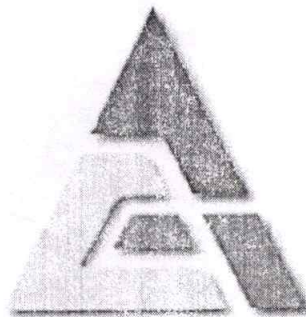


AMRITSAR GROUP OF COLLEGES

Autonomous status conferred by UGC under UGC act-1956, (2f), NAAC-A Grade,
(Formerly Known as Amritsar College of Engineering & Technology | Amritsar Pharmacy College)

14th Meeting of Board of Studies (06-05-2026)



**Department of Computer Applications
Amritsar Group of Colleges, Amritsar**

Ref No.: AGC/DCA/2891

Dr. Sandeep Sharma, Professor and Head CSE GNDU, Amritsar Member
Dr. Kamal Nain Sharma, Assistant Professor, School of Computer Member
Applications, LPU, Jalandhar
Dr. Neha Sethi, Assistant Professor, Hindu College, Amritsar Member
Mr. Gaurav Gupta, Alumni, Accenture, Gurugram Member
All Faculty members, Department of Computer Applications, AGC, Amritsar Member

Sub: Agenda of Board of Studies, Department of Computer Applications

Sir/ Madam,

A meeting of Board of Studies is scheduled on May 6th, 2026 at Department of Computer Applications of AGC, Amritsar

The agenda of the meeting is as follows:

1. To approve the minutes of Previous meeting of Board of Studies.
2. To discuss and finalize the detailed Study Scheme, Syllabi and Course Outcomes for 5th and 6th semester of BCA to be applicable for 2024 admitted batch and onwards.
3. To discuss and finalize the detailed Study Scheme, Syllabi and Course Outcomes for 3rd and 4th semester of BCA to be applicable for 2025 admitted batch and onwards.
4. To adopt Study Scheme and Syllabus for MCA as prescribed by IKGPTU in year 2025, to be applicable for 2026 admitted batch and onwards and to finalize Course Outcomes for the same.
5. To authorize the Chairperson (BoS) to approve appropriate SWAYAM courses for up to 40% of the subjects in a semester to be offered in online mode.
6. To apprise the BoS members about the results of the Nov-2025 End Semester Examination (ESE).
7. To apprise the BoS members regarding top performers during Nov-2025 End Semester Examination (ESE).
8. As per AICTE guidelines, all AICTE-approved institutions are required to introduce a mandatory non-credit course on "Disaster Management and Preparedness" starting from the January 2026 session for all undergraduate programs. Accordingly, it is proposed to introduce this course in the 5th semester for the BCA 2025 admitted batch and subsequent batches. The same will be placed for approval in the upcoming Board of Studies (BoS) meeting, subject to the availability of the prescribed syllabus.
9. Any other agenda with the permission of the chair.

Regards

Sachin
27/4/26

Dr. Sachin Khurana
Deputy Dean Academic Affairs, Head DCA
Chairman, Board of Studies
Department of Computer Applications



Dr. Sachin Khurana <hod.mca@acetedu.in>

Agenda of Board of Studies, Department of Computer Applications

1 message

Dr. Sachin Khurana <hod.mca@acetedu.in>

Tue, Apr 28, 2026 at 12:08 PM

To: amit singh <amitacet07@gmail.com>, amit singh <amit_07singh@yahoo.co.in>, waliakanwal@hotmail.com, deep aujla <aujladeep09@gmail.com>, SAHIL LUTHRA <sluthra423@gmail.com>, Saloni Verma <saloni.291997@gmail.com>, Komal Purba <komalpurba@gmail.com>, Nitika Sharma <nitikadvedogra123@gmail.com>, Kajal Kaler <kajal.kaler@acetedu.in>, Manupriya Sabharwal <priyamanu776@gmail.com>, shikha sharma <shonaya.sharma.27@gmail.com>, Anupreet Kaur <anupreet.kaur@acetedu.in>, sandeep.cse@gndu.ac.in, Kamal Nain Sharma <kamalnain3@gmail.com>, neha_tejpal@yahoo.com, Gaurav Gupta <gauravgupta.gsp@gmail.com>, Radhika sharma <sradhika179@gmail.com>, raman deep <ramand708@gmail.com>

Sir/ Madam,

A meeting of Board of Studies is scheduled on May 6th, 2026 at Department of Computer Applications of AGC, Amritsar. Invitation letter is attached.


The agenda of the meeting is as follows:

1. To approve the minutes of Previous meeting of Board of Studies.
2. To discuss and finalize the detailed Study Scheme, Syllabi and Course Outcomes for 5th and 6th semester of BCA to be applicable for 2024 admitted batch and onwards.
3. To discuss and finalize the detailed Study Scheme, Syllabi and Course Outcomes for 3rd and 4th semester of BCA to be applicable for 2025 admitted batch and onwards.
4. To adopt Study Scheme and Syllabus for MCA as prescribed by IKGPTU in year 2025, to be applicable for 2026 admitted batch and onwards and to finalize Course Outcomes for the same.
5. To authorize the Chairperson (BoS) to approve appropriate SWAYAM courses for up to 40% of the subjects in a semester to be offered in online mode.
6. To apprise the BoS members about the results of the Nov-2025 End Semester Examination (ESE).
7. To apprise the BoS members regarding top performers during Nov-2025 End Semester Examination (ESE).
8. As per AICTE guidelines, all AICTE-approved institutions are required to introduce a mandatory non-credit course on "Disaster Management and Preparedness" starting from the January 2026 session for all undergraduate programs. Accordingly, it is proposed to introduce this course in the 5th semester for the BCA 2025 admitted batch and subsequent batches. The same will be placed for approval in the upcoming Board of Studies (BoS) meeting, subject to the availability of the prescribed syllabus.

Any other agenda with the permission of the chair.

Regards

Dr. Sachin Khurana
Deputy Dean Academic Affairs'
HOD (Dept. of Computer Applications)

 Agenda & Invitation (14th BOS Meeting).pdf
128K



Dr. Sachin Khurana <hod.mca@acetedu.in>

14ht BOS meeting DCA

1 message

Dr. Sachin Khurana <hod.mca@acetedu.in>

Tue, May 5, 2026 at 3:07 PM


To: sandeep.cse@gndu.ac.in, Kamal Nain Sharma <kamalnain3@gmail.com>, neha_tejpal@yahoo.com, Gaurav Gupta <gauravgupta.gsp@gmail.com>, shikha sharma <shonaya.sharma.27@gmail.com>, Saloni Verma <saloni.291997@gmail.com>, waliakanwal@hotmail.com, amit singh <amitacet07@gmail.com>, Anupreet Kaur <anupreet.kaur@acetedu.in>, deep aujla <aujladeep09@gmail.com>, Kajal Kaler <kajal.kaler@acetedu.in>, Nitika Sharma <nitikadvedogra123@gmail.com>, Manupriya Sabharwal <priyamanu776@gmail.com>, SAHIL LUTHRA <sluthra423@gmail.com>, Savneet Kaur 1039 <savneetkaur2222@gmail.com>, Uma Arora <umaarora2002@gmail.com>, gurpredt900@gmail.com, Harleen Kaur <kaurharleenkaur469@gmail.com>, shilpa sharma <sharma.angel.madhuri@gmail.com>


As already communicated about BOS meeting on 6th May 2026. I am attaching all the annexures as conveyed in agenda of meeting. Please go through it and provide any comments or suggestions. We will be discussing all the agenda on 6th may in Reading hall 4.

Regards

Dr. Sachin Khurana
Deputy Dean Academic Affairs'
HOD (Dept. of Computer Applications)


6 attachments

 **Annexure-II (BCA 3rd and 4th Sem (2025 onwards) Study Scheme & Syllabus).pdf**
813K

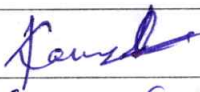
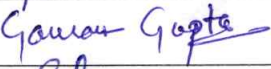



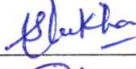
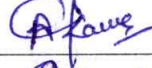
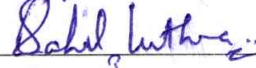
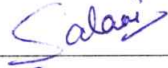


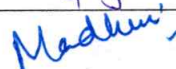
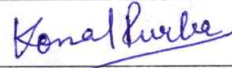


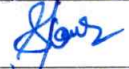

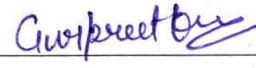
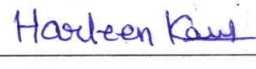
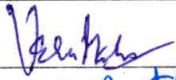

 **(Annexure-VI) Toppers List.pdf**
292K

 **Annexure-I (BCA 5 and 6 (2024 onwards Study Scheme and Syllabus)).pdf**
1023K

 **(Annexure-III)MCA-upto-4th-Sem-batch-2025-onwards.pdf**
2067K

 **(Annexure-V) Result Analysis.pdf**
897K

 **Annexure-IV (Online Courses NPTEL).pdf**
500K

Sno.	Name	Signature
1.	Dr. Sandeep Sharma	Online Mode
2.	Dr. Neha Sethi	Online Mode
3.	Dr. Kamal Nain Sharma	
4.	Mr. Gaurav Gupta	
5.	Dr. Sachin Khurana	
6.	Mr. Amit Singh	
7.	Mr. Kanwaljit Singh Walia	
8.	Ms. Shikha Sharma	
9.	Ms. Arshdeep Kaur	
10.	Mr. Sahil Luthra	
11.	Ms. Saloni Verma	
12.	Ms. Manupriya	
13.	Ms. Kajal Kaler	
14.	Ms. Madhuri Sharma	
15.	Ms. Komal Purba	
16.	Ms. Nitika Sharma	
17.	Ms. Anupreet Kaur	
18.	Ms. Savneet Kaur	
19.	Ms. Harmandeep Kaur	<u>Absent</u>
20.	Ms. Uma	
21.	Ms. Gurpreet Kaur	
22.	Ms. Harleen Kaur	
23.	Mr. Varun Mahajan	
24.	Ms. Jaspreet Kaur	




Dr. Sachin Khurana <hod.mca@acetedu.in>

Proceedings 14th BOS Meeting

2 messages

Nandita Khullar <deo.dca@acetedu.in>
To: "Dr. Sachin Khurana" <hod.mca@acetedu.in>

Thu, May 14, 2026 at 12:41 PM

 **Proceedings 14th BOS Meeting .pdf**
200K

Dr. Sachin Khurana <hod.mca@acetedu.in>

Thu, May 14, 2026 at 1:45 PM

To: sandeep.cse@gndu.ac.in, Kamal Nain Sharma <kamalnain3@gmail.com>, neha_tejpal@yahoo.com, Gaurav Gupta <gauravgupta.gsp@gmail.com>, shikha sharma <shonaya.sharma.27@gmail.com>, Saloni Verma <saloni.291997@gmail.com>, waliakanwal@hotmail.com, amit singh <amitacet07@gmail.com>, Anupreet Kaur <anupreet.kaur@acetedu.in>, deep aujla <aujladeep09@gmail.com>, Kajal Kaler <kajal.kaler@acetedu.in>, Nitika Sharma <nitikadvedogra123@gmail.com>, Manupriya Sabharwal <priyamanu776@gmail.com>, SAHIL LUTHRA <sluthra423@gmail.com>, Savneet Kaur 1039 <savneetkaur2222@gmail.com>, Uma Arora <umaarora2002@gmail.com>, gurpredt900@gmail.com, Harleen Kaur <kaurharleenkaur469@gmail.com>, shilpa sharma <sharma.angel.madhuri@gmail.com>, "Dr. Sachin Khurana" <hod.mca@acetedu.in>


Dear All members I am sharing proceedings of 14th BOS meeting held on 6th May 2026.

It was a fruitful and healthy discussion on all agendas of the meeting. Thanks for your valuable input and guidance.

Regards

Dr. Sachin Khurana
Deputy Dean Academic Affairs'
HOD (Dept. of Computer Applications)

 **Proceedings 14th BOS Meeting .pdf**
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 <p>AMRITSAR GROUP OF COLLEGES NAAC Grade "A" 3rd Cycle Autonomous Status (Since 2014) Conferred by UGC</p>	<p>Proceedings 14th BoS meeting</p>	<p>Department of Computer Applications</p>
	<p>Date: 8th May 2026</p>	

RefNo: AGC/DCA/2896

The Department conducted its Board of studies meeting on May 6th, 2026. Following members were invited for the meeting.

Dr. Sachin Khurana, HOD, DCA, AGC, Amritsar	-in chair
Dr. Sandeep Sharma, Professor and Head CSE GNDU, Amritsar	Member
Dr. Neha Sethi, Assistant Professor Hindu College, Amritsar	Member
Dr. Kamal Nain Sharma, Assistant Professor, School of Computer Applications, LPU, Jalandhar	Member
Mr. Gaurav Gupta, Alumni, Accenture, Gurugram	Member
All Faculty members, Department of Computer Applications, AGC, Amritsar	Member

1. The minutes of 13th meeting of BoS held on 11-Dec-2025 were approved as no further comments were received for the same.
2. Members approved Study Scheme, Syllabi and Course Outcomes for 5th and 6th semester of BCA to be applicable for 2024 admitted batch and onwards after detailed discussion. **(Annexure-I)**
3. Members approved Study Scheme, Syllabi and Course Outcomes for 3rd and 4th semester of BCA to be applicable for 2025 admitted batch and onwards after detailed discussion. **(Annexure-II)**
4. Members were apprised of Study Scheme and Syllabus of MCA as prescribed by IKGPTU (2025 Scheme), to be applicable for 2026 admitted batch and onwards and approved Course Outcomes for the same. **(Annexure-III)**
5. The members of the Board of Studies authorize the Chairperson to approve appropriate SWAYAM courses for up to 40% of the subjects in a semester. This provision shall apply to the 3rd and 4th semesters of the BCA 2025 batch, the 5th and 6th semesters of the BCA 2024 batch, and the 3rd and 4th semesters of the MCA 2025 batch. **(Annexure-IV)**
6. Members were apprised of the results of the Nov-2025 End Semester Examination (ESE). **(Annexure-V)**
7. Members were apprised top performers during Nov-2025 End Semester Examination (ESE). **(Annexure-VI)**
8. As per AICTE guidelines, all AICTE-approved institutions are required to introduce a mandatory non-credit course on "Disaster Management and Preparedness" starting from the January 2026 session for all undergraduate programs. Accordingly, it is proposed to introduce this course in the 5th semester for the BCA 2025 admitted batch

and subsequent batches. The same will be placed for approval in the upcoming Board of Studies (BoS) meeting, subject to the availability of the prescribed syllabus.
(Annexure-VII)

9. Any other agenda with the permission of the chair.
 - a. To apprise the members of Board of Studies about introducing new programmes on the basis of Local, Regional, National and Global needs.
 - b. To apprise the members of the Board of Studies regarding the introduction of the following new programmes from the academic session 2026–27 onwards: Master of Science (Information Technology) [M.Sc. (IT)], Master of Science (Computer Science) [M.Sc. (CS)], and B.Voc. (Software Development). The affiliation order from IKG, PTU is awaited.



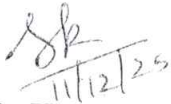
Dr. Sachin Khurana
Chairman, Board of Studies
Department of Computer Applications

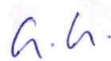
Date: 11 December 2025

The Department conducted its Board of studies meeting on December 10th, 2025. Following members were invited for the meeting.

