:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig,3rd Edition, Pearson, 2010.

SUPPLEMENTARY READING:

1. Artificial Intelligence: Foundations of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press ,2017.
2. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2013

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)		Semester: V	
Course: Web Services		Course Code: USMACS505	
Teaching Scheme		**Evaluation Scheme**	
Lecture (Hours per week)	**Credit**	**Continuous Assessment (CA)**	**Semester End Examinations (TEE)**
04	4	25%	75%

Learning Objectives:
- To be acquainted with details of web services technologies like SOAP, WSDL, and UDDI and to learn how to implement and deploy web service client and server, also comprehend the design principles and application of SOAP and REST based web services (JAX-Ws and JAX-RS), WCF service. & Graphql

Course Outcomes:
After completion of the course, learners would be able to:
CO1: Explored to the fundamentals of Web services using SOAP.
CO2: Apply and develop Service-Oriented Applications with WCF and get familiarize with latest web service platforms
CO3: Implement Web service using Restful and node.js.
CO4: Create open source GraphQL API.

Outline of Syllabus: (per session plan)

Module	Description	No of hours
1	Introduction to Web Services using SOAP	15
2	RESTFUL Web Services	15
3	GraphQL	15
4	Apply and develop Service-Oriented Applications with WCF and get familiarize with latest web service platforms	15
	Total	**60**

Module	Web Services	No. of Hours/Credits 60/4
1	**Introduction to Web Services using SOAP**	**15**
	Web services basics: What Are Web Services. Types of Web Services, software as a service, Characteristics of Web services, Service Oriented Architecture.	**5**
	Distributed computing infrastructure: Distributed computing and Internet protocols, client-server model, characteristics of overview of XML, SOAP.	**5**
	Building Web Services with JAX-WS, Registering and Discovering Web Services, Web Services Development Life Cycle, Developing and consuming simple Web Services across platform.	**5**
2	**RESTFUL Web Services**	**15**
	The REST Architectural style: Introducing HTTP, The core architectural elements of a RESTful system, Description and discovery of RESTful web services	**5**
	Java tools and frameworks for building RESTful web services, JSON message format and tools and frameworks around JSON, Build RESTful web services with JAX-RS APIs, The Description and Discovery of RESTful Web Services, Design guidelines for building RESTful web services, Secure RESTful web services.	**5**
	Introduction to Node.js, Features of Node.js, applications of Node.js, Environment Setup, Creating Node.js Application, Callback, Node Package Manager (NPM), Event-Driven Programming, Creating Web server, Express Overview.	**5**
3	**GraphQL**	**15**
	GraphQL: Introduction, GraphQL is the better REST, Core Concepts, Apollo client, the Schema Definition Language (SDL)	**5**
	Queries & amp; Mutations, Schemas and Types, Refetching queries in Apollo Client, Subscriptions	**5**
	GraphQL client and server, Connecting with Database via Prisma, GraphQL Tools and Ecosystem, Security.	**5**
4	**Apply and develop Service-Oriented Applications with WCF and get familiarize with latest web service platforms**	**15**
	What Is Windows Communication Foundation, Fundamental Windows Communication Foundation Concepts.	**5**
	Windows Communication Foundation Architecture, WCF and .NET Framework Client Profile, Basic WCF Programming	**5**

	WCF Feature Details. Web Service QoS, Introduction Latest web services platforms.	**5**

RECOMMENDED READING:
ESSENTIAL READING:

1. Web Services: Principles and Technology, Michael P. Papazoglou, Pearson Education Limited, 2008
2. RESTful Java Web Services, Jobinesh Purushothaman, PACKT Publishing, 2nd Edition, 2015
3. Developing Service-Oriented Applications with WCF, Microsoft and https://docs.microsoft.com/en-us/dotnet/framework/wcf/index
4. https://graphql.org/leam/ and https://www.howtographql.com

SUPPLEMENTARY READING:

1. Leonard Richardson and Sam Ruby, RESTful Web Services, O'Reilly, 2007
2. The java EE 6Tutorial, Oracle, 2013

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)		Semester: V	
Course: Computer Science Practical 11 (Based on Artificial Intelligence and Web Services)		Course Code: USMACSP512	
Teaching Scheme		Evaluation Scheme	
Practical (Hours per week)	Credit	Continuous Assessment (CA)	Semester End Examinations (SEE)
6	3	20%	80 %

List of Practical: Artificial Intelligence

Sr. No.	Topic
1	Write a program to implement Breadth first search algorithm for Romanian map problem
2	Write a program to implement Depth first search algorithm for Romanian map problem
3	Write a program to implement Iterative Deep Depth first search algorithm for Romanian map
4	Write a program to implement A* search algorithm for Romanian map
5	Write a program to implement recursive best-first search algorithm for Romanian map problem
6	Write a program to solve N-Queen problem
7	Write a program to implement Wumpus-world problem
8	Write a program to implement alpha beta search.
9	Write a program to solve Hill climbing problem.
10	Write a program to solve water jug problem

List of Practical: Web Services

Sr. No.	Topic.
1	Implement and consume a simple web service.
2	Develop client, which consumes web services developed in different platform.
3	To implement the operation to receive request and return a response in two ways. a) One - Way operation b) Request-Response.
4	Write a JAX-WS web service to perform the following operations. Define a Servlet/JSP that consumes the web service.
5	Define a web service method that returns the contents of a database in a JSON string. The contents should be displayed in a tabular format OR Using JSON Implement CRUD Operation.

6	Implement a simple GraphQL query using the Node.JS.
7	Implement a simple GraphQL mutation using the Node JS.
8	Demonstrate a database connected GraphQL query using Prisma.
9	Implement a typical service and a typical client using WCF.
10	Use WCF to create a basic ASP.NET Asynchronous JavaScript and XML (AJAX) service.

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Program: Bachelor of Science (Computer Science)			Semester: V	
Course: Information and Network Security			Course Code: USMACS503	
Teaching Scheme			Evaluation Scheme	
Lecture (Hours per week)	Credit	Continuous Assessment	Semester End Examinations (SEE) (Marks-75 in Question Paper)	
04	4	25%	75%	

Learning Objectives:
- To provide students with knowledge of basic concepts of computer security including network security and cryptography.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Identify risk related to information and network security

CO2: Recommend various security techniques, applications and intrusion detection methods.