Dr. Sachin Khurana, HOD, DCA, AGC, Amritsar	-in chair
Dr. Sandeep Sharma, Professor and Head CSE GNDU, Amritsar	Member
Dr. Neha Tejpal, Professor Hindu College, Amritsar	Member
Dr. Kamal Nain Sharma, Assistant Professor, School of Computer Applications, LPU, Jalandhar	Member
Mr. Gaurav Gupta, Alumni, Accenture, Gurugram	Member
All Faculty members, Department of Computer Applications, AGC, Amritsar	Member

1. The minutes of 12th meeting of BoS held on 12-June-2025 were approved as no further comments were received for the same.
2. Members were apprised of the Study Scheme, Syllabi, and Course Outcomes for the 1st semester and the Study Scheme for the 2nd semester of the BCA, applicable for the 2025 admitted batch and onwards. **(Annexure-I)**
3. Detailed discussion of Syllabi and Course Outcomes for 2nd semester of BCA course approved which will be applicable for 2025 admitted batch and onwards. **(Annexure-II)**
4. Members approved courses of MCA offered in online mode through SWAYAM/ NPTEL platform for 4th semester students applicable to 2024 admitted batch and onwards as per NEP 2020 policy of offering upto 40% of total courses in a semester in online mode. **(Annexure-III)**
5. Members approved course of BCA offered in online mode through SWAYAM/ NPTEL platform for 4th semester students applicable to 2024 admitted batch and onwards as per NEP 2020 policy of offering upto 40% of total courses in a semester in online mode. **(Annexure-IV)**
6. Members were apprised of the results of May-2025 of ESE Examinations. **(Annexure-V)**
7. Members were apprised of the external paper setter and evaluator for Nov -Dec 2025 and May-June 2026 ESE examination. **(Annexure-VI)**
8. Members were apprised top performers during May-2025 ESE examination. **(Annexure-VII)**


Dr. Sachin Khurana
Chairman, Board of Studies
Department of Computer Applications

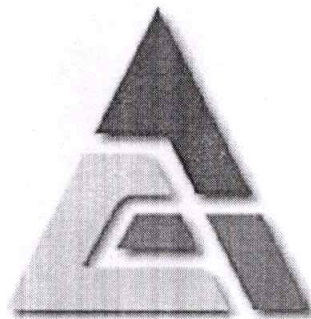






**Scheme and Syllabus of
5th and 6th Semester
Bachelor of Computer Applications
(BCA)**

Batch 2024 onwards



**Department of Computer Applications
Amritsar Group of Colleges, Amritsar**

BCA-5 th Sem									
Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
			BCA24501	Skill Enhancement	Information Security	4	0		
BCA24502	Skill Enhancement	Information Security Laboratory	0	0	2	60	40	100	1
BCA24503	Core Theory	Programming in Java	4	0	0	40	60	100	4
BCA24504	Core Practical/Laboratory	Programming in Java Laboratory	0	0	2	60	40	100	1
	Professional Elective-III Theory		4	0	0	40	60	100	4
	Professional Elective-III Laboratory		0	0	2	60	40	100	1
	Professional Elective-IV Theory		3	0	0	40	60	100	3
	Professional Elective-IV Laboratory		0	0	2	60	40	100	1
BCA24505	Skill Enhancement	Minor Project	0	0	2	60	40	100	1
	TOTAL		15	0	10	460	440	900	20

Professional Elective-III Theory		
Course Code	Course Title	Discipline
BCA24506	Web Programming-I	Full Stack Development
BCA24508	Introduction to Machine Learning	Data Science
BCA24510	Introduction to Data Science	AIML

Professional Elective-III Laboratory		
Course Code	Course Title	Discipline
BCA24507	Web Programming-I Laboratory	Full Stack Development
BCA24509	Introduction to Machine Learning Laboratory	Data Science
BCA24511	Introduction to Data Science Laboratory	AIML

Professional Elective-IV Theory		
Course Code	Course Title	Discipline
BCA24512	Digital Marketing	Full Stack Development
BCA24514	Natural Language Processing	Data Science
BCA24516	Neural Network	AIML

Professional Elective-IV Laboratory		
Course Code	Course Title	Discipline
BCA24513	Digital Marketing Laboratory	Full Stack Development
BCA24515	Natural Language Processing Laboratory	Data Science
BCA24517	Neural Network Laboratory	AIML

G.H.   

(Annexure-I)
BCA-2024

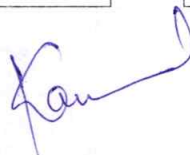
BCA-6 th Sem									
Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BCA24601	Skill Enhancement	Cyber Law & IPR	3	0	0	40	60	100	3
BCA24602	Skill Enhancement Practical/Laboratory	Cyber Law & IPR Laboratory	0	0	2	60	40	100	1
BCA24603	Core Theory	Software Testing & Quality Assurance	4	0	0	40	60	100	4
	Professional Elective-V Theory		4	0	0	40	60	100	4
	Professional Elective-V Laboratory		0	0	2	60	40	100	1
	Professional Elective-VI Theory		4	0	0	40	60	100	4
	Professional Elective-VI Laboratory		0	0	2	60	40	100	1
BCA24604	Skill Enhancement	Major Project	0	0	2	60	40	100	1
	TOTAL		15	0	8	400	400	800	20

Professional Elective-V Theory		
Course Code	Course Title	Discipline
BCA24605	Android Programming	Full Stack Development
BCA24607	Big Data Analytics	Data Science
BCA24609	Digital Image Processing	AIML

Professional Elective-V Laboratory		
Course Code	Course Title	Discipline
BCA24606	Android Programming Laboratory	Full Stack Development
BCA24608	Big Data Analytics Laboratory	Data Science
BCA24610	Digital Image Processing Laboratory	AIML

Professional Elective-VI Theory		
Course Code	Course Title	Discipline
BCA24611	Search Engine Optimization	Full Stack Development
BCA24613	Web Programming-II	Full Stack Development
BCA24615	Prompt Engineering	AIML

Professional Elective-VI Laboratory		
Course Code	Course Title	Discipline
BCA24612	Search Engine Optimization Laboratory	Full Stack Development
BCA24614	Web Programming-II Laboratory	Full Stack Development
BCA24616	Prompt Engineering Laboratory	AIML

G.H. 

SP 

5 th Semester		Information Security			
BCA24501					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Identify issues involved in the field of information security.
CO2	Develop fundamental concepts of cryptography.
CO3	Categorize various types of viruses.
CO4	Develop an understanding of information assurance in operating system.
CO5	Provide basic understanding to manage database security on application level.
CO6	Outline information security risks across the Internet.

Unit	Detailed Contents	CO
I	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense, Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption algorithms, Secure Architecture of an open System. DES and RSA Algorithm.	CO1
	Encryption based security: Asymmetric and symmetric Key Cryptography, Role based Security, Digital Signatures, The Data Encryption Standard, The AES Encryption Algorithms, Public Key Encryptions and Uses of Encryption.	CO2
II	Security in Program: Secure Programs, Non malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General- Purpose operating system protected objects and methods of protection memory and addmens protection. File protection Mechanisms, User Authentication Designing Trusted.	CO3
III	Operating System: Security polices models of security, trusted Operating System design, Assurance in trusted Operating System Implementation examples.	CO4
	Database and Network Security: Database Integration and Secrecy, Inferential Control, Sensitive data, Inference, multilevel database, proposals for multilevel security. Security in Network: Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-Mail	CO5
IV	Administering Security: Security Planning, Risk Analysis, Organizational Security policies, Physical Security. Legal Privacy and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime, Praia, Ethical issues in Computer Security, Case Studies of Corporate Security.	CO6

Reference Books:

1. Charles P.Pfleeger, Shari Lawrence. Security in Computing, Pfleeger. PHI.
2. Jason Andress. The Basics of Information Security, Syngress
3. Mark Stamp. Information Security: Principles and Practice, Wiley.
4. A. Kahate. Cryptography and Network Security, TMH.

A.C. *Kan* *SP* *[Signature]*

5 th Semester		Information Security Laboratory			
BCA24502					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Analyze various system and network attacks including DoS, sniffing, spoofing, viruses, and trojans.
CO2	Evaluate web-based password capturing techniques and related security vulnerabilities.
CO3	Apply anti-intrusion mechanisms and authentication techniques to enhance system security.
CO4	Demonstrate understanding and implementation of symmetric and asymmetric encryption algorithms.
CO5	Apply cryptographic and encryption techniques for securing data and communication.
CO6	Understand network security fundamentals, security policies, ethical hacking, and social engineering concepts.

Sno.	Experiment
1	Study of System threat attacks - Denial of Services. [CO1]
2	Study of Sniffing and Spoofing attacks. [CO1]
3	Study of Different attacks causes by Virus and Trojans. [CO1]
4	Study of Techniques uses for Web Based Password Capturing. [CO2]
5	Study of Anti-Intrusion Technique – Honey pot. [CO3]
6	Study of IP based Authentication. [CO3]
7	Implementation of S-DES algorithm for data encryption. [CO4]
8	Implementation of Asymmetric Encryption Scheme – RSA. [CO4]
9	Study of Symmetric Encryption Scheme – RC4. [CO4]
10	Study of Cryptography Techniques. [CO5]
11	Study of Encryption algorithms [CO5]
12	Study of Security policies. [CO6]
13	Study of Network Security Fundamentals, Ethical Hacking and Social Engineering [CO6]

Reference Books:

1. Charles P.Pfleeger, Shari Lawrence. Security in Computing, Pfleeger. PHI.
2. Jason Andress. The Basics of Information Security, Syngress
3. Mark Stamp. Information Security: Principles and Practice, Wiley.
4. A. Kahate, Cryptography and Network Security, TMH.

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5 th Semester		Programming in JAVA			
BCA24503					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Differentiate between java and procedural languages.
CO2	Define Basic concepts in Java Programming.
CO3	Outline various OOPs concepts in Java Programming.
CO4	Implement Array and strings in Java Programming.
CO5	Outline the importance of exception handling in programs.
CO6	Explain advanced concepts like multithreading, applet used in java.

Unit	Detailed Contents	CO
I	Java Programming Fundamentals: Introduction to Java, Stage for Java, Origin, Challenges of Java, Java Features, Java Program Development, Object Oriented Programming.	CO1
	Java Essentials: Elements of Java Program, Java API, Variables and Literals, Primitive Data Types, The String class, Variables, Constants, Operators, Scope of Variables & Blocks, Types of Comment in Java. Control Statements: Decision making statements (if, if-else, nested if, else if ladder, switch, conditional operator), Looping statements (while, do-while, for, nested loops), Jumping statements (Break and Continue).	CO2
II	Classes and Objects: Basic concepts of OOPS, Classes and Objects, Modifiers, Passing arguments, Constructors, Overloaded Constructors, Overloaded Operators, Static Class Members, Garbage Collection. Inheritance: Basics of inheritance, Inheriting and Overriding Superclass methods, Calling Superclass Constructor, Polymorphism, Abstract Classes, Final Class.	CO3
III	Arrays and Strings: Introduction to array, Processing Array Contents, Passing array as argument, Returning array from methods, Array of objects, 2D arrays, Array with three or more dimensions. String class, string concatenation, Comparing strings, Substring, Difference between String and String Buffer class, String Tokenizer class.	CO4
	Interface and Packages: Basics of interface, Multiple Interfaces, Multiple Inheritance Using Interface, Multilevel Interface, Packages, Create and Access Packages, Static Import and Package Class, Access Specifiers. Exception Handling: Introduction, Try and Catch Blocks, Multiple Catch, Nested Try, Finally, Throw Statement, Built-In Exceptions.	CO5
IV	Multithreading: Introduction, Threads in Java, Thread Creation, Lifecycle of Thread, Joining a Thread, Thread Scheduler, Thread Priority, Thread Synchronization. Applets: Introduction, Applet Class, Applet Life Cycle, Graphics in Applet, Event- Handling. File and I/O Streams: File Class, Streams, Byte Streams, Filtered Byte Streams, Random Access File Class, Character Streams.	CO6

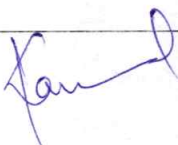
Reference Books:

1. Java, The complete Reference, H. Schildt, 7th Edition, TMH.

Text Books:

1. Programming with Java A Primer, 5th Edition, E. Balagurusamy, TMH.

2. Java Programming for Core and Advanced Learners, Sagayaraja, Denis, Karthik, Gajalakshmi, Universities Press.

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5 th Semester		Programming in JAVA Laboratory		
BCA24504				
Internal Marks:	60	L	T	P
External Marks:	40	0	0	2
Total Marks:	100	Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Illustrate the role of different data types and operators in java with the help of programs
CO2	Depict the role of different control statement in java.
CO3	Implement the concept of strings and Arrays in java.
CO4	Write programs to handle exceptions and Implement multithreading in java.
CO5	Execute interfaces and packages in java
CO6	Understand the concept of file handling in java.

Instructions: All programs are to be developed in Java programming language.

List of assignments:

Sno.	Experiments
1.	Write a program to perform following operations on two numbers input by the user: 1) Addition 2) subtraction 3) multiplication 4) division [CO1]
2.	Write a Java program to print result of the following operations. 1. $-15 + 58 * 45$ 2. $(35+8) \% 6$ 3. $24 + -5*3 / 7$ 4. $15 + 18 / 3 * 2 - 9 \% 3$ [CO1]
3.	Write a Java program to compute area of: 1) Circle 2) rectangle 3) triangle 4). [CO1]
4.	Write a program to convert temperature from Fahrenheit to Celsius degree using Java. [CO1]
5.	Write a program through Java that reads a number in inches, converts it to meters. [CO1]
6.	Write a program to convert minutes into a number of years and days. [CO1]
7.	Write a Java program that prints current time in GMT. [CO1]
8.	Design a program in Java to solve quadratic equations using if, if else. [CO2]
9.	Write a Java program to determine greatest number of three numbers. [CO2]
10.	Write program that gets a number from the user and generates an integer between 1 and 7 subsequently should display the name of the weekday as per that number. [CO2]
11.	Construct a Java program to find the number of days in a month. [CO2]
12.	Developed Program & design a method to find the smallest number among three numbers. [CO2]
13.	Compute the average of three numbers through a Java Program. [CO2]
14.	Write a program to sum values of a Single Dimensional array. [CO3]
15.	Design & execute a program in Java to sort a numeric array and a string array. [CO3]
16.	Calculate the average value of array elements through Java Program. [CO3]
17.	Write a Java program to test if an array contains a specific value. [CO3]
18.	Find the index of an array element by writing a program in Java. [CO3]
19.	Write a Java program to remove a specific element from an array. [CO3]
20.	Design a program to copy an array by iterating the array. [CO3]
21.	Write a Java program to insert an element (on a specific position) into Multidimensional array. [CO3]
22.	Write a program to perform following operations on strings: 1) Compare two strings. 2) Count string length. 3) Convert upper case to lower case & vice versa.

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	4) Concatenate two strings. 5) Print a substring. [CO3]
23	Write a Program & design a method to count all vowels in a string [CO3]
24	Write a Java method to count all words in a string. [CO3]
25	Write a method in Java program to count all words in a string. [CO3]
26	Write a Java program to handle following exceptions: 1) Divide by Zero Exception. 2) Array Index Out Of B bound Exception [CO4]
27	To represent the concept of Multithreading write a Java program. [CO4]
28	To represent the concept of all types of inheritance supported by Java, design a program. [CO5]
29	Write a program to implement Multiple Inheritance using interface. [CO5]
30	Construct a program to design a package in Java. [CO5]
31	To write and read a plain text file, write a Java program. [CO6]
32	Write a Java program to append text to an existing file. [CO6]
33	Design a program in Java to get a list of all file/directory names from the given. [CO6]
34	Develop a Java program to check if a file or directory specified by pathname exists or not. [CO6]
35	Write a Java program to check if a file or directory has read and write permission. [CO6]

Reference Books:

1. Java, The complete Reference, H. Schildt, 7th Edition, TMH.
2. Data Analytics using R, Seema Acharya, TMH.

Text Books:

1. Programming with Java A Primer, 5th Edition, E. Balagurusamy, TMH.
2. Java Programming for Core and Advanced Learners, Sagayaraja, Denis, Karthik, Gajalakshmi, Universities Press.
3. Java Fundamentals, A Comprehensive Introduction, H. Schildt, D. Skrien, TMH.

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5 th Semester		Web Programming-I			
BCA24506					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits	4	

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand fundamental concepts of server-side scripting and PHP programming.
CO2	Apply control structures and functions to develop dynamic PHP-based web applications.
CO3	Design interactive web pages using form handling, cookies, and session management.
CO4	Implement data handling techniques using arrays, strings, and file operations in PHP.
CO5	Develop backend applications with database integration using CRUD operations.
CO6	Build basic web services using JSON and REST APIs for client-server communication.

Unit	Detailed Contents	CO
I	Fundamentals of PHP Programming: Server-side scripting overview, Introduction to PHP: syntax, variables, Dynamic variables and Variable scope, constants, Data types, Testing for a specific data type, expressions, operators.	CO1
	Control Statements: if() and elseif() condition Statement, The switch statement, Using the? Operator, Using the while() Loop, The do while statement, Using the for()Loop. Functions: Function definition, Creation, Returning values, Library Functions, User- defined functions, Dynamic function, default arguments, Passing arguments to a function by value.	CO2
II	Web Interaction using PHP: Embedding PHP into HTML, Handling HTML forms using GET and POST, Introduction to cookies and sessions, Session and cookie management	CO3
III	Data Handling in PHP: Arrays: indexed, associative, multidimensional, Array functions: sorting, merging, searching, String functions: manipulation and formatting, File handling: open, read, write, append, delete, File uploads through forms	CO4
IV	Backend Development: Introduction to server-side development (PHP / Node.js), Express.js routing (if Node.js is used), Handling GET/POST requests, Introduction to databases (MySQL/PostgreSQL/MongoDB), CRUD operations	CO5
	Database Integration: Database connectivity, JSON and REST APIs, Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select).	CO6

Reference Books:

1. "Core PHP Programming" by Leon Atkinson – Pearson Education
2. "PHP 7 Programming Cookbook" by Doug Bierer – Packt Publishing
3. "Murach's PHP and MySQL" by Joel Murach – Mike Murach & Associates

Textbooks:

1. "PHP & MySQL Web Development" by Luke Welling & Laura Thomson – Pearson Education
2. "Learning PHP, MySQL & JavaScript" by Robin Nixon – O'Reilly Media

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5 th Semester		Web Programming-I Laboratory			
BCA24507					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Perform basic arithmetic operations and solve mathematical problems using programming constructs.
CO2	Apply looping and conditional statements to solve problems involving sequences, series, and data evaluation.
CO3	Implement array and string-based operations to solve computational problems.
CO4	Develop web applications using functions, forms, and session management techniques.
CO5	Design interactive web pages and implement file handling operations using PHP.
CO6	Develop database-driven web applications and mini projects using forms and backend integration.

Sno.	Experiment
1.	Take values from the user and compute sum, subtraction, multiplication, division and exponent of value of the variables. [CO1]
2.	Write a program to find area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram. [CO1]
3.	Print multiplication table of a number input by the user. [CO1]
4.	Calculate sum of natural numbers from one to n number. [CO2]
5.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13 21.....n. [CO2]
6.	Write a program to find the factorial of any number. [CO2]
7.	Write a program to compute, the Average and Grade of students marks. [CO2]
8.	Compute addition, subtraction and multiplication of a matrix. [CO3]
9.	Count total number of vowels in a word "Develop & Empower Individuals". [CO3]
10.	Determine whether a string is palindrome or not? [CO3]
11.	Display word after Sorting in alphabetical order. [CO3]
12.	Check whether a number is in a given range using functions. [CO4]
13.	Write a program to create a login form. On submitting the form, the user should navigate to profile page.[CO4]
14.	Create a session-based login system. [CO4]
15.	Design front page of a college or department using graphics method. [CO5]
16.	Create simple PHP scripts for form input, conditions, and loops. [CO5]
17.	Write a program to upload and download files. [CO5]
18.	Build a feedback form using GET/POST. [CO6]
19.	Develop a user registration form that stores data in MySQL. [CO6]
20.	Mini Project: Examples – Blog system, Inventory manager, Task tracker. [CO6]

Reference Books:

1. PHP: The Complete Reference, "Steven Holzner", January 1, 2007. Tata McGraw- Hill Education.
2. Programming PHP, "Kevin Tetroi", O' Reilly.
3. Published by Wiley Publishing, Inc. 10475 Crosspoint Boulevard Indianapolis, IN 46256

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5 th Semester		Introduction to Machine Learning			
BCA24508					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits	4	

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand fundamental concepts and applications of Machine Learning.
CO2	Apply regression techniques including linear and logistic regression.
CO3	Implement supervised classification algorithms such as Decision Tree and Random Forest.
CO4	Use Naïve Bayes and Support Vector Machine with hyperparameter tuning.
CO5	Apply clustering techniques like K-means and Hierarchical Clustering.
CO6	Understand Reinforcement Learning concepts including MDP and Q-learning.

Unit	Detailed Contents	CO
I	Introduction : What is Machine Learning, Unsupervised Learning, Reinforcement Learning Machine Learning Use-Cases, Machine Learning Process Flow, Machine Learning Categories.	CO1
	Regression: Linear Regression, linear classification, logistic regression.	CO2
II	Supervised Learning Classification and its use cases, Decision Tree, Algorithm for Decision Tree Induction Creating a Perfect Decision Tree, Confusion Matrix, Random Forest.	CO3
III	What is Naïve Bayes, How Naïve Bayes works, Implementing Naïve Bayes Classifier, Support Vector Machine, Illustration how Support Vector Machine works, Hyper parameter Optimization, Grid Search Vs Random Search, Implementation of Support Vector Machine for Classification.	CO4
IV	Clustering What is Clustering & its Use Cases, K-means Clustering, How does K-means algorithm work, C-means Clustering, Hierarchical Clustering, How Hierarchical Clustering works.	CO5
	Why Reinforcement Learning, Elements of Reinforcement Learning, Exploration vs Exploitation dilemma, Epsilon Greedy Algorithm, Markov Decision Process (MDP) Q values and V values, Q – Learning, α values.	CO6

Textbooks:
1. Pattern Reorganization and Machine learning by Christopher M. Bishop.
2. The elements of Statistical learning by Jeromeh. Friedman, Robert Tivshirani and Trevorhaspie.
3. Introduction to Machine Learning by Ethem Alpaydin. PHI Publisher.
4. Machine Learning, A practical approach on the statistical learinging theory by Rodrigo fernandes de Mello and Moacir Antonelli Ponti.
5. Machine Learning A probabilistic prospective by Kevin P. Murphy

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5 th Semester		Introduction to Machine Learning Laboratory			
BCA24509					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits	1	

Course Outcomes: After studying the course, students will be able to:

CO1	Use CSV data for basic data processing and analysis.
CO2	Implement Decision Tree and Random Forest algorithms for classification tasks.
CO3	Apply Naïve Bayes classifier and evaluate performance using accuracy, precision, and recall.
CO4	Develop and analyze Bayesian Network models for real-world datasets.
CO5	Implement k-NN algorithm for classification and interpret prediction results.
CO6	Apply clustering and classification algorithms such as K-means, Hierarchical Clustering, and SVM.

Sno.	Experiment
1.	Read the numeric data from .CSV file and use some basic operation on it. [CO1]
2.	Write a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. [CO2]
3.	Write a program to demonstrate the working of the Random Forest algorithm. [CO2]
4.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. [CO3]
5.	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set. [CO3]
6.	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API. [CO4]
7.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. [CO5]
8.	Write a program to demonstrate the working of the K-means clustering algorithm. [CO6]
9.	Write a program to demonstrate the working of the Support Vector Machine for Classification Algorithm. [CO6]
10.	Write a program to demonstrate the working of the Hierarchical Clustering. [CO6]

Reference Books:

1. Rodrigo fernandes de Mello and Moacir Antonelli Ponti., Machine Learning, A practical approach on the statistical learning
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective". Chapman and Hall, CRC Press, Second Edition, 2014.
4. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
5. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014
6. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

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5 th Semester		Introduction to Data Science			
BCA24510					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits	4	

Course Outcomes: After studying the course, students will be able to:

CO1	Understand the fundamental concepts, lifecycle, and applications of Data Science.
CO2	Apply data collection and preprocessing techniques to prepare datasets for analysis.
CO3	Perform exploratory data analysis using statistical methods and visualization tools.
CO4	Implement basic machine learning algorithms for predictive analysis.
CO5	Evaluate and optimize machine learning models using appropriate performance metrics.
CO6	Analyze real-world data science applications along with ethical and big data considerations.

Unit	Detailed Contents	CO
I	Introduction to Data Science: Definition and importance of Data Science, Data Science lifecycle, Roles: Data Analyst, Data Scientist, Data Engineer, Applications of Data Science, Introduction to tools: Python, R, Jupyter Notebook	CO1
	Data Collection & Preprocessing: Types of data (structured, unstructured, semi-structured), Data collection methods, Data cleaning (handling missing values, noise, outliers), Data transformation and normalization, Data integration and reduction	CO2
II	Exploratory Data Analysis (EDA): Descriptive statistics (mean, median, mode, variance), Data visualization techniques (bar chart, histogram, scatter plot, box plot), Correlation and covariance, Introduction to libraries (Pandas, NumPy, Matplotlib, Seaborn)	CO3
III	Machine Learning Basics: Introduction to Machine Learning, Types: Supervised, Unsupervised, Reinforcement Learning, Algorithms: Linear Regression, Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees, Model training and testing	CO4
IV	Model Evaluation & Optimization: Confusion matrix, Accuracy, precision, recall, F1-score, Cross-validation, Overfitting and underfitting, Feature selection	CO5
	Introduction to Big Data & Applications: Basics of Big Data, Tools: Hadoop, Spark (overview), Real-world case studies, Ethics in Data Science, Data privacy and security	CO6

Textbooks:

1. Data Science from Scratch: First Principles with Python (Joel Grus): Focuses on building algorithms from the ground up to deeply understand the mechanics of machine learning and statistics without relying immediately on libraries.
2. Python Data Science Handbook (Jake VanderPlas): A comprehensive guide to using tools like Pandas, Numpy, Matplotlib, and Scikit-Learn for data analysis and visualization.

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5 th Semester	Introduction to Data Science Laboratory				
BCA24511					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Understand and apply basic Python programming and essential libraries for data science.
CO2	Perform data collection, cleaning, and preprocessing using appropriate techniques.
CO3	Analyze datasets using exploratory data analysis and visualization methods.
CO4	Implement basic machine learning algorithms for prediction and classification tasks.
CO5	Evaluate machine learning models using standard performance metrics.
CO6	Develop end-to-end data science solutions using real-world datasets.

Sno.	Experiment
1.	Installation of Python, Jupyter Notebook[CO1]
2.	Introduction to libraries: NumPy, Pandas[CO1]
3.	Creating datasets (CSV, Excel), Reading and writing data[CO2]
4.	Data manipulation (filtering, sorting, grouping) [CO2]
5.	Data Cleaning & Preprocessing, Handling missing values, Removing duplicates, Data transformation and normalization[CO2]
6.	Exploratory Data Analysis (EDA), Descriptive statistics[CO3]
7.	Identifying patterns and trends, Correlation analysis[CO3]
8.	Data Visualization, Plotting graphs: bar chart, line chart, histogram, scatter plot[CO3]
9.	Visualization using Matplotlib and Seaborn[CO3]
10.	Implementation of Classification Algorithm linear and logistic regression.[CO4]
11.	Model Evaluation, Confusion matrix.[CO5]
12.	Mini Project: Apply complete data science lifecycle on a dataset, Data collection → preprocessing → analysis → model → evaluation.[CO6]

Reference Books:

1. Python for Data Analysis – Wes McKinney
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow – Aurélien Géron
3. Introduction to Data Science – Joel Grus

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5 th Semester		Digital Marketing			
BCA24512					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Highlight the key elements of a digital marketing strategy.
CO2	Choose the right platform for digital marketing.
CO3	Define Search Engine Optimizations and its types.
CO4	Understand the concept of web traffic and tools for managing the contents.
CO5	Design content for digital marketing.
CO6	Develop digital marketing strategy and plan.

Unit	Detailed Contents	CO
I	Introduction to Digital Marketing Difference between Traditional Marketing and Digital Marketing, Benefits of using Digital Media, Inbound and Outbound Marketing, Online marketing POEM: (Paid, Owned, and Earned Media), Components of Online Marketing (Email, Forum, Social network, Banner, Blog), Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing.	CO1
	Email Marketing: Email newsletters, Digests, Dedicated Emails, Lead Nurturing, Sponsorship Emails and Transactional Emails, Drawbacks of Email Marketing. Social Media Marketing (SMM): Different types of Social Media Marketing like Facebook, LinkedIn, Twitter, Video, Instagram etc.	CO2
II	Search Engine Optimisation (SEO) About SEO, Need of an SEO friendly website, Importance of Internet and Search Engines; Role of Keywords in SEO. On-Page Optimization (Onsite): Basics of Website Designing / Development; HTML Basics for SEO; Onsite Optimization Basics; Website Structure and Navigation Menu Optimization; SEO Content Writing. Keywords Research and Analysis (eg. SWOT analysis of website, finding appropriate keywords). Off Page Optimization: Introduction; Local marketing of websites depending on locations; Promoting Subsequent pages of the website. Introduction to organic SEO vs non-organic SEO; Social Media Optimization Techniques and Page Rank Technology.	CO3
III	Website Planning & Creation Content Marketing Strategy: Goals and concepts, Strategic building blocks, Content creation & channel distribution, Tools of the trade, Advantages and challenges. Keywords Research and Analysis: Introduction to Keyword Research; Business Analysis; Types of Keywords; Keywords Analysis Tools. Web Presence: How to increase online presence and drive more traffic for a website, Search result visibility in search engines for chosen keyword and phrases, using e-mail marketing to drive traffic for a website, posting social media content for lead generation, Tools to create and manage content, Use of Blogging as content strategy.	CO4
IV	Creating content: Writing and posting content on the web and in social networks, blog and video; Create, manage and implement a content marketing strategy; Monitoring and	CO5





recording results to improve content marketing campaigns; Successful content marketing strategies and case studies.	
Online Advertising, Mobile Marketing and Web analytics Introduction to Online Advertising and its advantages, paid versus Organic, Pay Per Click (PPC) Model. Basic concepts Cost Per Click (CPC), CPM, CTR, CR etc. About Mobile Marketing, Objectives of Mobile Advertising, Creating a Mobile Marketing Strategy, Introduction to SMS Marketing. About Web Analytics, Types of Web Analytics (On-site, Off-site). Importance of Web Analytics.	CO6

Textbooks:

1. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
2. Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford
3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

Reference Books:

1. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
2. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
3. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.
4. Enge, E., Spencer, S., Stricchiola, J., & Fishkin, R. (2012). The art of SEO. " O'Reilly Media, Inc."