CO3: Apply cryptographic algorithms to maintain information security.

CO4: Differentiate between the use of cryptography and Hashing

CO5: Apply measures to prevent attacks on networks using firewall.

CO6: Formulate hash function for authentication

Outline of Syllabus: (per session plan)

Module	Description	No of hours
1	Introduction, Classical Encryption Techniques, Cryptography and RSA	15
2	Program Security	15
3	Digital Signatures and Authentication	15
4	Electronic Mail Security, Web Security, Intrusion, Firewalls	15
	Total	**60**

Module	Information and Network Security	No. of Hours/Credits 60/4
1	**Introduction, Classical Encryption Techniques, Cryptography and RSA**	15
	Introduction: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms	3
	Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques Steganography	7
	Block Cipher Principles, The Data Encryption Standard, The Strength of DES, AES (round details not expected), Multiple Encryption and Triple DES, Block Cipher Modes of Operation, Stream Ciphers	4
	Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm, Key Management: Public-Key Cryptosystems, Key Management, Diffie-Hellman Key Exchange	2
2	**Program Security**	15
	Program Security: Secure programs: Fixing Faults, Unexpected Behavior, Types of Flaws. Non-malicious program errors: Buffer overflows, Incomplete Mediation.	4
	Viruses and other malicious code: Why worry about Malicious Code, Kinds of malicious code, how viruses attach, how viruses gain control, Prevention,	4
	Control Example: The Brain virus, The Internet Worm, Web bugs. Targeted malicious code- Trapdoors, Salami Attack.	4
	Controls against program threats- Development Controls, Peer reviews, Hazard Analysis.	3
3	**Digital Signatures and Authentication**	15
	Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and Macs, Secure Hash Algorithm, HMAC	6
	Digital Signatures and Authentication: Digital Signatures, Authentication Protocols, Digital Signature Standard Authentication Applications:	4
	Kerberos, X.509 Authentication, Public-Key Infrastructure	2
	Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control.	2
	Wireless Network Security: Mobile Device Security, Wireless LAN Security	1

4	**Electronic Mail Security, Web Security, Intrusion, Firewalls, Biometric security**	**15**
	Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail.	**3**
	IP Security: Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management	**3**
	Web Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, HTTPS standard , Secure Socket Shell	**3**
	Intrusion: Intruders, Intrusion Techniques, Intrusion Detection,	**2**
	Firewalls: Firewall Design Principles, Types of Firewalls	**2**
	Security in Online transactions	

RECOMMENDED READING:

ESSENTIAL READING:

1. Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson, 2010.
2. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2013.

SUPPLEMENTARY READING:

1. Cryptography and Network, Behrouz A Fourouzan, Debdeep Mukhopadhyay, 2ndEdition, TMH, 2011.
2. Information Security Principles and Practice By Mark Stamp, Willy India Edition.

Program: Bachelor of Science (Computer Science)			Semester : V	
Course: Optimization Techniques			Course Code: USMACS504	
Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Credit**	**Continuous Assessment**	**Semester End Examinations (SEE)**	
04	4	25%	75%	

Learning Objectives:

- Demonstrate the application of optimization in real life.
- Apply concepts of optimization in design of computer science.
- Develop pseudo code for analyzing optimization techniques in language and compiler design.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Apply techniques of LPP in real life situations.

CO2: Analyze the tools available to solve various problems of assignments.

CO3: Apply numerical techniques in real life situations.

CO4: Formulate different optimization techniques and apply them.

CO5: Develop techniques of problem solving.

Outline of Syllabus: (per session plan)		
Module	**Description**	**No of hours**
1	Introduction, Introduction to simplex methods	15
2	Advanced simplex methods, dual simplex algorithm and duality	15
3	Transportation and assignment models.	15
4	Solutions of Algebraic and Transcendental Equations	15
	Total	**60**

Module	Optimization Techniques	No. of Hours/Credits 60/4
1	**Introduction, Introduction to simplex methods**	**15**
	Introduction to operation research and optimization. Need of optimization, historical development, classification and formulation of optimization problem. Classical optimization methods, calculus based methods, random search algorithm.	3
	Linear programming problem: Formulation , objective function constraints, decision variables, canonical and standard form, parameter and variables. Graphical LPP for two variables.	3
	Introduction to Simplex method : simplex algorithm and tabular representation , types of solution feasible/ non feasible , generate/ non generate , unique/alternate/ infinite , bounded/unbounded solutions and their interpretation from simplex table , mutual solutions of problem solving up to four iterations.	3
	Integer programming : branch and bound technique , cutting plane algorithm	3
	Sensitivity Analysis : change in objective function coefficient(cj), change in the coefficient of non basic variable, change in coefficient of non basic variable in cost minimization problem	3
2	**Advanced simplex methods, dual simplex algorithm and duality**	**15**
	Artificial variables, Big M methods, bounded / unbounded solution, pseudo optimum solution, degeneracy.	3
	Two Phase simplex method , dual simplex method, relationship of primal and dual , formulation of dual simplex method, rules for constructing dual from primal, advantages.	3
	Duality and computation of replacement ratio. bounded / unbounded solution, pseudo optimum solution, degeneracy. Comparison of duality and dual simplex method.	3
	Introduction to simulation : definition, working area of simulation, steps of simulation process, advantages and disadvantages of simulation, role of simulation in computer science, applications	3
	introduction to sequencing problem, processing n jobs through two machines	3
3	**Transportation and assignment models.**	**15**
	Transportation and assignment models : special case of LPP model, problem formulation, transportation algorithms NWCR, LCM, VAM. Finding optimal solution using MODI method.	5
	Assignment problem and problem formulation, Hungarian method traveling sales man problem, advantages and applications of transportation and assignment model.	3