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5 th Semester		Digital Marketing Laboratory		
BCA24513				
Internal Marks:	60	L	T	P
External Marks:	40	0	0	2
Total Marks:	100	Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Highlight the key elements of a digital marketing strategy.
CO2	Implement common digital marketing exercise using SEO, Social media and Blogs.
CO3	Identify the major digital marketing channels.
CO4	Understand the concept of web traffic and tools for managing the contents.
CO5	Design content for digital marketing.
CO6	Develop digital marketing strategy and plan.

Sno.	Experiment
1.	Explore Online Display Advertising, Ecommerce Marketing, Mobile Web and Content marketing. [CO1]
2.	Explore Facebook, LinkedIn, Twitter, Video, Instagram, blog etc. [CO2]
3.	Posting social media content for lead generation. [CO2]
4.	Show results for Search Engine Algorithms & Page Rank Technology [CO2]
5.	Writing and posting content on the web and in social networks. [CO2]
6.	Explore Email Marketing; Google AdWords and Google Analytics [CO3]
7.	Using e-mail marketing to drive traffic for a website. [CO3]
8.	Monitoring and recording results to improve content marketing campaigns [CO3]
9.	How to increase online presence and drive more traffic for a website. [CO4]
10.	Search result visibility in Google for chosen keyword and phrases. [CO4]
11.	Tools to create and manage content. [CO4]
12.	How to promote home page, SWOT Analysis of Website & finding right appropriate keywords. [CO5]
13.	Create a Video/ YouTuber [CO5]
14.	Manage a Video/ YouTuber platform and enhance viewership. [CO5]
15.	Use of Blogging as content strategy. [CO6]

Reference Books:

1. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
2. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
3. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.

Texts Books:

1. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
2. Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford
3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

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5 th Semester		Natural Language Processing			
BCA24514					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:


CO1	Explain the fundamentals of Natural Language Processing including its history, challenges, components, phases, tools, and applications.
CO2	Apply language modeling techniques such as unigram, bigram, trigram, and N-gram models with smoothing methods for text processing tasks.
CO3	Analyze linguistic structures using techniques like parts-of-speech tagging, morphology, and named entity recognition.
CO4	Implement text preprocessing and representation methods including tokenization, cleaning, stemming, lemmatization, embeddings, and word sense disambiguation.
CO5	Evaluate methods for text classification, summarization, information extraction, and multilingual question answering in information retrieval systems.
CO6	Demonstrate NLP applications such as document clustering, speech recognition, and machine translation using rule-based and statistical approaches.

Unit	Detailed Contents	CO
I	Introduction to NLP: What is NLP? Challenges of NLP, History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, how to build an NLP pipeline? Phases of NLP, NLP APIs, NLP Libraries	CO1
	Natural Language Processing Models and Algorithm: Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modelling, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition	CO2
II	Text Processing: Continuous Bag-Of-Words, embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge-Based and Supervised Word Sense Disambiguation, Tokenization, Cleaning, Tokenizing, Removing Special Characters, Expanding Contractions, Removing Stop words, Correcting Words, Stemming, Lemmatization, Understanding Text structure	CO3
III	Text Analysis, Summarization and Extraction: Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR	CO4
IV	Applications of NLP: Unsupervised Learning on Text Clustering by Document Similarity – Distance Metrics, Partitive Clustering, Hierarchical Clustering: Analyzing Document Similarity, Document Clustering, Speech recognition.	CO5
	Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge-Based MT System, Statistical Machine Translation (SMT)	CO6

Reference Books:

1. Speech and Language Processing - An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition Second Edition by Daniel Jurafsky and James H. Martin, Pearson Education India
2. Foundations of Statistical Natural Language Processing, Chris Manning and Hinrich Schütze, MIT Press

 C.H. Paul SK

5 th Semester		Natural Language Processing Laboratory			
BCA24515					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Demonstrate the use of Python libraries for NLP and perform feature extraction on textual datasets.
CO2	Apply preprocessing techniques including tokenization and stemming on textual data.
CO3	Perform and analyze Part-of-Speech (POS) tagging to understand syntactic structures.
CO4	Generate N-grams and represent text using TF-IDF for feature engineering.
CO5	Implement text classification and text similarity techniques for text analysis.
CO6	Analyze real-world NLP applications through case studies such as machine translation and sentiment analysis.

Sno.	Experiment
1.	Introduction to python libraries for feature extraction and NLP.[CO1]
2.	Apply preprocessing steps on the selected Dataset. Support link for data set: https://www.kaggle.com/learn/natural-language-processing . [CO2]
3.	Tokenization: Split the text sentence/paragraph/Data set and generate Tokens. [CO2]
4.	Implement a suitable stemming algorithm based on chosen data set.[CO2]
5.	POS tagging part 1: Perform POS tagging annotation on input text. [CO3]
6.	POS tagging part 2: Analyze the result of POS Tagging. [CO3]
7.	Generate N-grams of the text. [CO4]
8.	Convert text into TF IDF vectors.[CO4]
9.	Perform text classification. [CO5]
10.	Implement text similarity technique.[CO5]
11.	Case Study – Study and prepare a report of Machine translation of Google.[CO6]
12.	Case Study - Identify the sentiment of tweets.[CO6]

Reference Books:
1. Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, and Edward Loper.
2. Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing Company Inc.



5 th Semester		Neural Networks			
BCA24516					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

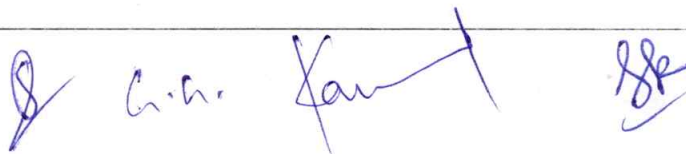
Course Outcomes: After studying the course, students will be able to:

CO1	Explain fundamentals of Artificial Neural Networks including neuron models, architectures, activation functions, and key terminologies.
CO2	Apply neural network learning rules and analyze models like perceptron, Adaline, and Madaline for classification.
CO3	Implement backpropagation and optimization techniques to evaluate advanced neural network architectures.
CO4	Analyze associative memory and recurrent models such as Hopfield networks, Boltzmann machines, and BAM.
CO5	Evaluate machine learning techniques including SVM, RBFN, and generalization methods for real-world applications.
CO6	Apply deep learning concepts, especially CNNs, for tasks like image classification and computer vision.

Unit	Detailed Contents	CO
I	Introduction to Artificial Neural Networks: Fundamentals of Artificial Neural Networks, Evolution of Neural Networks and Deep Learning, Structure and Functions of Biological and Artificial Neurons, Models of Artificial Neural Networks (ANN), Activation Functions (ReLU, Sigmoid, Tanh, Softmax, etc.), Neural Network Architectures (Feedforward, Recurrent, Convolutional, etc.), Key Terminologies in ANN (e.g., Weights, Biases, Layers, Epochs, etc.)	CO1
	Neural Network Learning Paradigms: Neural Network Learning Rules: Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow-Hoff Learning Rule, Winner – Takes-All Learning Rule, McCulloch Pitts Neuron Model, Linear Separability and XOR Problem, Advanced Neuron Models: Adaline, Madaline, and Multi-class Perceptron's.	CO2
II	Learning Algorithms and Advanced Architectures: Backpropagation Algorithm and Its Variants (e.g., Stochastic Gradient Descent, Adam Optimizer, RMSprop, Nadam), Importance of Learning Parameters and Momentum Terms, Counter Propagation Networks (Full counter Propagation Network, Forward only Counter Propagation Network), Kohonen Self-Organizing Maps (SOMs), Learning Vector Quantization (LVQ), Adaptive Resonance Theory (ART), Advanced Architectures: Hamming Net, Max Net	CO3
III	Associative Memories: Characteristics and Types, Recurrent Neural Networks (RNNs): Fundamentals and Applications, Continuous and Discrete Hopfield Networks, Boltzmann Machines and Restricted Boltzmann Machines (RBMs), Bi-directional Associative Memory (BAM), Optimization Techniques in Neural Networks (Gradient Descent, Genetic Algorithms)	CO4
IV	Modern Applications and Deep Learning Concepts: Learning from Examples and Generalization Techniques, Support Vector Machines (SVM): Introduction and Applications, Applications of ANN: (Image Classification, Texture Classification, Character Recognition), Radial Basis Function Networks (RBFN)	CO5
	Introduction to Convolutional Neural Networks (CNN): CNN Architecture and Layers, Convolution and Pooling Operations, Applications in Computer Vision (e.g.)	CO6

Reference Books:

1. Neural Networks and Deep Learning: A Textbook by Charu C. Aggarwal: A comprehensive overview of both classical and modern neural network architectures.



5 th Semester		Neural Network Laboratory			
BCA24517					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand the fundamentals of MATLAB environment, including syntax, variables, and basic matrix operations.
CO2	Apply MATLAB programming to visualize mathematical concepts by plotting graphs such as straight lines, sine curves, and multiple curves.
CO3	Analyze the role of weights and bias in determining the output of artificial neurons.
CO4	Evaluate the impact of different activation functions (purelin, hardlim, hardlims, tansig, logsig) on neuron output.
CO5	Interpret how weights and biases define decision boundaries in feature space for classification problems.
CO6	Implement and analyze the Perceptron Learning Rule for both linearly separable and non-linearly separable problems.

Sno.	Experiment
1.	To study about MATLAB. [CO1]
2.	Write a program to perform the basics matrix operations. [CO1]
3.	WAP to plot the Straight line [CO2]
4.	WAP to plot the Sine curve. [CO2]
5.	How the weight & bias value effects the output of neurons. [CO2]
6.	How the choice of activation function effect the output of neuron experiment with the following function purelin(n), binary threshold(hardlim(n) hardlims(n)), Tansig(n) logsig(n) [CO3]
7.	How the weight and biased value are able to represent a decision boundary in the feature space [CO4]
8.	How the Perceptron Learning rule works for Linearly Separable Problem? [CO5]
9.	How the Perceptron Learning rule works for Non-Linearly Separable Problem? [CO6]
10.	Write a program to draw a graph with multiple curve. [CO6]

Reference Books:
1. Neural Networks and Learning Machines by Simon Haykin: A comprehensive foundational text for understanding the theory.
2. Neural Network Design by Martin T. Hagan, Howard B. Demuth: Focuses on the architectural design of networks and weight/bias optimization.

G.C. Javed SP D

6 th Semester		Cyber Law & IPR			
BCA24601					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Identify statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
CO2	Categorize case law and common law to current legal dilemmas in the technology field
CO3	Outline the primary forms of intellectual property rights.
CO4	Compare the different forms of intellectual property protection in terms of their key differences and similarities.
CO5	Illustrate the Importance of copyright and How it is different from related rights.
CO6	Depict the role of trademarks in various fields.

Unit	Detailed Contents	CO
I	Introduction Overview of Computer and Web Technology, need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Jurisdictional Aspects in Cyber Law Issues of jurisdiction in cyberspace, Types of jurisdiction, Minimum Contacts Theory, Sliding Scale Theory, Effects Test and International targeting, Jurisdiction under IT Act, 2000.	CO1
II	Cyber Crimes & Legal Framework Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Ethics and Etiquettes of Cyber World, Cyber Pornography, Identity Theft & Fraud, Cyber Terrorism.	CO2
	Cyber Defamation, Right to Privacy and Data Protection on Internet, Concept of privacy, Threat to privacy on internet, Self-regulation approach to privacy.	CO3
III	Overview of Intellectual Property Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development IPR in abroad, Data Protection, Open Source Software, Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document How to protect your inventions?, Granting of patent, Rights of a patent.	CO4
IV	Copyright, Related Rights and Trademarks What is copyright? Latest editions of Designs, what is covered by copyright? How long does copyright last? Why protect copyright? What are related rights? Distinction between related rights and copyright?	CO5
	What is a trademark? Rights of trademark?, What kind of signs can be used as trademarks?, types of trademark, function does a trademark perform, How is a trademark protected?, How is a trademark registered?	CO6

Text Books:

1. Anirudh Rastogi. Cyber Law, LexisNexis.
2. Vakul Sharma. Information Technology Law and Practice Cyber Laws and Laws Relating to E-Commerce, Universal Law Publishing.
3. Pankaj Sharma. Information Security and Cyber Laws, Kataria, S. K., & Sons.

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6 th Semester		Cyber Law & IPR Laboratory			
BCA24602					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Identify statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
CO2	Categorize case law and common law to current legal dilemmas in the technology field
CO3	Outline the primary forms of intellectual property rights.
CO4	Compare the different forms of intellectual property protection in terms of their key differences and similarities.
CO5	Illustrate the Importance of copyright and How it is different from related rights.
CO6	Depict the role of trademarks in various fields.

Sno.	Experiment
1	Study of Jurisdictional Aspects in Cyber Law Issues [CO1]
2	Study of Jurisdiction under IT Act, 2000. [CO1]
3	Study of Hacking, Digital Forgery. [CO2]
4	Discussion with reference to authentication of Electronic Record using Digital Signatures. [CO2]
5	Study of threat to privacy on internet. [CO3]
6	Study of Privacy and Data Protection on Internet. [CO3]
7	Study of intellectual property right (IPR) in India. [CO3]
8	Study about impact of the patent system. [CO4]
9	Study for Granting of patent. [CO4]
10	Study related to Rights of Patents [CO4]
11	Study about the difference between related rights and copyright. [CO5]
12	Study of Copyright, Related Rights and Trademarks. [CO5]
13	Study about registration process of trademark. [CO6]
14	Study about different kind of signs can be used as trademarks [CO6]

Reference Books:

1. Anirudh Rastogi. Cyber Law, LexisNexis.
2. Vakul Sharma. Information Technology Law and Practice Cyber Laws and Laws Relating to E-Commerce, Universal Law Publishing.
3. Pankaj Sharma. Information Security and Cyber Laws, Kataria, S. K., & Sons.
4. Navneet Nagpal. Intellectual Property Right, Ebooks2go Inc.
5. Dr. S.K. Singh. Intellectual Property Rights, Central Law Agency.

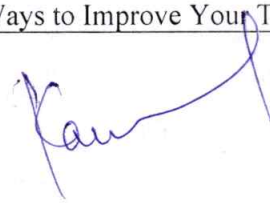


Ash *faw* *SK* *J*

6 th Semester		Software Testing & Quality Assurance			
BCA24603					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits	4	

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain fundamentals of software testing, models, principles, and terminology.
CO2	Apply testing strategies including structural, functional, and black-box techniques.
CO3	Implement static and dynamic white-box testing techniques.
CO4	Evaluate special and web testing types including GUI, configuration, and compatibility testing.
CO5	Develop test plans, test cases, and manage defect life cycle using testing tools.
CO6	Assess software quality assurance practices, metrics, and standards like CMM and ISO 9000.