	Game theory :introduction, two person zero sum games, pure strategies , games with saddle point.	3
	Introduction to decision theory : steps in decision theory approach, types of decision making environments, decision making under uncertainty , criteria of regret.	4
4	**Solutions of Algebraic and Transcendental Equations**	15
	The Bisection Method, The Newton-Raphson Method, The Regula-falsi method, The Secant Method. Interpolation: Forward Difference, Backward Difference, Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation, Lagrange's Interpolation	5 5 5

RECOMMENDED READING:

ESSENTIAL READING:

1) Operation research –Theory and Applications , 7th Edition J K Sharma
2) Operation research – P K Gupta , Hira S Chand 2018
3) Introductory Methods of Numerical Methods S. S. Shastri PHI

SUPPLEMENTARY READING:

1) Mathematical Programming Techniques : Kambo N S , McGraw Hill
2) Numerical Analysis Richard L. Burden, J. Douglas Faires Cengage Learning 9 th 2011

Program: Bachelor of Science (Computer Science)		Semester: V	
Course: Computer Science Practical 12 (Information and Network Security and Optimization Technique)		Course Code: USMACSP534	
Teaching Scheme		**Evaluation Scheme**	
Practical (Hours per week)	**Credit**	**Continuous Assessment (CA)**	**Semester End Examinations (SEE)**
6	3	20%	80%

List of Practical: Information and Network Security (Languages use as Python / java)

Sr. No.	Topic
1	Write programs to implement the following Substitution Cipher Techniques: - CaesarCipher - Monoalphabetic Cipher
2	Write programs to implement the following Substitution Cipher Techniques: - VernamCipher - Playfair Cipher
3	Write programs to implement the following Transposition Cipher Techniques: - Rail Fence Cipher - Simple Columnar Technique
4	Write program to encrypt and decrypt strings using - DES Algorithm - AES Algorithm
5	Write a program to implement RSA algorithm to perform encryption / decryption of agiven string.
6	Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys.
7	Write a program to create worm.
8	Write a program to create a virus
9	Write a program to generate SHA-512
10	Write a program to calculate HMAC-SHA1 Signature

List of Practical: Optimization Technique

Sr. No.	Topic.
1	LPP by graphical minimization/ maximization of LPP
2	LPP by simplex (<=)

3	LPP by simplex using big M method
4	Transportation problems using NWCR, LCM and VAM
5	Optimization of transportation using MODI
6	Assignment problem
7	Two Phase simplex method
8	Converting primal to dual and solve by simplex
9	Game theory
10	Bisection Method, The Newton-Raphson Method

Program: Bachelor of Science (Computer Science)		Semester : V	
Course: Skill Enhancement: Software Testing and Quality Assurance		Course Code: USMACS502	
Teaching Scheme		Evaluation Scheme	
Lecture (Hours per week)	Credit	Continuous Assessment (CA)	Semester End Examinations (SEE)
2	2	25%	75%

Learning Objectives:

- To Summarize different software testing techniques
- To articulate how testing methods can be used to ensure quality assurance in software projects
- To sketch efficient test cases

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Illustrate different testing strategies and methods with appropriate case studies
CO2: Design test plans for software projects
CO3: Use automation of test cases
CO4: Apply Selenium test cases on websites and programs

Outline of Syllabus: (per session plan)

Module	Description	No of hours
1	Software Testing and its types, Introduction to Quality	10
2	Software Metrics and Defect Management, Selenium IDE	10
3	Software Quality Assurance and Automation of Test Cases	10
	Total	**30**

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Module	Skill Enhancement: Software Testing and Quality Assurance	No. of Hours/Credits 30/2
1	**Software Testing and its types, Introduction to Quality**	**10**
	Software Testing and Introduction to quality : Introduction, Nature of errors, an example for Testing	2
	Definition of Quality , QA, QC, QM and SQA , Software Development Life Cycle, Software Quality Factors	2
	Verification and Validation : Definition of V &V , Different types of V & V Mechanisms	2
	Concepts of Software Reviews, Inspection and Walkthrough Software Testing Techniques : Testing Fundamentals, Test Case Design, White Box Testing and its types, Black Box Testing and its types.	3
2	**Software Metrics and Defect Management, Selenium IDE**	**10**
	Software Testing Strategies : Strategic Approach to Software Testing, Phases of Testing - Unit Testing, Integration Testing, Validation Testing, System Testing	3
	Software Metrics : Concept and Developing Metrics, Different types of Metrics – Size-Oriented Metrics, Function-Oriented Metrics, Halstead Metrics, Complexity metrics	3
	Defect Management: Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.	2
	Introduction to Selenium IDE – Selenium Commands, Creating test cases in Selenium, Testing a website.	2
3	**Software Quality Assurance and Automation of Test Cases**	**10**
	Software Quality Assurance : Quality Concepts, Quality Movement, Background Issues, SQA activities, Software Reviews, Formal Technical Reviews, Formal approaches to SQA, Statistical Quality Assurance, Software Reliability	4
	The ISO 9000 Quality Standards, , SQA Plan , Six sigma, Informal Reviews Quality Improvement : Introduction, Pareto Diagrams, Cause-effect Diagrams, Scatter Diagrams, Run charts Quality Costs : Defining Quality Costs, Types of Quality Costs, Quality Cost Measurement, Utilizing Quality Costs for Decision-Making	3
	Automation of Test Cases – Automation of creation and retrieval of Excel file, Counting the number of objects in a webpage	3

RECOMMENDED READING:
ESSENTIAL READING:
1. Software Engineering for Students, A Programming Approach, Douglas Bell, 4 th Edition, Pearson Education, 2005.
2. Software Engineering – A Practitioners Approach, Roger S. Pressman, 5 th Edition, Tata McGraw Hill, 2001

SUPPLEMENTARY READING:
1. Software engineering: An Engineering approach, J.F. Peters, W. Pedrycz , John Wiley,2004
2. Software Testing and Quality Assurance Theory and Practice, Kshirsagar Naik, Priyadarshi Tripathy , John Wiley & Sons, Inc. , Publication, 2008
3. Software Engineering and Testing, B. B. Agarwal, S. P. Tayal, M. Gupta, Jones and Bartlett Publishers, 2010

Program: Bachelor of Science (Computer Science)		Semester: V	
Course: Project Implementation		Course Code: USMACSP56	
Teaching Scheme		**Evaluation Scheme**	
Learner Effort (Total Hours)	**Credit**	**Continuous Assessment (CAE)**	**Semester End Examinations (SEE)**
60 - 80	2	40%	60%

Learning Objectives:

- Identifying the problem
- Identifying suitable Technologies to create the application
- Implementing or performing experiments and develop correct practices of observing the results
- Applying various techniques to evaluate results and deferring appropriate conclusions

Course Outcomes:

After completion of the course the learners will:

CO1: Identify the domain area and apply techniques
CO2: Apply fundamental concepts of database in real life.
CO3: Apply software development lifecycle
CO4: Develop front end solutions with test cases
CO5: Create operationally feasible solutions

Guidelines for Project Implementation in Semester – V

- To ensure proper conduction of each project, progress of each project should be monitored on continuous basis first by the supervisor.
- Students are expected to create Application which has User Interface, Business Logic and Database Connectivity.
- Student must report progress of the project to faculty in-charge once a week.
- Faculty in-charge should conduct mid-semester presentations of the student project as part of continuous evaluation.
- **Evaluation scheme for continuous evaluation:**
  Maximum: 40 Marks

- **Evaluation Scheme for End Semester:**
  Maximum: 60 Marks

Guidelines for Documentation of Project Implementation in Semester – V	
1.	Title: Title of the project
2.	Preparation of Abstract
3.	Preliminary Investigation
4.	Feasibility Study
5.	Description of Modules
6.	UML Diagrams (System Analysis and Design)
7.	The report may be of around 30-35 pages, which needs to be signed by the faculty in charge and head of the Department. Student should submit the signed project

	implementation report along with evaluated copy of the project proposal documentation at the time of Project evaluation and viva as part of the Term End examination
8.	Experimental set up and results: A detailed explanation on how experiments were conducted, what software used and the results obtained. Details like screen shots, tables and graphs can come here. It shall be of 10 to 15 pages.
9.	Analysis of the results: A description on what the results means and how they have been arrived at. Different performing measures or statistical tools used etc. may be part of this. It shall be of 4 to 6 pages.
10.	Testing and Writing test cases: A List of tests are performed and List of test cases identify for the project
11.	Conclusion: A conclusion of the project performed in terms of its outcome (May be half a page).
12.	Future enhancement. A small description on what enhancement can be done when more time and resources are available (May be half a page)
13.	Program code: The program code should be given as appendix. 8. The report may be of around 30 pages (excluding program code), which needs to be signed by the faculty in charge and head of the Department. Student should submit the signed project implementation report along with evaluated copy of the project proposal documentation at the time of Project evaluation and viva as part of the Term End examination.

Program: Bachelor of Science (Computer Science)			Semester: VI	
Course: Wireless Sensor Networks and Mobile Communication			Course Code: USMACS601	
Teaching Scheme			Evaluation Scheme	
Lecture (Hours per week)	Credit	Continuous Assessment	Semester End Examinations (SEE)	
04 -	- 4	25%	75%	

Learning Objectives:

- In this era of wireless and adhoc network, connecting different wireless devices and understanding their compatibility is very important. Information is gathered in many different ways from these devices. Learner should be able to conceptualize and understand the framework. On completion, will be able to have a firm grip over this very important segment of wireless network.

Course Outcomes:
After completion of the course, learners would be able to:
CO1: Develop various applications of wireless sensor networks
CO2: Explore the concepts, protocols, design, implementation and use of wireless sensor networks.
CO3: Model working of mobile telecommunications system

Outline of Syllabus: (per session plan)		
Module	Description	No of hours
1	Fundamentals of WSN	15
2	Advanced issues in WSN	15
3	MAC in WSN	15
4	Mobile telecommunications	15
	Total	60

Module	Wireless Sensor Networks and Mobile Communication	No. of Hours/Credits 60/4
1	**Fundamentals of WSN**	**15**
	Introduction: Introduction to Sensor Networks, unique constraints and challenges. Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETworks (MANETs) and Wireless Sensor Networks, Wireless fieldbuses and WSNs, Enabling technologies for Wireless Sensor Networks.	**5**
	Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Runtime environments for sensor nodes, Operating systems and execution environments, introduction to TinyOS and nesC. Network architecture, Optimization goals and figures of merit	**6**
	Design principles for WSNs, Service interfaces of WSNs, Gateway concepts. Channel models, Transceiver design	**4**
2	**Advanced issues in WSN**	**15**
	Naming & Addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses, Distributed assignment of locally unique addresses, Content-based and geographic addressing	**5**
	Time synchronization: Introduction, Protocols based on sender/receiver synchronization - LTS, Protocols based on receiver/receiver synchronization - RBS	**5**
	Localization and positioning: Properties of localization and positioning procedures, Possible approaches, Single-hop localization, Positioning in multihop environments	**5**
3	**MAC in WSN**	**15**
	Medium Access Control Protocols: Principal options and difficulties, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC, Dynamic S-MAC, Mobility-aware MAC, D-MAC, Timeout-MAC Case Study	**6**
	Routing Protocols : Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks.	**5**
	Transport Control Protocols : Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols	**4**

4	Mobile telecommunications	15
	Introduction, Wireless Transmission and Medium Access Control: Applications, A short history of wireless communication. Wireless Transmission: Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems. Telecommunication,	4
	Satellite and Broadcast Systems: GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, security, New data services; DECT: System architecture, Protocol architecture; ETRA, UMTS and IMT- 2000.	8
	Satellite Systems: History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover Broadcast Systems: DAB: Architecture, DVB	3

RECOMMENDED READING

ESSENTIAL READING:

1. Protocols and Architectures for Wireless Sensor Network, Holger Kerl, Andreas Willig, John Wiley and Sons, 2005
2. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli and TaiebZnati, John Wiley & Sons, 2007
3. Mobile communications, Jochen Schiller,2nd Edition, Addison wisely, Pearson Education,2012

SUPPLEMENTARY READING:

4. Fundamentals of Wireless Sensor Networks, Theory and Practice, Waltenegus Dargie, Christian Poellabauer , Wiley Series on wireless Communication and Mobile Computing, 2011
5. Networking Wireless Sensors, Bhaskar Krishnamachari , Cambridge University Press, 2005

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)		Semester: VI	
Course: Ethical Hacking & Cyber forensics		Course Code:- USMACS605	
Teaching Scheme		**Evaluation Scheme**	
Lecture (Hours per week)	**Credit**	**Continuous Assessment**	**Semester End Examinations (SEE)**
04	4	25%	75%

Learning Objectives:

- To advance conceptual cognizance of ethics, legality, methodologies and techniques of hacking and the procedures for identification, preservation, extraction of electronic evidence, auditing and investigation of network and host system intrusions, analysis and documentation of information gathered.