Unit	Detailed Contents	CO
I	Introduction to Software Testing: Introduction, Definition of a Bug, Role of a Software Tester, Software Development Model, Software Testing Axioms, Software Testing Terms and Definitions.	CO1
II	Fundamentals of Software Testing: Testing Strategies and Techniques, Structural and Functional testing, Static Black Box and Dynamic Black Box Testing Techniques.	CO2
	White Box Testing: Static White Box Testing, Dynamic White Box Testing.	CO3
	Special Types of Testing: Configuration Testing, Compatibility Testing, Graphical User Interface Testing.	
	Documentation and Security Testing: Documentation Testing, Security Testing	
III	Web site Testing: Web Page Fundamentals, Black Box Testing, White Box Testing and Gray Box Testing, Configuration and Compatibility Testing.	CO4
IV	Testing Tools: Benefits of Automation Testing, Random Testing, Bug Bashes and Beta Testing Test Planning: Test Planning, Test Cases, Bug life cycle.	CO5
	Software Quality Assurance: Definition of Quality, Testing and Quality Assurance at Workplace, Test Management and Organizational Structure, Software Quality Assurance Metrics, Quality Management in IT. Organizational Structure: CMM (Capability Maturity Model), ISO 9000, Software Engineering Standards	CO6

Reference Books:
1. "Software Testing: Principles and Practices" by Naresh Chauhan
2. "Software Testing" by Ron Patton
3. "Foundations of Software Testing" by Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black
4. "Effective Software Testing: 50 Specific Ways to Improve Your Testing" by Elfriede Dustin

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6 th Semester		Android Programming			
BCA24605					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Prepare environment for working on Android OS.
CO2	Design innovative User Interface and develop activity for android app.
CO3	Deploy software to mobile devices using cloud services
CO4	Highlight various security issues in Android platform.
CO5	Outline the steps for creating database applications.
CO6	Write programs for basic Android based applications.

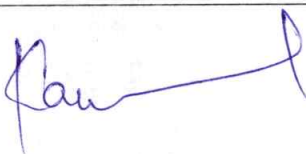


Unit	Detailed Contents	CO
I	Characteristics of Mobile applications, Introduction to Android Development Environment, Advantages and Features of Android.	CO1
	Architecture and working of Android, User-interface design for mobile applications and managing application data	CO2
II	Integrating cloud services, networking, OS and hardware into mobile applications.	CO3
III	Enterprise requirements in mobile applications: Performance, Scalability, Modifiability, Availability and Security.	CO4
	Mobile Software Engineering (Design Principles, Development, Testing methodologies for mobile applications.	CO5
IV	Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.	CO6

Reference Books:

1. Professional Mobile Application Development, JEFFMCWHERTER, SCOTTGOWELL, Wiley.
2. Professional Android 4 Application Development, Reto Meier, Wrox Publication
3. Beginning iPhone Development with Swift, David Mark, A press Publication

Text Books:

1. Android Studio Application Development, Belen Cruz, Zapata, Packt Publishing
2. Deitel, P., Deitel, H., Deitel, A., and Morgano, M., Android for Programmers – An App-Driven Approach, Prentice Hall

G.h.   

6 th Semester		Android Programming Laboratory			
BCA24606					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits	1	

Course Outcomes: After studying the course, students will be able to:

CO1	Prapare environment for working on Android OS.
CO2	Program basic Android based applications.
CO3	Highlight various security issues in Android platform.
CO4	Implement database applications.
CO5	Design innovative User Interface and develop activity for android app.
CO6	Design application for Mobile using various sensors.

Sno.	Experiment
1.	Installation of Java, android Framework [CO1]
2.	Android SDK Manager and its all components [CO1]
3.	Programs based on the overriding, constructor, classes in Java [CO1]
4.	Programs based on the Final, this and static keyword in Java [CO2]
5.	Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML. [CO2]
6.	Applications based on Text Boxes and Button[CO2]
7.	Applications based on Check Boxes and button [CO3]
8.	Applications based on Radio Buttons [CO3]
9.	Applications based on Intents and Intent Filters [CO3]
10.	Applications based on Activities and services [CO4]
11.	Applications based on Action Bar [CO4]
12.	Applications based on Option Menu [CO4]
13.	Applications based on Rating Bar [CO5]
14.	Applications based on Media Player [CO5]
15.	Applications based on Content Providers [CO5]
16.	Applications based on accessing camera [CO6]
17.	Applications based on accessing location [CO6]
18.	Applications based on the activation of sensors [CO6]
19.	Applications based on Animations [CO6]

Reference Books:

1. Deitel, P., Deitel, H., Deitle, A., and Morgano, M., Android for Programmers – An App-Driven Approach, Prentice Hall, Upper Saddle River, NY, 2012, ISBN: 212136-0.
2. Professional Mobile Application Development, JEFFMCWHERTER, SCOTTGOWELL, Wiley.

Arb *Jan* *SP* *D*

6 th Semester		Big Data Analytics			
BCA24607					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

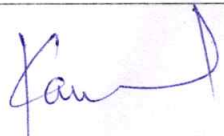

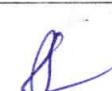
Course Outcomes: After studying the course, students will be able to:

CO1	Explain the concepts of big data, its characteristics, and challenges in handling large-scale datasets.
CO2	Understand the architecture and components of Hadoop ecosystem including HDFS and MapReduce.
CO3	Apply data processing techniques using Hadoop MapReduce and Spark frameworks.
CO4	Analyze structured and unstructured data using big data tools and NoSQL databases.
CO5	Evaluate real-time data processing and streaming techniques.
CO6	Design and implement big data analytics solutions for real-world applications.

Unit	Detailed Contents	CO
I	Introduction to Big Data: Definition of Big Data, Characteristics of Big Data (5 Vs: Volume, Velocity, Variety, Veracity, Value), Traditional vs Big Data systems ,Challenges in Big Data Analytics ,Applications of Big Data (Healthcare, Finance, E-commerce, Social Media)	CO1
	Hadoop Ecosystem: Introduction to Hadoop, Hadoop Architecture ,Hadoop Distributed File System (HDFS) ,MapReduce Framework ,YARN Architecture ,Hadoop Ecosystem Tools (Hive, Pig, Sqoop, Flume)	CO2
II	Data Processing with Hadoop and Spark: MapReduce Programming Model, Writing MapReduce programs:Limitations of MapReduce,,Introduction to Apache Spark ,Spark Architecture ,RDD (Resilient Distributed Datasets) ,Spark vs Hadoop MapReduce	CO3
III	NoSQL Databases: Introduction to NoSQL ,Types of NoSQL Databases (Key-Value, Document, Column, Graph) ,CAP Theorem ,Overview of MongoDB and Cassandra ,Querying NoSQL Databases	CO4
	Real-Time Big Data Processing: Need for Real-Time Analytics, Stream Processing Concepts ,Tools: Apache Kafka, Apache Storm ,Batch vs Stream Processing ,Lambda Architecture	CO5
IV	Big Data Analytics Applications: Data Analytics Lifecycle, Machine Learning with Big Data ,Data Visualization Techniques ,Case Studies (E-commerce recommendations, Fraud detection, Social media analytics)	CO6

Reference Books:

1. Hadoop: The Definitive Guide – Tom White
2. Big Data Fundamentals – Thomas Erl
3. NoSQL Distilled – Pramod J. Sadalage

GG.   

6 th Semester		Big Data Analytics Laboratory			
BCA24608					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Install and configure Big Data tools and environments including Python, Hadoop, and HDFS.
CO2	Apply Python libraries such as NumPy and Pandas for data manipulation and visualization.
CO3	Implement NoSQL database operations using MongoDB for structured and unstructured data.
CO4	Apply advanced MongoDB operations including aggregation and data processing functions.
CO5	Develop and execute MapReduce programs for processing large datasets.
CO6	Implement big data analytics techniques using Spark and integrate tools like MongoDB, Pig, or R.

Sno.	Experiment
1.	Install, configure and run python, numPy and Pandas. [CO1]
2.	Install, configure and run Hadoop and HDFS. [CO1]
3.	Visualize data using basic plotting techniques in Python. [CO2]
4.	Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB). [CO3]
5.	Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB. [CO4]
6.	Implement word count / frequency programs using MapReduce. [CO5]
7.	Implement a MapReduce program that processes a dataset. [CO5]
8.	Implement clustering techniques using SPARK. [CO6]
9.	Implement an application that stores big data in MongoDB / Pig using Hadoop / R. [CO6]

Reference Books:
1. "Big Data Analytics" by Seema Acharya & Subhasini Chellappan
2. "Hadoop: The Definitive Guide" by Tom White
3. "Python for Data Analysis" by Wes McKinney

C. h.   

6 th Semester		Digital Image Processing			
		BCA24609			
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Explain digital image fundamentals including sampling, quantization, and pixel relationships.
CO2	Apply various image transforms such as FFT, DCT, Walsh, Hadamard, and Wavelet transforms for image analysis.
CO3	Implement image enhancement techniques in spatial and frequency domains.
CO4	Analyze image restoration methods including inverse filtering and least square techniques.
CO5	Apply image segmentation techniques such as edge detection, thresholding, and region-based methods.
CO6	Evaluate morphological operations and image compression techniques including JPEG standards.

Unit	Detailed Contents	CO
I	Digital image fundamentals & Image Transforms: Digital Image fundamentals, Sampling and quantization, Relationship between pixels. Image Transforms: 2-D FFT, Properties. Walsh transforms, Hadamard Transform, Discrete cosine Transform, Discrete Wavelet Transform.	CO1
	Image enhancement (spatial domain): Introduction, Image Enhancement in Spatial Domain, Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation, gray level Transformation, local or neighborhood operation, median filter, spatial domain high- pass filtering. Image enhancement (Frequency domain): Filtering in Frequency Domain, Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Low Pass (smoothing) and High Pass (sharpening) filters in Frequency Domain	CO2
II	Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration.	CO3
III	Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation	CO4
	Morphological Image Processing: Dilation and Erosion, Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, the Hit or Miss Transformation.	CO5
IV	Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.	CO6

Reference Books:

- 1 Digital Image Processing and analysis-human and computer vision application with using CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011
2. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
3. Fundamentals of Digital Image Processing-A.K. Jain, PHI, 1989

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6 th Semester		Digital Image Processing Laboratory			
BCA24610					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Implement basic image processing operations including intensity level reduction and arithmetic operations on images.
CO2	Apply image resizing techniques such as pixel replication and bilinear interpolation.
CO3	Perform image enhancement using intensity transformations and histogram equalization.
CO4	Apply spatial filtering techniques including smoothing and Laplacian-based sharpening.
CO5	Implement image segmentation algorithms for extracting meaningful regions from images.
CO6	Develop and evaluate image compression techniques for efficient storage and transmission.

Sno.	Experiment
1.	Image Printing Program Based on Half toning. [CO1]
2.	Reducing the Number of Intensity Levels in an Image. [CO1]
3.	Apply Arithmetic Operations on Images. [CO1]
4.	Zooming and Shrinking Images by Pixel Replication. [CO2]
5.	Zooming and Shrinking Images by Bilinear Interpolation. [CO2]
6.	Image Enhancement Using Intensity Transformations. [CO3]
7.	Image Enhancement using Histogram Equalization. [CO3]
8.	Image Enhancement using Spatial Filtering. [CO4]
9.	Image Enhancement Using the Laplacian. [CO4]
10.	Implementation of Image Segmentation Algorithm. [CO5]
11.	Implementation of Image Compression Algorithms. [CO6]

Reference Books:

1. Digital Image Processing – Rafael C. Gonzalez and Richard E. Woods
2. Fundamentals of Digital Image Processing – Anil K. Jain
3. Digital Image Processing Using MATLAB – Rafael C. Gonzalez, Richard E. Woods, Steven Eddins

G.G. Kaur S.K. S.

6 th Semester		Search Engine Optimization			
BCA24611					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain the fundamentals of SEO, including domain concepts, WWW, search engines, and SEO techniques.
CO2	Apply SEO research methods such as keyword analysis, market research, and competitor analysis.
CO3	Design SEO-friendly websites by applying content optimization and structural guidelines.
CO4	Implement on-page optimization techniques to improve website visibility and ranking.
CO5	Apply off-page optimization strategies including link building and online promotion methods.
CO6	Analyze website performance using SEO tools and analytics for reporting and ranking improvement.

Unit	Detailed Contents	CO
I	Basics for SEO: What is Domain, Basic Knowledge of World Wide Web, Difference between Portal and Search Engines, What is SEO, Types of SEO Techniques, Black hat techniques, White Hat techniques, How Search Engine works.	CO1
	SEO Research & Analysis: Market Research, Keyword Research and Analysis, Keyword opportunity, Competitors Website Analysis, SWOT Analysis of Website, How to Choose Best Keywords, Tools available for Keyword Research.	CO2
	Website Design SEO Guidelines: Content Research, Content Guidelines, Content Optimization, Design & Layout, XML Sitemap / URL List Sitemap.	
II	On-page Optimization: The Page Title, Meta Descriptions & Meta Keywords, Headings, Bold Text, Domain Names & Suggestions, Canonical Tag, Meta Tags, Images and Alt Text, Internal Link Building, The Sitemap, Invisible Text, Server and Hosting Check, Robots Meta Tag, Doorway Pages, 301 Redirects, 404 Error, Duplicate content.	CO3
III	Off-page Optimization: Page Rank, Link Popularity, Link Building in Detail, Directory Submission, Social Bookmark Submission, Blog Submission, Articles, Links Exchange, Reciprocal Linking, Posting to Forums, Submission to Search Engine, RSS Feeds Submissions, Press Release Submissions, Forum Link Building, Competitor Link Analysis.	CO4
	Analytics: Google Analytics, Installing Google Analytics, How to Study Google Analytics, Interpreting Bars & Figures, How Google Analytics can Help SEO, Advanced Reporting, Webmaster Central & Bing/Yahoo, Open Site Explorer, Website Analysis using various SEO Tools available.	CO5
IV	SEO Tools: Keyword Density Analyzer Tools, Google Tools, Yahoo / Bing Tools, Rich Snippet Text Tools, Comparison Tools, Link Popularity Tools, Search Engines Tools, Site Tools, Miscellaneous Tools. SEO Reporting: Google analysis, Tracking and Reporting, Reports Submission, Securing Ranks	CO6

Reference Books:
1. The Art of SEO (Theory in Practice) - Eric Enge, Stephen Spencer, Jessie Stricchiola, and Rand Fishkin (O'REILLY)
2. Search Engine Optimization All-in-One For Dummies by Bruce Clay

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6 th Semester		Search Engine Optimization Laboratory			
BCA24612					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Understand and apply basic SEO concepts and techniques.
CO2	Perform keyword research and competitor analysis for SEO planning.
CO3	Design and optimize website content following SEO guidelines.
CO4	Implement on-page and technical SEO techniques.
CO5	Apply off-page SEO strategies for improving website ranking.
CO6	Analyze SEO performance using tools and generate reports.

Sno.	Experiment
1.	Understanding domain, WWW, search engines, and SEO techniques. [CO1]
2.	Perform keyword research using tools and identify keyword opportunities. [CO2]
3.	Analyze competitor websites and perform SWOT analysis. [CO2]
4.	Create and optimize content based on SEO guidelines. [CO3]
5.	Optimize title tags, meta descriptions, headings, images, and URLs. [CO4]
6.	Create XML sitemap, robots.txt, and handle 301 redirects and 404 errors. [CO4]
7.	Implement internal linking and improve website navigation. [CO4]
8.	Perform directory submission, social bookmarking, and blog submission. [CO5]
9.	Practice link building and analyze link popularity. [CO5]
10.	Install and analyze website traffic using analytics tools. [CO6]
11.	Use tools for keyword density, backlinks, and website auditing. [CO6]
12.	Generate SEO reports and track website ranking improvements. [CO6]

Reference Books:

1. "Search Engine Optimization All-in-One for Dummies" – Bruce Clay
2. "The Art of SEO" – Eric Enge, Stephan Spencer, Jessie Stricchiola
3. "SEO 2023" – Adam Clarke

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6 th Semester		Web Programming-II			
BCA24613					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4




Course Outcomes: After studying the course, students will be able to:

CO1	Explain the fundamentals of full-stack development, JavaScript ecosystem, and asynchronous programming concepts.
CO2	Develop server-side applications using Node.js and Express.js with RESTful API design.
CO3	Implement database connectivity and perform CRUD operations using MongoDB or MySQL.
CO4	Design dynamic front-end applications using React.js with components, hooks, and routing.
CO5	Integrate front-end and back-end systems, including API communication, authentication, and deployment practices.
CO6	Apply web and cross-platform development concepts using AJAX, XML, Bootstrap, and Flutter with Dart programming.