Course Outcomes:

After completion of the course, learners will be able to:

CO1: Identify security vulnerabilities and weaknesses in the target applications.
CO2: Analyse security systems using various tools
CO3: Investigate forensics in different networks
CO4: Evaluate various media to collect evidence, report them in a way that would be acceptable in the court of law.

Outline of Syllabus: (per session plan)

Module	Description	No of hours
1	Information Security: Attacks, Vulnerabilities and their prevention mechanisms	15
2	Ethical Hacking – I (Introduction and pre-attack).	15
3	Computer, Network, Cell Phone & Internet Forensics.	15
4	E-mail Forensics, social media forensics & Investigations	15
	Total	**60**

Module	Ethical Hacking & Cyber forensics	No. of Hours/Credits 60/4
1	**Information Security: Attacks, Vulnerabilities and their prevention mechanisms**	**15**
	Information Security: Attacks and Vulnerabilities Asset, Access Control, CIA, Authentication, Authorization, Risk, Threat, Vulnerability, Attack, Malware, Worms, viruses, Trojans, Spyware, Rootkits, Types of vulnerabilities: Top 10 OWASP.	**5**
	Types of attacks and their common prevention mechanisms: Keystroke Logging, Denial of Service (DoS /DDoS), Waterhole attack, brute force, phishing and fake WAP, Eavesdropping, Man-in-the-middle, Session Hijacking, Clickjacking, Cookie Theft, URL Obfuscation, buffer overflow, DNS poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs and BOTNETs	**5**
	Case-studies: Recent attacks – Yahoo, Adult Friend Finder, eBay, Equifax, WannaCry, Target Stores, Uber, JP Morgan Chase, Bad Rabbit, Media Markt, Kaseya, JBS, Colonial Pipeline, The University of California at San Francisco.	**5**
2	**Ethical Hacking**	**15**
	Introduction: Ethical Hacking Terminology, Types of Hacking Technologies, Phases Black Hat vs. Gray Hat vs. White Hat (Ethical) hacking, why is Ethical hacking needed?	**5**
	How is Ethical hacking different from security auditing and digital forensics? Vulnerability assessment and Penetration Testing, Application Security Testing, Phases, Foot printing and Social Engineering, Sniffers, systems hacking – Windows and Linux – Metasploit	**5**
	Kali Linux, Keylogging, Buffer Overflows, Privilege Escalation, Network hacking - ARP Poisoning, Password Cracking, WEP Vulnerabilities, MAC Spoofing, MAC Flooding, IP Spoofing, SYN Flooding, Smurf attack. Recent Case studies.	**5**
3	**Computer, Network, Cell Phone & Internet Forensic Forensics**	**15**
	Computer Forensics: Introduction to Digital Forensics and its phases, Preparing for Digital Investigations, Data Acquisition and Processing Crime Incident Scenes, Understanding File Systems and recovery, Data Encryption and Compression, Automated Search Techniques, Forensics Software	**5**
	Network Forensic: Introduction to Network Forensics and tracking network traffic, Reviewing Network Logs, Network Forensics	**5**

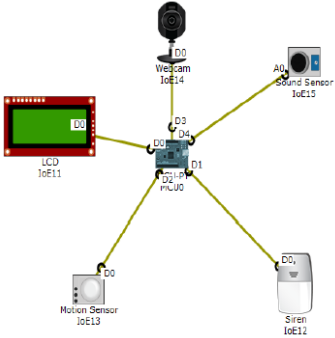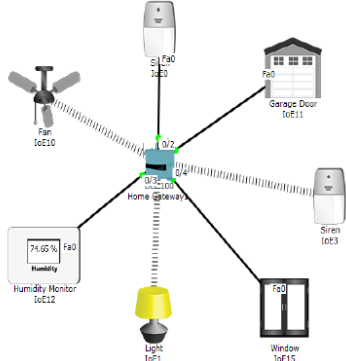|		
	Tools, Performing Live Acquisitions, Order of Volatility, and Standard Procedure. Cell Phone and Mobile Device Forensics: Overview, Acquisition Procedures for Cell Phones and Mobile Devices Internet Forensic: Introduction to Internet Forensics, World Wide Web Threats, Obscene and Incident transmission, Domain Name Ownership Investigation, Reconstructing past internet activities and events	5
4	**E-mail Forensics, social media forensics & Investigations**	**15**
	E-mail Forensics: e-mail analysis, e-mail headers and spoofing, Laws against e-mail Crime, Messenger Forensics: Yahoo Messenger	5
	Social Media Forensics: Social Media Investigations Browser Forensics: Cookie Storage and Analysis, Analyzing Cache and temporary internet files, Web browsing activity reconstruction	5
	Investigation, Evidence presentation and Legal aspects of Digital Forensics: Authorization to collect the evidence, Acquisition of Evidence, Authentication of the evidence, Analysis of the evidence, Reporting on the findings, Testimony, Report Writing for High-Tech Investigations Introduction to Legal aspects of Digital Forensics: Laws & regulations, Information Technology Act, Giving Evidence in court, Case Study – Cyber Crime cases, Case Study – Cyber Crime cases.	5

RECOMMENDED READING:

ESSENTIAL READING:

1) CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Kimberly Graves
2) Guide to computer forensics and investigations, Bill Nelson, Amelia Philips and Christopher Steuart, course technology,5th Edition,2015 Additional
3) https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project 5)
4) https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10 6)
5) https://www.owasp.org/index.php/OWASP_Testing_Guide_v4_Table_of_Contents 7)
6) https://www.owasp.org/index.php/OWASP_Secure_Coding_Practices_-_Quick_Reference_
7) Guide 8) https://cve.mitre.org/ 9) https://access.redhat.com/blogs/766093/posts/2914051 10)
8) http://resources.infosecinstitute.com/applications-threat-modeling/#gref 11)
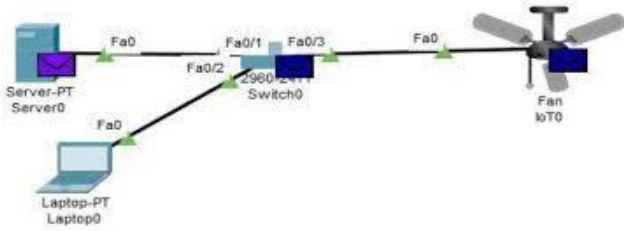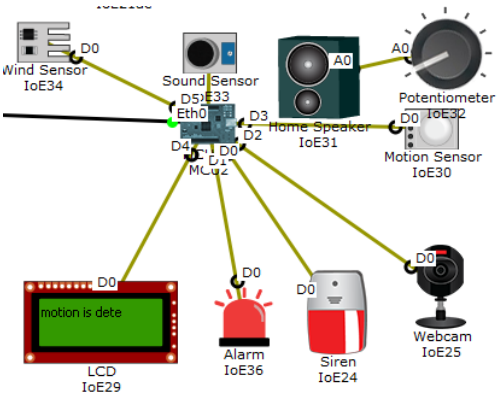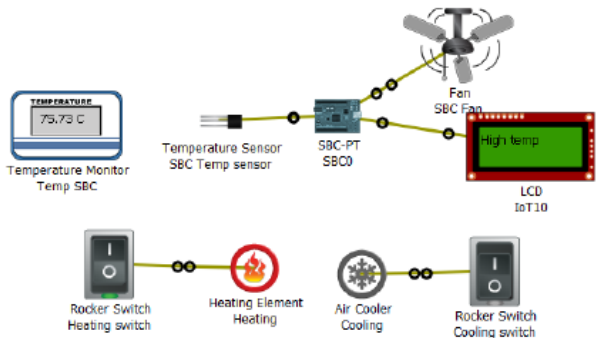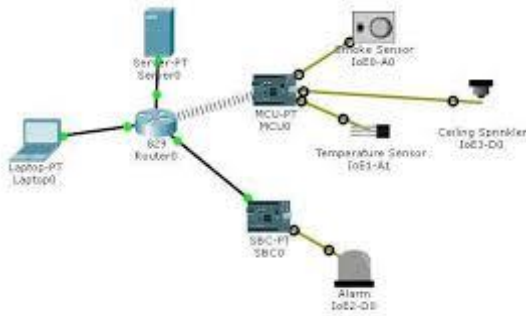9) http://www.vulnerabilityassessment.co.uk/Penetration%20Test.html

SUPPLEMENTARY READING:

1) Incident Response and computer forensics, Kevin Mandia, Chris Prosise, Tata McGrawHill,2nd Edition,2003
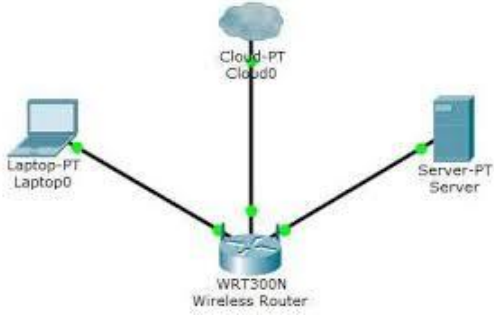2) Certified Ethical Hacker: Michael Gregg, Pearson Education,1st Edition, 2013

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)		Semester: VI
Course: Computer Science Practical 13 (Based on Wireless Sensor Networks and Mobile Communication and Ethical Hacking and Cyber Forensics)		Course Code: USMACSP612

Teaching Scheme		Evaluation Scheme	
Practical (Hours per week)	Credit	Continuous Assessment (CA)	Semester End Examinations (SEE)
6	3	20%	80%

List of Practical Wireless Sensor Networks and Mobile Communication	
Sr. No.	Topic.
1	Create and simulate a simple adhoc network
2	Create the following network & simulate its working:
3	Create the following network & simulate its working:
4	Create the following network & simulate its working:

5	Create the following network & simulate its working:
6	Create the following network & simulate its working:
7	Create the following network & simulate its working:

8	Create the following network & simulate its working:
9	Implement the working of LEACH algorithm
10	Implement the working of SPIN algorithm

List of Practical Ethical Hacking and Cyber Forensics

Sr. No.	Topic.
1	Port Scanning using NMap, Superscan
2	Use Wireshark (Sniffer) to capture network traffic and analyze.
3	Simulate persistent cross-site scripting attack.
4	Session impersonation using Firefox and Tamper Data add-on.
5	Perform SQL injection attack
6	simple keylogger using python
7	Creating a Forensic Image using FTK Imager/Encase Imager : - Creating Forensic Image - Check Integrity of Data - Analyze Forensic Image
8	Using Sysinternals tools for Network Tracking and Process Monitoring : - Check Sysinternals tools - Monitor Live Processes - Capture RAM - Capture TCP/UDP packets - Monitor Hard Disk - Monitor Virtual Memory - Monitor Cache Memory
9	Recovering and Inspecting deleted files - Check for Deleted Files - Recover the Deleted Files - Analyzing and Inspecting the recovered files Perform this using recovery option in ENCASE and also Perform manually through command line.
10	Email forensics using Access Data FTK

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)		Semester: VI	
Course: Information Retrieval		Course Code: USMACS603	
Teaching Scheme		**Evaluation Scheme**	
Lecture (Hours per week)	**Credit**	**Continuous Assessment**	**Semester End Examinations (SEE)**
04	4	25%	75%

Learning Objectives:
- To provide an overview of the important issues in classical and web information retrieval. Thefocus is to give an up-to- date treatment of all aspects of the design and implementation of systems for gathering, indexing, and searching documents and of methods for evaluating systems.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Define Information retrieval and tabulate its components.
CO2: Identify Boolean retrieval methods and evaluate queries using it.
CO3: Infer term vocabulary and apply normalization.
CO4: Discuss and Demonstrate different index construction and compression methods.
CO5: Explain different recommender system and specialized searches.
CO6: Assess link analysis methods and implement them.
CO7: Appraise and create simple crawlers.