Unit	Detailed Contents	CO
I	Foundations of Full-Stack JavaScript & Node.js Back-End: Introduction to Full-Stack Development and JavaScript Ecosystem, Node.js: Setup, npm, Modules, REPL, File System, Asynchronous Programming: Callbacks, Promises, Async/Await.	CO1
	Express.js: Setting up a Server, Routing, Middleware, Handling HTTP Methods: GET, POST, PUT, DELETE, RESTful API Design, Working with JSON and Postman, CRUD Operations using MongoDB (or MySQL), Connecting Node.js with Database (MongoDB/Mongoose or MySQL).	CO2
II	Front-End Development with React.js: Introduction to SPA and React.js, JSX Syntax and Virtual DOM, Functional Components vs Class Components, Props and State, Event Handling and Conditional Rendering, Lists and Keys, React Router for Navigation, Forms and Controlled Components. useState and useEffect Hooks, Fetching Data from APIs using fetch() or axios.	CO3
III	Integrating React with Node.js & Deployment: Connecting React Front-End with Node/Express API, Cross-Origin Resource Sharing (CORS), Managing Form Submission and API Requests, Authentication: Introduction to JWT (JSON Web Tokens), Simple Login/Signup Workflow (Session or Token-based), Full-Stack Project Structure & Best Practices	CO4
	Ajax : Introduction and Use of Ajax in Website, XML: Introduction to XML, XML Basics, XML Syntax and Editors, documents, Elements, Attributes. Creating XML documents. Bootstrap : Components of Bootstrap	CO5
IV	Introduction to Flutter & Dart: Overview of cross-platform development, Flutter architecture, and advantages. Environment Setup: Installing the Flutter SDK and setting up IDEs like VS Code. Dart Basics: Programming fundamentals including variables, data types, control flow (if/switch, loops), functions, and Object-Oriented Programming (OOP) in Dart.	CO6

Reference Books:

1. Web Development with Node and Express – by Ethan Brown
2. Node.js Design Patterns – by Mario Casciaro & Luciano Mammino
3. Flutter in Action – by Eric Windmill

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6 th Semester		Web Programming-II Laboratory			
BCA24614					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Develop RESTful APIs using Node.js and Express for basic applications.
CO2	Implement database connectivity and perform CRUD operations using MongoDB.
CO3	Design and develop front-end applications using React.js.
CO4	Implement client-side routing and API integration in React applications.
CO5	Build and deploy full-stack applications integrating frontend and backend.
CO6	Manage user data and create dynamic, data-driven web applications.

Sno.	Experiment
1.	Build a simple REST API (e.g., Todo List API) [CO1]
2.	Connect API to MongoDB and test with Postman [CO2]
3.	Create a React App (e.g., Weather App, Movie Search) [CO3]
4.	Build multi-page navigation with React Router [CO4]
5.	Consume a public API and display data [CO4]
6.	Full-stack mini project (e.g., Blog System, Task Tracker, Notes App) [CO5]
7.	Deploy both frontend and backend [CO5]
8.	Store user data and render dynamic views [CO6]
9.	Installation of flutter. [CO6]
10.	Mini Projects:(e.g. Student Attendance Management App, Online Quiz / MCQ App, Online Blogging Platform (Frontend)

Reference Books:

1. **Web Development with Node and Express** – Ethan Brown
2. **Learning React** – Alex Banks & Eve Porcello
3. **Eloquent JavaScript** – Marijn Haverbeke

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6 th Semester		Prompt Engineering			
BCA24615					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Explain the fundamentals of Large Language Models (LLMs) and their evolution in AI.
CO2	Apply prompt engineering techniques for effective interaction with LLMs.
CO3	Generate and refine text outputs using standard prompting practices and strategies.
CO4	Create AI-driven content for applications such as copywriting, social media, and research.
CO5	Analyze and design prompts for image generation using diffusion models.
CO6	Develop AI-powered applications while considering usability and ethical implications.

Unit	Detailed Contents	CO
I	Introduction to Large Language Models : What are Text Generation Models, Large Language Models are Magic, A Brief History of Language Models, LLMs in the Market	CO1
	Understanding Prompting and Prompt Techniques : Five Principles of Prompting, Introducing LLM Prompts, How LLM Prompts Work, Types of Prompts, Components of an Prompt, Defining Personality in Prompts, Mix and Match Strategic Combination for Enhanced Prompts, Challenges and Limitations of Using Prompts	CO2
II	Standard Practices for Text Generation : Generating Lists, Explain It Like I'm Five, Universal Translation Through LLMs, Ask For Context, Text Style Unbundling, Identifying the Desired Textual Features, Generating New Content with the Extracted Features, Role Prompting, Analyzing Existing Prompts for Strengths and Weaknesses	CO3
III	Generating Text with AI for Content Creation: Using AI for Copywriting, Creating Social Media Posts. Writing Video Scripts, Using AI for Personalized Messaging, Creating Engaging and Tailored Content with AI, Techniques for Crafting Effective Prompts for Surveys, Assessments, and Data Collection, Using Prompts in Research Methodology	CO4
	Introduction to Diffusion Models for Image Generation : Introduction to Image Generation with AI, Principles of Designing Prompts for Image Generation, Available Models - OpenAI DALL-E, Midjourney, Stable Diffusion, Google Gemini, Text to Video, Model Comparison, Reverse Engineering Prompts, Negative Prompts, Prompt Re-Writing, Prompt Analysis	CO5
IV	Building AI Powered Applications : AI Blog Writing, Topic Research, Expert Interview, Generate Outline, Text Generation, Writing Style, Title Optimization, AI Blog Images, User Interface, Ethical Considerations of Using AI for Text and Image Generation	CO6

Reference Books:

1. Artificial Intelligence Basics – by Tom Taulli
2. Deep Learning – by Ian Goodfellow, Yoshua Bengio & Aaron Courville

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6 th Semester		Prompt Engineering Laboratory			
BCA24616					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Understand the working of LLMs and basic prompt engineering concepts.
CO2	Design effective prompts for generating accurate text outputs.
CO3	Apply advanced prompting techniques for complex problem-solving.
CO4	Develop AI-generated content for various applications.
CO5	Utilize prompt engineering for image generation and research tasks.
CO6	Build simple AI-powered applications using prompt engineering.

Sno.	Experiment
1.	Explore tools like ChatGPT, Google Gemini and understand basic text generation. [CO1]
2.	Design simple prompts for text generation (questions, summaries, paraphrasing). [CO2]
3.	Apply role prompting, few-shot prompting, and structured prompts. [CO3]
4.	Analyze and refine prompts for better accuracy and relevance. [CO3]
5.	Generate blogs, emails, and social media content using AI. [CO4]
6.	Use prompts for surveys, data collection, and analysis. [CO4]
7.	Create images using tools like DALL·E and Stable Diffusion. [CO5]
8.	Use prompts for literature review and academic writing. [CO5]
9.	AI-powered Content Creation Project: Develop content such as video scripts or marketing material. [CO6]
10.	Mini Project: AI Application: Build a simple AI-based solution (chatbot, content generator, etc.). [CO6]

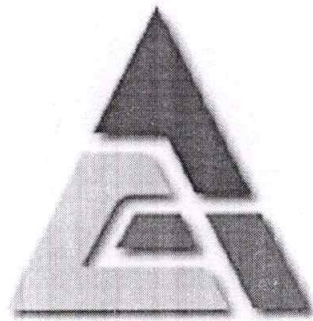
Reference Books:

1. Artificial Intelligence Basics – Tom Taulli
2. Deep Learning – Ian Goodfellow, Yoshua Bengio, Aaron Courville
3. Natural Language Processing with Transformers – Lewis Tunstall et al.

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**Scheme and Syllabus of
3rd and 4th Semester
Bachelor of Computer Applications
(BCA)**

Batch 2025 onwards



**Department of Computer Applications
Amritsar Group of Colleges, Amritsar**

BCA-3 rd Sem									
Course Code	Course Type	Course Title	Load			Marks		Total Marks	Credits
			Allocation			Distribution			
			L	T	P	Internal	External		
BCA25301	Core Theory	Computer Networks	4	0	0	40	60	100	4
BCA25302	Core Theory	Data Structures	4	0	0	40	60	100	4
BCA25303	Skill Enhancement	Web Designing	3	0	0	40	60	100	3
BCA25304	Core Practical/ Laboratory	Computer Networks Laboratory	0	0	2	60	40	100	1
BCA25305	Core Practical/ Laboratory	Data Structures Laboratory	0	0	2	60	40	100	1
BCA25306	Skill Enhancement Practical/ Laboratory	Web Designing Laboratory	0	0	2	60	40	100	1
BCA25307	Value Added Course/ Theory	Introduction to Artificial Intelligence	3	0	0	40	60	100	3
	Professional Elective-I		3	0	0	40	60	100	3
EMC- 25201	Skill Enhancement Course Laboratory		0	0	4	60	40	100	2
TOTAL			17	0	10	440	460	900	22

Professional Elective-I	
BCA25308	Software Engineering
BCA25309	Data Security and Privacy

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BCA-4 th Sem									
Course Code	Course Type	Course Title	Load			Marks		Total Marks	Credits
			Allocation			Distribution			
			L	T	P	Internal	External		
BCA25401	Core Theory	Programming in Python	4	0	0	40	60	100	4
BCA25402	Core Theory	Database Management Systems	4	0	0	40	60	100	4
BCA25403	Core Theory	Operating Systems	4	0	0	40	60	100	4
BCA25404	Core Practical/Laboratory	Programming in Python Laboratory	0	0	2	60	40	100	1
BCA25405	Core Practical/Laboratory	Database Management Systems Laboratory	0	0	2	60	40	100	1
BCA25406	Core Practical/Laboratory	Operating Systems Laboratory	0	0	2	60	40	100	1
BCA25407	Skill Enhancement	Design Thinking and Innovation	2	0	0	40	60	100	2
	Professional Elective-II		3	0	0	40	60	100	3
EMC-25301	Skill Enhancement Course Laboratory		0	0	4	60	40	100	2
TOTAL			17	0	10	440	460	900	22

Students will undergo 6 weeks Institutional Summer Training* after 4th semester. Examination will be conducted along with 5th semester practical.

Professional Elective-II	
BCA25408	Cloud Computing
BCA25409	Introduction to Biometrics

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3 rd Semester		Computer Networks			
BCA25301					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Identify Hardware and software components for designing network.
CO2	Define different network technologies and their application.
CO3	Describe the role of network reference models.
CO4	Describe the different services that data link layer offers to network layer.
CO5	Explain the different transport layer functions.
CO6	Identify different applications in presentation layer and application layer.

Unit	Detailed Contents	CO
I	Types of Networks: LAN, MAN, WAN Network Topologies: Bus, Star, Ring, Mesh, Tree, Hybrid Communication Channels: Wired transmissions: Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fibre transmission. Communication Switching Techniques: Circuit Switching, Message Switching, Packet Switching.	CO1
II	Data communications concepts: Digital and analogue transmissions- Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. MAC sub layer: CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) [CO2] Network Layer: Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking.	CO2
	Network Reference Models: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models. Transmission impairments – Attenuation, Distortion, Noise. Multiplexing – frequency division, Time division, Wavelength division.	CO3
III	Data Link Layer Design Issues: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP).	CO4
	Transport Layer: Design issues, Elements of transport protocols– Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols.	CO5

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IV	Session, Presentation and Application Layers: Session Layer– Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography. Application Layer–Distributed application (client/server, peer to peer, cloud etc.), World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), HTTP as an application layer protocol.	CO6
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References:

Text Books:

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
3. Computer Today, S.K. Basandra, First Edition, Galgotia.

Reference Books:

1. Data Communication System, Black, Ulysse, Third Edition, PHI.
2. Data and Computer Communications, Stalling, Ninth Edition, PHI.
3. James F. Kurose and Keith W. Ross, "Computer Networking", Pearson Education.
4. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

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3 rd Semester		Data Structures			
BCA25302					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Analyze and compare different types of data structures based on their characteristics, advantages, limitations, and applications.
CO2	Apply appropriate constructs of Programming language, coding standards for application development.
CO3	Evaluate and select suitable data structures for efficient problem solving in programming scenarios.
CO4	Illustrate the outcome of various operations on data structures.
CO5	Explain the concepts of graphs, directed graphs, and weighted graphs with suitable examples.
CO6	Identify appropriate searching and/or sorting techniques for wide range of problems and data types.

Unit	Detailed Contents	CO
I	Introduction to Data Structures: Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion.	CO1
	Arrays, Pointers and Strings: Introduction to Arrays, Definition, One Dimensional Array and Multi-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings.	CO2
II	Stacks and Queue: Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack. Queues: Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue.	CO3
III	Linked Lists and Trees: Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List. Trees: Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree B Tree, B+ Tree.	CO4
IV	Graphs, Searching, Sorting and Hashing: Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms.	CO5
	Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing	CO6

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References:

Text Books:

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Kruse R.L. Data Structures and Program Design in C; PHI
3. Aho Alfred V., Hopperoft John E., Ullman Jeffrey D., "Data Structures and Algorithms", AddisonWesley

Reference Books:

1. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.
2. Yashwant Kanetkar, Understanding Pointers in C, BPB Publications.
3. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.

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3 rd Semester		Web Designing			
BCA25303					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:

CO1	Understand the basics of Internet
CO2	Create pages with simple tags in HTML.
CO3	Design webpages with multiple sections or frames & Explain how to link webpages through hypertext.
CO4	Organise data in tabular form using HTML tables & Design forms with special controls using HTML.
CO5	Understand basic concepts of javascript.
CO6	Outline the key web designing concepts using javascript.

Unit	Detailed Contents	CO
I	Internet Basics Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address, Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags, Singular Tags).	CO1
II	Introduction to HTML Commonly Used Html Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines). Basic Formatting Tags HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. Type of Lists (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists. Adding Graphics To Html Documents Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute.	CO2
	Frames Introduction to Frames: The tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style Tag. Linking Documents Links (External Document References, Internal Document References), Image As Hyperlinks.	CO3

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	Tables Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell Padding Attribute, Using the Cell Spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes.	CO4
III	Forms Used by a Web Site The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element).	CO4
IV	Introduction to JavaScript JS Introduction, Where To, Output, Statements, Syntax, Comments, Variables, Operators, Arithmetic, Assignment, Data Types, Conditions, Switch, Loop For, Loop While, Break, Booleans, Comparisons, Type Conversion, Bitwise, RegExp, Objects, Events, Functions, Function Definitions, Function Parameters, Function Invocation, Function Call, Function Apply, Function Closures	CO5
	Strings: String Methods, Numbers, Number Methods, Arrays, Array Methods, Array Sort, Array Iteration, Dates, Date Formats, Date Get Methods, Date Set Methods, Math, Random, Errors, Scope, Hoisting, Strict Mode, JSON, Forms, Forms API	CO6

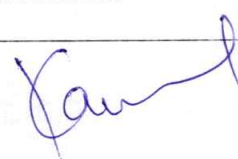


References:

Text Books/Reference Books:

1. Internet for Everyone: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Heppel, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.
3. Raj Kamal, "Internet & Web Technologies", edition Tata McGraw-Hill Education. 2009.