Outline of Syllabus: (per session plan)

Module	Description	No of hours
1	Introduction to Information Retrieval and Boolean Retrieval	15
2	Index Construction, Compression & Specialized Search	15
3	Vector Space Model, Query Expansion and feedback	15
4	Web Search Engine Crawlers and Link Analysis	15
	Total	**60**

Module	Information Retrieval	No. of Hours/Credits 60/4
1	**Introduction to Information Retrieval and Boolean Retrieval**	15
	Introduction to Information Retrieval: Introduction, History of IR, Components of IR, and Issues related to IR	2
	Boolean retrieval, The term vocabulary and postings lists,	9
	Dictionaries and tolerant retrieval.	4
2	**Index Construction, Compression & Specialized Search**	15
	Index Construction & Compression	9
	Personalized search, Collaborative filtering and content-based recommendation of documents and products	3
	handling "invisible" Web, Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval,	4
	Hadoop & Map Reduce	1
3	**Vector Space Model, Query Expansion and feedback**	15
	Vector space model - Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring	6
	Evaluation in information retrieval - Information retrieval system evaluation, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results	5
	Assessing relevance Relevance feedback and pseudo relevance feedback	4
4	**Web Search Engine Crawlers and Link Analysis**	15
	Link Analysis, hubs and authorities, Page Rank and HITS algorithms	5
	Web Search Engine: Web search overview, web structure, the user, paid placement, search engine optimization/spam, Web size measurement, search engine optimization/spam, Web Search Architectures	6
	Web crawling and indexes	4

RECOMMENDED READING:

ESSENTIAL READING:

1. Introduction to Information Retrieval, C. Manning, P. Raghavan, and H. Schütze, Cambridge University Press, 2008
2. Modern Information Retrieval: The Concepts and Technology behind Search, Ricardo Baeza - Yates and Berthier Ribeiro – Neto, 2nd Edition, ACM Press Books 2011.

SUPPLEMENTARY READING:

1. Search Engines: Information Retrieval in Practice, Bruce Croft, Donald Metzler and Trevor Strohman, 1st Edition, Pearson, 2009.
2. Information Retrieval Implementing and Evaluating Search Engines, Stefan Büttcher,
3. Charles L. A. Clarke and Gordon V. Cormack, The MIT Press; Reprint edition (February 12, 2016)

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)			Semester : VI	
Course: Data Science			Course Code: USMACS606	
Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Credit**		**Continuous Assessment**	**Semester End Examinations (SEE)**
04	4		25%	75%

Learning Objectives:

- Demonstrate the application data in real life.
- Apply concepts of statistical techniques with respect to data.
- Develop pseudo code for analyzing data and its parameters.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Analyse the importance and veracity of data

CO2: Prioritize the tools available to visualize data

CO3: Apply supervised learning models on standard data set.

CO4: Develop techniques of removing noise from data

Outline of Syllabus: (per session plan)		
Module	**Description**	**No of hours**
1	Introduction to Data Science	15
2	Data Curation	15
3	Data Management and Organization	15
4	Data Visualization	15
	Total	**60**

Module	Data Science	No. of Hours/Credits 60/4
1	**Introduction to Data Science**	**15**
	What is Data? Different kinds of data, Introduction to high level programming language + Integrated Development Environment (IDE), Exploratory Data Analysis (EDA) + Data Visualization, Different types of data sources, Data Management: Data Collection, Data cleaning/extraction, Data analysis & Modeling	**7**
	Introduction to high level programming language + Integrated Development	**3**
	Data sources: e.g. relational databases, web/API, streaming, Data collection: e.g. sampling, design (observational vs experimental) and its impact on visualization, modeling and generalizability of results	**5**
2	**Data Curation**	**15**
	Data Curation: Query languages and Operations to specify and transform data, Structured/schema based systems as users and acquirers of data Semi-structured systems as users and acquirers of data, Unstructured systems in the acquisition and structuring of data, Security and ethical considerations in relation to authenticating and authorizing access to data on remote systems.	**7**
	Data analysis/modeling: Question/problem formation along with EDA Introduction to estimation and inference (testing and confidence intervals) including simulation and resampling o Scope of inference Assessment and selection e.g. training and testing sets	**8**
3	**Data Management and Organization**	**15**
	Large scale data systems Paradigms for distributed data storage o Practical access to example systems , Introduction to NoSQL Amazon Web Services (AWS) provides public data sets in Landsat, genomics, multimedia.	**5**
	Layered Framework: Definition of Data Science Framework, Cross Industry Standard Process for Data Mining (CRISP-DM), Homogeneous Ontology for Recursive Uniform Schema, The Top Layers of a Layered Framework, Layered Framework for High-Level Data Science and Engineering Business Layer: Business Layer, Engineering a Practical Business Layer Utility Layer: Basic Utility Design, Engineering a Practical Utility Layer	**5**
	Layer II Three Management Layers: Operational Management Layer, Processing-Stream Definition and Management, Audit, Balance, and Control Layer, Balance, Control, Yoke Solution, Cause-and-Effect, Analysis System, Functional Layer, Data Science Process	**5**

4	**Introduction to Supervised Algorithms**	15
	Introduction to Regression: Linear Regression, Polynomial regression. Metric for regression –mean square error.	5
	Introduction to classification : decision tree, threshold for classification , metric for classification-accuracy, F1 score , confusion matrix. Type I and type 2 errors.	5
	Bias and variance , overfitting and under fitting in supervised algorithm	5