E-Books/ Online learning material:

1. Bayross Ivan, "HTML, DHTML, JavaScript, PERL, CGI", 3rd Edition, BPB Publication, 2009.
2. Chris Payne, "ASP in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.
3. A Beginner's Guide To HTML <http://www.Ncsa.Nine.Edit/General/Internet/www/Html.Prmter>
4. https://www.tutorialspoint.com/html/html_tutorial.pdf
5. <https://www.w3schools.com/js/>
6. <https://www.w3schools.com/html/>
7. https://www.cs.uct.ac.za/mit_notes/web_programming.html
8. http://www.pagetutor.com/table_tutor/index.html

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3 rd Semester		Computer Networks Laboratory			
BCA25304					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Familiarization with networking components and devices and implement resource sharing
CO2	Implement network configuration settings for an operating system
CO3	Prepare different types of cables for networking.
CO4	Design network model using network simulation tool
CO5	Implement various setting on FTP, Proxy and other servers.
CO6	Implement various troubleshooting commands

Sno.	List of Assignments:
1	Familiarization with networking components and devices: LAN Adapters, Hubs, Switches, Routers etc.[CO1]
2	Implementation of resource sharing (file, printer etc.) [CO1]
3	Configuration of TCP/IP Protocols in Windows and Linux.[CO2]
4	Designing and implementing class A, B and C networks.[CO2]
5	To configure dynamic IP address for a computer connected to a LAN.[CO2]
6	Subnet planning and its implementation.[CO2]
7	Familiarization with transmission media and tools: Coaxial cable, UTP cable, Crimping tool, Connectors etc. [CO3]
8	Preparing straight and cross cables.[CO3]
9	Study of various LAN topologies and their creation using network devices, cables and computers.[CO3]
10	Familiarization with network simulation tools. [CO4]
11	Installation of FTP server and client.[CO5]
12	To configure proxy server.[CO5]
13	Use of commands like ping, ipconfig for trouble shooting network related Problems.[CO6]

References:

Reference Books:

1. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
2. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

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3 rd Semester		Data Structures Laboratory			
BCA25305					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement Dynamic memory allocation.
CO2	Create different data structures in C/ C++
CO3	Implement various operations of all data structures
CO4	Illustrate the outcome of various operations with the help of examples.
CO5	Implement various searching and sorting algorithms through programming.
CO6	Analyze Graph Traversing with help of examples.

Instructions: Programs may be developed in C/C++/Python/Java language.

Sno.	List of Assignments
1	Write a program to create an Array. [CO1]
2	Write a program to Insert an element at the end of an array. [CO1]
3	Write a program to Delete an element of an array. [CO1]
4	Write a program to Insert an element in between of an array. [CO1]
5	Write a program to traverse an element from an array. [CO1]
6	Write a program to merge one dimensional array. [CO1]
7	Write a program for addition and subtraction of two matrices. [CO1]
8	Write a program for implementing multiplication of two matrices [CO1]
9	Write a program to implement linear search using one and two-dimensional array. [CO1]
10	Write a program to calculate length of the string using user defined function. [CO2]
11	Write a program to concatenate two strings using user defined function. [CO2]
12	Write a program to compare two strings using user defined function. [CO2]
13	Write a program to reverse a sentence by recursion. [CO2]
14	Write a program for using the concept of pointer to string. [CO2]
15	Write a program to delete all repeated words in string. [CO2]
16	Write a program to find the number of vowels, consonants, digits and white space in a string. [CO2]
17	Write a program to find the length of the longest repeating sequence in a string. [CO2]
18	Write a program to find highest and lowest frequency character in a string. [CO2]
19	Write a program for implementing Stack using array. [CO3]
20	Write a program for implementing Stack using pointer. [CO3]
21	Write a program for implementing multiple stack. [CO3]
22	Write a program to push an element in stack. [CO3]
23	Write a program to pop an element in stack. [CO3]
24	Write a program for converting infix to postfix form. [CO3]
25	Write a program for implementing Queue using array. [CO3]
26	Write a program to Insert and Delete an element in queue. [CO3]

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27	Write a program for dynamic implementation of queue and dequeue. [CO3]
28	Write a program for implementing circular queue priority queue. [CO3]
29	Write a program for implementing Singly Linked list. [CO4]
30	Write a program for implementing Doubly Linked list. [CO4]
31	Write a program for implementing Linear Search Tree. [CO4]
32	Write a program for implementing Binary Search Tree. [CO4]
33	Write a program for Breadth First Search (BFS) for graph traversal. [CO4]
34	Write a program for Depth First Search (DFS) for graph traversal. [CO5]
35	Write a program for implementing selection sort. [CO5]
36	Write a program for implementing insertion sort. [CO5]
37	Write a program for implementing quick sort. [CO5]
38	Write a program for implementing merge sort. [CO5]
39	Write a program for implementing bubble sort. [CO6]

References:

Reference Books:

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.

G.A. Kaur  

3 rd Semester		Web Designing Laboratory			
BCA25306					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Design pages with simple tags in HTML
CO2	Create web pages with Audio and Video content in it.
CO3	Depict the movement from one web page to another.
CO4	Illustrate the data in tabular form using tables.
CO5	Design webpages with multiple sections or frames.
CO6	Implement web designing concepts using java script & execute a small web-based project for the benefit of society.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Create a simple HTML page to demonstrate the use of different tags. [CO1]
2	Design index page of a book on web designing. [CO1]
3	Display Letter Head of your college on a web page. [CO1]
4	Display letter using different Text formatting Tags. [CO1]
5	Create a student Bio- Data. [CO1]
6	Design front page of hospital with different style sheets. [CO2]
7	Embed Audio and Video into your web page. [CO2]
8	Create a Hyperlink to move around within a single page rather than to load another page. [CO3]
9	Design Time Table of your department and highlights of most important periods. [CO4]
10	Use Tables to provide layout to your web page. [CO4]
11	Divide a web page vertically and horizontally and display logo of your college in left pane and logo of university in right pane. [CO5]
12	Design a web page and display two different pages at a time. [CO5]
13	Write a program to create a login form. On submitting the form, the user should get navigated to a profile page using JavaScript. [CO5]
14	Write a code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials using JavaScript. [CO6]
15	Write an HTML code to create your Institute website/Department website/ Tutorial website for specific subject. Also use Java Script for validation. [CO6]

Reference Books:

1. Greenlaw R; Hepp E, "Fundamentals of Internet and www", 2nd Edition, Tata. McGraw-Hill, 2007.
2. A Beginner's Guide to HTML <http://www.Ncsa.Nine.Edit/General/Internet/www/>
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Online Experiment material:

1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

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3 rd Semester		Introduction to Artificial Intelligence			
BCA25307					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents.
CO2	Gain insights about Uninformed and Heuristic search techniques and apply them to solve search applications.
CO3	Apply adversarial search methods on various applications.
CO4	Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.
CO5	Determine inference methods on various chaining techniques.
CO6	Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI.

Unit	Detailed Contents	CO
I	Introduction to AI: What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents. Knowledge Based Agents: Introduction to Knowledge-Based Agents, Problem-solving: Problem-solving agents.	CO1
II	Advanced Search Techniques Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search.	CO2
	Adversarial Search & Games: Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP.	CO3
III	Logical Reasoning and Uncertainty Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting.	CO4
IV	Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems. Introduction to Planning: Blocks World problem.	CO5
	Understanding Prompting and Prompt Techniques : Five Principles of Prompting, Introducing LLM Prompts, How LLM Prompts Work, Types of Prompts, Components of an Prompt, Defining Personality in Prompts, Mix and Match Strategic Combination for Enhanced Prompts, Challenges and Limitations of Using Prompts, Explore tools like ChatGPT, Google Gemini and understand basic text generation.	CO6

Reference Books:
1. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.

G. H. Jawar *SK* *S*

Text Books:

1. Artificial Intelligence-A Modern Approach, Russel and Norvig, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and SB Nair, 3 Ed., Tata McGraw-Hill.
3. Artificial Intelligence And Expert Systems, D.W.Patterson, Prentice Hall.
4. Artificial Intelligence Structures and Strategies for complex Problem Solving, George F. Luger, Pearson Addison Wesley.

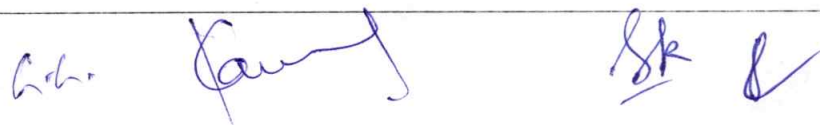
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3 rd Semester		Software Engineering			
BCA25308					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Highlight the need of software engineering.
CO2	Outline the phases and activities involved in the conventional software life cycle models.
CO3	Design documents for various phases of software life cycle.
CO4	Compute the complexity of the software based on multiple metrics.
CO5	Identify the tools needed for different types of documents required in software testing.
CO6	Identify the tools needed for different types of documents required in software metrics.

Unit	Detailed Contents	CO
I	The Nature of Software: Need of Software Engineering, Prescriptive Process Models, Specialized Process Models, The Unified Process.	CO1
II	Role of a system analyst: SRS, Properties of a good SRS document, functional and non- functional requirements. Decision tree and Decision table.	CO2
	Formal Requirements Specification: Software Cost Estimation.	CO3
III	Software design and its activities: Preliminary and detailed design activities, Characteristics of a good software design, features of a design document, Cohesion and Coupling, Structured Analysis, Function Oriented Design, Object-Oriented Design.	CO4
IV	Testing Fundamentals: Unit Testing, Integration Testing, Validation Testing, System Testing, Maintenance and Reengineering.	CO5
	Measures Metrics and Indicators: Software Measurement, Metrics for Requirements Model, Metrics for Design Model, Metrics for Testing, Metrics for Maintenance.	CO6

Reference Books:
1. Software Engineering–A Practitioner’s Approach, Roger S.Pressman, Seventh Edition, McGrawHill, 2010.
Text Books:
1. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, Narosa Publishing House, 2005
2. Software Engineering, Ian Sommerville, Ninth Edition, Addison-Wesley, 2011



3 rd Semester		Data Security & Privacy			
BCA25309					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	To learn the basic concepts related to data security and understand the different types of symmetric key ciphers.
CO2	To understand concepts of data encryption standards.
CO3	To understand the digital signature concept and data hiding in text.
CO4	To learn the basic concepts of Data Hiding in Images.
CO5	To understand the concepts of privacy, authentication, web and email security.
CO6	To understand the role of legal and ethical issues in computer security.

Unit	Detailed Contents	CO
I	Introduction: Security goals, Cryptographic Attacks, Services and Mechanism, Techniques. Traditional Symmetric Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers. Introduction to Modern Symmetric-Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers.	CO1
II	Data Encryption Standard (DES): Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES. Advanced Encryption Standard (AES): Introduction, Transformations, Key Expansion, AES Ciphers, Analysis of AES. Asymmetric-Key Cryptography: Introduction, RSA Cryptosystem.	CO2
	Digital Signature: Comparison, Process, Services, Attacks on Digital Signature, Digital Signature Standard. Data Hiding in Text: Basic Features, Applications of Data Hiding, Watermarking, Intuitive Methods, Simple Digital Methods, Data Hiding in Text, Innocuous Text, Mimic Functions.	CO3
III	Data Hiding in Images: LSB Encoding, BPCS Steganography, Lossless Data Hiding, Spread Spectrum Steganography, Data Hiding by Quantization, Patchwork, Signature Casting in Images, Transform Domain Methods, Robust Data Hiding in JPEG Images, Robust Frequency Domain Watermarking, Detecting Malicious Tampering.	CO4
IV	Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, E-Mail Security, Impacts on Emerging Technologies.	CO5
	Legal and Ethical Issues in Computer Security: Protecting Programs and Data, Information and the Law, Rights of Employees and employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security.	CO6

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Reference Books:

1. Information Security: Principles and Practice by Mark Stamp, Wiley Inter Science, 2011.
2. Computer Security: Art and Science by Matt Bishop, First Edition, Addison Wesley, 2002.
3. Cryptography and Network Security by William Stallings, Pearson Education, 7th edition, 2017.

Text Books:

1. Cryptography and Network Security by Behrouz A. Forouzan, Dedeep Mukhopadhyay, TMH, 2nd edition, 2013. (Modules I, II, III)
2. Data Privacy and Security by Salomon, David, Springer, 2003. (Module III)
3. Security in Computing by Charles Pfleeger, Shari Lawrence Pfleeger, 5th Edition, PHI, 2015. (Module IV)

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4 th Semester		Programming in Python		
BCA25401				
Internal Marks:	40	L	T	P
External Marks:	60	4	0	0
Total Marks:	100	Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Compare Python with other programming languages.
CO2	Explain environment, data types, operators used in Python.
CO3	Outline the use of control structures and numerous native data types with their methods.
CO4	Knowledge to learn how to write user define function and modules and packages.
CO5	Illustrate files and exception handling methods.
CO6	Write solutions for Object Oriented Programming Concepts.

Unit	Detailed Contents	CO
I	Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.	CO1
	Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.	CO2
II	Control Structures: Decision making statements, Python loops, Python control statements. Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).	CO3
III	Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.	CO4
IV	Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python.	CO5
	Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.	CO6

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References:

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

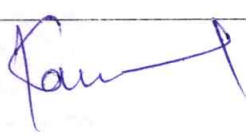


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4 th Semester		Database Management Systems			
BCA25402					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Define the basic concepts of DBMS.
CO2	Design SQL queries.
CO3	Design PL/SQL queries
CO4	Illustrate the concept of data normalization with the help of real life examples.
CO5	Explain the concept of transaction management.
CO6	Outline features of advanced database management systems.

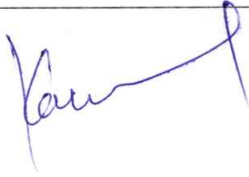


Unit	Detailed Contents	CO
I	Introduction of DBMS: Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. Introduction to Data Models, Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model.	CO1
II	Relational Database: Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL. PL/SQL Concepts: Cursors, Stored Procedures, Stored Functions, Database Triggers.	CO2 CO3
III	Introduction to Normalization: First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).	CO4
IV	Database Recovery: Concurrency Management, Database Security, Integrity and Control. Distributed Database: Structure and Design of Distributed Databases.	CO5 CO6

References:
Reference Books: 1. "SQL, PL/SQL The Programming Language of Oracle", Ivan Bayross. BPB Publications, 4th Revised Edition (2009) 2. "An Introduction to Database Systems", C. J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, (2006). 3. Database Management Systems, Raghu Ramakrishnan, McGraw-Hill, Third Edition, 2014.

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Text Books:

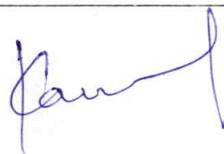
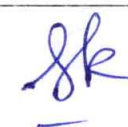

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications Pvt Ltd-New Delhi, Revised Edition, (2012).
2. "Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).