RECOMMENDED READING:

ESSENNTIAL READING:

1) "Fundamentals of Data Science: Take the First Step to Become A Data Scientist", Samuel Burns, Amazon KDP Printing and Publishing.
2) "Practical Statistics for Data Science", Peter Bruce, Andrew Bruce, O'Reilly, 2017.
3) "Practical Data Science Cookbook", Prabhanjan Tatter, Tony Ojeda, Sean Patrik Murphy, Benjamin Bengfort, Abhijit Dasgupta, 2nd Edition, Packt, 2014

SUPPLEMENTARY READING:

1) "Probability and Statistics for Engineers", Dr. J. Ravichandran,2010.
2) "Statistics for Data Science", James D. Miller, Packt, 2017

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)		Semester: V	
Course: Computer Science Practical 14 (Based on Information Retrieval and Data Science)		Course Code: USMACSP634	
Teaching Scheme		**Evaluation Scheme**	
Practical (Hours per week)	**Credit**	**Continuous Assessment (CA)**	**Semester End Examinations (SEE)**
6	3	20%	80%

List of Practical Information Retrieval

Sr. No.	Topic.
1	Write a program to implement incidence matrix and evaluate query.
2	Write a program for Pre-processing of a Text Document: stop word removal.
3	Write program to implement k-grams.
4	Implement Dynamic programming algorithm for computing the edit distance betweenstrings s1 and s2. (Hint. Levenshtein Distance)
5	Implement Porter Stemmer.
6	Write a program to Compute Similarity between two text documents.
7	Write a program to implement Soundex algorithm
8	Write a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each letter should be case-insensitive (i.e.,include both upper-case and lower-case versions of the letter; Ignore non-alphabetic characters).
9	Write a program for index compression
10	Implement Page Rank Algorithm.
11	Write a program for mining Twitter to identify tweets for a specific period and identifytrends and named entities.
12	Write a program to implement simple web crawler.

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Sr. No.	Topic.
List of Practical Data Science	
1	Data Collection, Modelling and Compilation.
2	Data Visualization.
3	Data normalization (removal of useless columns, clean data)
4	Exploratory data analysis.
5	Linear regression
6	Multivariate Regression analysis
7	Data transformations and quality analysis.
8	Implement decision tree
9	Data visualization

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Computer Science)		Semester : VI	
Course: Skill Enhancement: Human Computer Interaction		Course Code: USMACS607	
Teaching Scheme		**Evaluation Scheme**	
Lecture (Hours per week)	Credit	Continuous Assessment	Semester End Examinations (SEE)
02	2	25%	75%

Learning Objectives:
- To facilitate communication between students of psychology, design, and computer science on user interface development projects.
- To provide the future user interface designer with concepts and strategies for making design decisions.
- To expose the future user interface designer to tools, techniques, and ideas for interface design.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Analyze the importance user interactions.

CO2: Compare the tools and techniques of screen design components **CO3:** Analyze the tools and techniques of components

CO3: Apply models in real life

CO4: Develop techniques of designing human computer interactions

Outline of Syllabus: (per session plan)		
Module	**Description**	**No of hours**
1	Introduction to HCI	10
2	Screen Designing	10
3	Components and tools	10
	Total	**30**

Module	Skill Enhancement: Human Computer Interaction	No. of Hours/Credits 30/2
1	**Introduction to HCI**	**10**
	Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.	3
	The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.	3
	Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions.	4
2	**Screen Designing**	**10**
	Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design	6
	Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls.	4
3	**Components and tools**	**10**
	Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors. Software tools – Specification methods, interface – Building Tools.	5
	Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers	5

RECOMMENDED READING:

ESSENTIAL READING:

1) The essential guide to user interface design, Wilbert O Galitz, Wiley DreamTech.
2) Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.

SUPPLEMENTARY READING:

1) Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education
2) Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech
3) User Interface Design, Soren Lauesen , Pearson Education

Program: Bachelor of Science (Computer Science)		Semester: VI	
Course: Project Implementation		Course Code: USMACSP66	
Teaching Scheme		**Evaluation Scheme**	
Learner Effort (Total Hours)	**Credit**	**Continuous Assessment(CA)**	**Semester End Examinations (SEE)**
60 - 80	2	40%	60%

Learning Objectives:

- Implementing various kinds of new technologies like Gamming Application, Data Science, Artificial Intelligence, etc.
- Identifying suitable Technologies to create the application
- Implementing or performing experiments and develop correct practices of observing the results
- Applying various techniques to evaluate results and deferring appropriate conclusions

Course Outcomes:

After completion of the course the learners will:

CO1: Design environment for computer-based problem solving
CO2: Analyse the importance of data
CO3: Demonstrate different visualization techniques
CO4: Create abstract machine environment for real life applications
CO5: Design solutions for decidable problem statements

Guidelines for Project Implementation in Semester – VI

Guidelines for Documentation of Project Implementation in Semester – VI	
1.	Title: Title of the project
2.	Preparation of Abstract
3.	Preliminary Investigation
4.	Feasibility Study
5.	Description of Modules (if any)
6.	UML Diagrams (System Analysis and Design) Or the Flow chart of the working
7.	The report may be of around 30-35 pages, which needs to be signed by the faculty in charge and head of the Department. Student should submit the signed project implementation report along with evaluated copy of the project proposal documentation at the time of Project evaluation and viva as part of the Term End examination
8.	Experimental set up and results: A detailed explanation on how experiments were conducted, what software used and the results obtained. Details like screen shots, tables and graphs can come here.
9.	Analysis of the results: A description on what the results means and how they have been arrived at. Different performing measures or statistical tools used etc. may be part of this. It shall be of 4 to 6 pages.

10.	Testing and Writing test cases: A List of tests are performed and List of test cases identify for the project
11.	Conclusion: A conclusion of the project performed in terms of its outcome (May be half a page).
12.	Future enhancement. A small description on what enhancement can be done when more time and resources are available (May be half a page)