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4 th Semester		Operating Systems			
BCA25403					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Discuss the evaluation of operating systems.
CO2	Explain different resource managements performed under CPU process and Thread.
CO3	Describe various CPU scheduling algorithm.
CO4	Describe the architecture in terms of functions performed by different types of operating systems.
CO5	Analyze the performance of different algorithms used in design of operating system components.
CO6	Compare the key properties of different types of Operating Systems.

Unit	Detailed Contents	CO
I	Fundamentals of Operating system: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems.	CO1
	Process & Thread Management: Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, Process synchronization.	CO2
II	CPU Scheduling: Need of CPU scheduling, CPU I/O Burst Cycle, Pre-emptive vs. Non-pre-emptive scheduling, Different scheduling criteria's, scheduling algorithms (FCFS, SJF, Round-Robin, Multilevel Queue).	CO3
III	Memory Management: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms.	CO4
IV	I/O Device Management: I/O devices and controllers, device drivers; disk storage. File Management: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection.	CO5
	Advanced Operating systems: Introduction to Distributed Operating system, Characteristics, architecture, Issues, Communication & Synchronization; Introduction Multiprocessor Operating system, Architecture, Structure, Synchronization & Scheduling; Introduction to Real-Time Operating System, Characteristics, Structure & Scheduling. Case study of Linux operating system	CO6

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References:

Reference Books:

1. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published by Pearson Education.
2. Operating system by Stalling, W., Sixth Edition, Published by Prentice Hall (India)

Text Books:

1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.
2. Principals of Operating System by Naresh Chauhan, Published by OXFORD University Press, India.

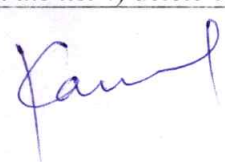
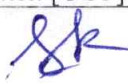

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4 th Semester		Programming in Python Laboratory			
BCA25404					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Outline various programming constructs with data types of Python.
CO2	Outline control structures programming constructs of Python.
CO3	Implement different data structures.
CO4	Implement modules and functions.
CO5	Illustrate concept of object oriented programming.
CO6	Implement file handling.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user. [CO1]
2	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram. [CO1]
3	Compute volume of following 3D shapes: cube, cylinder, cone and sphere. [CO1]
4	Compute and print roots of quadratic equation $ax^2+bx+c=0$, where the values of a, b, and c are input by the user. [CO1]
5	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,... [CO2]
6	Write a program to determine whether a triangle is isosceles or not? [CO2]
7	Print multiplication table of a number input by the user. [CO2]
8	Compute sum of natural numbers from one to n number. [CO2]
9	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13.....n [CO2]
10	Compute factorial of a given number. [CO2]
11	Count occurrence of a digit 5 in a given integer number input by the user [CO2]
12	Print Geometric and Harmonic means of a series input by the user. [CO2]
13	. Evaluate the following expressions: a. $x-x^2/2!+x^3/3!-x^4/4!+... x^n/n!$ b. $x-x^3/3!+x^5/5!-x^7/7!+... x^n/n!$ [CO2]
14	Print all possible combinations of 4, 5, and 6. [CO2]
15	Determine prime numbers within a specific range. [CO2]
16	Count number of persons of age above 60 and below 90. [CO2]
17	Compute transpose of a matrix. [CO3]
18	Perform following operations on two matrices. [CO3] 1) Addition 2) Subtraction 3) Multiplication
19	Count total number of vowels in a word. [CO3]
20	Count occurrence of vowels. [CO3]
21	Determine whether a string is palindrome or not. [CO3]
22	Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete entire list. [CO3]

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23	Display word after Sorting in alphabetical order. [CO3]
24	Perform sequential search on a list of given numbers. [CO3]
25	Perform sequential search on ordered list of given numbers. [CO3]
26	Maintain practical note book as per their serial numbers in library using Python dictionary. [CO3]
27	Perform following operations on dictionary 1) Insert 2) delete 3) change [CO3]
28	Check whether a number is in a given range using functions. [CO4]
29	Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string. [CO4]
30	To find the Max of three numbers using functions. [CO4]
31	Multiply all the numbers in a list using functions. [CO4]
32	Solve the Fibonacci sequence using recursion. [CO4]
33	Get the factorial of a non-negative integer using recursion. [CO4]
34	Write a program to create a module of factorial in Python. [CO4]
35	Design a Python class named Rectangle, constructed by a length & width, also design a method which will compute the area of a rectangle. [CO5]
36	Design a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle. [CO5]
37	Design a Python class to reverse a string 'word by word'. [CO5]
38	Write a Python program to read an entire text file. [CO6]
39	Design a Python program to read first n lines of a text file. [CO6]
40	Construct a Python program to write and append text to a file and display the text. [CO6]

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

A. S. Kumar *JS* *S*

4 th Semester		Database Management Systems Laboratory			
BCA25405					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Differentiate between DDL, DML and DCL commands
CO2	Implement DDL, DML and DCL commands
CO3	Write integrity constraints on a database
CO4	Design Databases and Tables in relational model for some project related to society welfare
CO5	Implement PL/SQL.
CO6	Implement PL/SQL.(Cursor and Trigger)

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Used of CREATE, ALTER, RENAME and DROP statement in the database tables (relations) [CO1]
2	Used of INSERT INTO, DELETE and UPDATE statement in the database tables (relations) [CO1]
3	Use of simple select statement. [CO2]
4	Use of select query on two relations [CO2]
5	Use of nesting of queries. [CO2]
6	Use of aggregate functions. [CO2]
7	Use of substring comparison. [CO2]
8	Use of order by statement. [CO2]
9	Consider the following schema for a Library Database: BOOK (<i>Book_id, Title, Publisher_Name, Pub_Year</i>) BOOK_AUTHORS (<i>Book_id, Author_Name</i>) PUBLISHER (<i>Name, Address, Phone</i>) BOOK_COPIES (<i>Book_id, Branch_id, No- of Copies</i>) BOOK_LENDING (<i>Book_id, Branch_id, Card_No, Date_Out, Due_Date</i>) LIBRARY_BRANCH (<i>Branch_id, Branch_Name, Address</i>) Write SQL queries to 1. Retrieve details of all books in the library_id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books between Jan 2018 to Jun 2018 3. Delete a book in BOOK table. Update the contents of other tables to reflect this datamanipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. Create a view of all books and its number of copies that are currently available in the Library. [CO3]

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10	Consider the following schema for Order Database: SALESMAN (<i>Salesman_id, Name, City, Commission</i>) CUSTOMER (<i>Customer_id, Cust_Name, City, Grade, Salesman_id</i>) ORDERS (<i>Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id</i>) Write SQL queries to 1. Count the customers with grades above Amritsar's average. 2. Find the name and numbers of all salesmen who had more than one customer. 3. List all salesmen and indicate those who have and don't have customers in their cities(Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted. [CO4]
11	Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time. [CO5]
12	Write a PL/SQL code to find sum of first 10 natural numbers using while and for loop. [CO5]
13	Write a program to create a trigger which will convert the name of a student to upper case before inserting or updating the name column of student table. [CO6]
14	Write a PL/SQL block to count the number of rows affected by an update statement using SQL%ROWCOUNT [CO6]
15	Write a PL/SQL block to increase the salary of all doctors by 1000. [CO6]

Reference Books:

1. "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition, Ivan Bayross (2009).
2. "Oracle PL/SQL Programming", 5th Edition, Steven Feuerstein and Bill Pribyl (2009).

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4 th Semester		Operating Systems Laboratory			
BCA25406					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Implement the installation and configuration of different operating systems.
CO2	Write programs for different scheduling algorithms.
CO3	Execute various commands in Vi editor
CO4	Implement the dual boot installation
CO5	Execute commands in shell programming
CO6	Implement commands in shell programming with various control statement.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Installation of windows OS. [CO1]
2	Installation of Linux OS. [CO1]
3	Implementation of FCFS Scheduling algorithm. [CO2]
4	Implementation of SJF Scheduling algorithm. [CO2]
5	Implementation of Round-Robin Scheduling algorithm. [CO2]
6	Vi Editor & its commands. [CO3]
7	Shell Commands. [CO3]
8	Dual boot installation of Operating systems. [CO4]
9	Shell Scripting- Using variables. [CO5]
10	Shell Scripting- Input & Output. [CO5]
11	Shell Scripting- Data types. [CO5]
12	Shell Scripting- Use of arithmetic operators. [CO5]
13	Shell Scripting- if control statement programs. [CO6]
14	Shell Scripting- while control statement. [CO6]
15	Shell Scripting- for control statement. [CO6]

Reference Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw- Hill Publication.
2. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.

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4 th Semester		Design thinking and innovation			
BCA25407					
Internal Marks:	40		L	T	P
External Marks:	60		2	0	0
Total Marks:	100		Credits		2

Course Outcomes: After studying the course, students will be able to:	
CO1	Basics of Design Thinking.
CO2	Propose real-time innovative product designs and Choose appropriate frameworks, strategies, techniques during prototype development.
CO3	Learning to Empathize and Define the Problem.
CO4	Ideate, Prototype and Implement.
CO5	Feedback, Re-Design & Re-Create.
CO6	Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products.

Unit	Detailed Contents	CO
I	Basics of Design Thinking Understand the concept of innovation and its significance in business Understanding creative thinking process and problem solving approaches Know Design Thinking approach and its objective Design Thinking and customer centrality – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product.	CO1
	Discussion of a few global success stories: AirBnB, Apple, IDEO, Netflix etc. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement	CO2
II	Know the importance of empathy in innovation process – how can students develop empathy using design tools Observing and assimilating information Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences. What are wicked problems, Identifying wicked problems around us and the potential impact of their solutions	CO3
III	Ideate, Prototype and Implement Know the various templates of ideation like brainstorming, systems thinking Concept of brainstorming – how to reach consensus on wicked problems Mapping customer experience for ideation Know the methods of prototyping, purpose of rapid prototyping. Implementation	CO4
IV	Feedback Feedback loop, focus on User Experience, address ergonomic challenges, user focused design	CO5

A. K. Kaur

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Re-Design & Re-Create Final concept testing, Final Presentation – Solving Problems through innovative design concepts & creative solution	CO6
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Reference Books:

1. Design Thinking by Nigel Cross, Bloomsbury

Text Books:

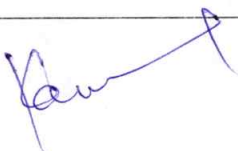


1. E Balaguruswamy (2023), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company
2. Tim Brown, (2008), "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", *Harvard Business Review*
3. 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing

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4 th Semester		Cloud Computing			
BCA25408					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Define the concept of cloud computing.
CO2	Outline the benefits if migrating to a cloud solution for different applications. Compare different virtualization technologies.
CO3	Fundamental of capacity planning and analysis.
CO4	Identify various resources needed to build cloud.
CO5	Explain various security threats to cloud.
CO6	Explore some important cloud computing driven commercial systems.

Unit	Detailed Contents	CO
I	Overview of Computing Paradigm: Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Introduction to Cloud Computing: Vision of Cloud Computing, Defining a Cloud, Cloud delivery Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud computing vs. Cluster computing vs. Grid computing.	CO1
	Migrating into a Cloud: Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud. Virtualization: Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Hypervisor Technology Examples- Xen, VMware, Microsoft Hyper-V.	CO2
II	Capacity Planning: Elasticity vs Scalability, Introduction, Defining Baseline and Metrics-Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.	CO3
III	SLA Management in Cloud Computing: Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management.	CO4
IV	Securing Cloud services: Cloud Security, Securing Data- Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance. Steps to ensure security over cloud.	CO5
	Cloud Platforms in Industry: Amazon Web Services-Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life Cycle. Cost Model. Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.	CO6

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Reference Books:



1. Cloud Computing for Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.
3. Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6, New Delhi, India, 2011

Text Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India, Feb 2013.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978- 81-265-2980-3, New Delhi, India, 2011.

E Books/ Online learning material

1. P.D. Kaur, I. Chana, Unfolding the distributed computing paradigm, in: Proceedings of the IEEE International Conference on Advances in Computer Engineering, ACE, Bangalore, Karnataka, India, 2010, pp. 339–342.
2. P. Mell and T. Grance, "The NIST definition of cloud computing (draft), NIST Spec. Publ. 800 (2011) 7.

A.G. Kaur  

4 th Semester	Introduction to Biometrics				
BCA25409					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:

CO1	Understand the benefits of biometrics
CO2	Perceive fingerprint, face, and iris recognition
CO3	Explain retina and hand recognition
CO4	Analyze signature and handwriting technology, keyboard / keystroke dynamics
CO5	Examine multi biometrics and Voice recognition
CO6	To understand various applications of biometric system.

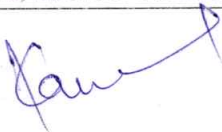
Unit	Detailed Contents	CO
I	Concepts - biometric recognition, biometrics, requirements for biometrics Biometric systems, their modes and architectures, Biometric system errors and evaluation	CO1
	Physiological Biometric Technologies: Fingerprints - Technical description - characteristics - Competing technologies - strengths - weaknesses - deployment. Facial scan - Technical description - characteristics - weaknesses-deployment. Iris scan - Technical description - characteristics - strengths - weaknesses - deployment	CO2
II	Overview: Comparison and evaluation of various biometrics, Unimodal biometric systems, their advantages, disadvantages and limits, Multimodal biometric systems, their modes of operation, levels of fusion	CO3
III	Signature and handwriting technology: Technical description - classification. Keyboard / keystroke dynamics. Voice - data acquisition - feature extraction - characteristics - strengths - weaknesses deployment	CO4
IV	Biometric: pattern recognition methods, Privacy protection and social acceptance, Biometric standardization, data formats	CO5
	Design and implementation of biometric systems: applications of biometric systems, biometric databases, security of biometric systems	CO6



Reference Books:

1. Guide to Biometrics, Ruud M. Bolle, Jonathan H. Connell, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Springer

Text Books:

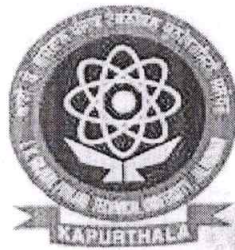
1. Biometrics: Concepts and Applications, GR Sinha, Sandeep B. Patil, Wiley.
2. Biometrics: A Very Short Introduction, Michael Fairhurst.

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**Scheme & Syllabus of
Master of Computer Applications
(MCA)**

Batch 2025 onwards



By

Board of Study Computer Applications

Department of Academics

**IK Gujral Punjab Technical
University**

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA-B1	Bridge Course*	Computer Programming using C	2	0	0	50	-	50	S/US
PGCA-B2	Bridge Course*	Computer Science Essentials	2	0	0	50	-	50	S/US
PGCA-B3	Bridge Course*	Mathematics	2	0	0	50	-	50	S/US
PGCA1917	Core Theory	Discrete Structures & Optimization	4	0	0	30	70	100	4
PGCA1951	Core Theory	Programming in Python	4	0	0	30	70	100	4
PGCA1952	Core Theory	Advanced Data Structures	4	0	0	30	70	100	4
PGCA1953	Core Theory	Advanced Database Management System	4	0	0	30	70	100	4
PGCA1905	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	0	0	30	70	100	3
PGCA1954	Core Practical/Laboratory	Data Structures using Python Laboratory	0	0	4	70	30	100	2
PGCA1955	Core Practical/Laboratory	Advanced Database Management System Laboratory	0	0	4	70	30	100	2
PGCA1908	Ability Enhancement Compulsory Course (AECC)	Technical Communication Laboratory	0	0	2	30	20	50	1
TOTAL			19	0	10	320	430	750	24

*Bridge courses are not applicable to all the students, please refer MCA eligibility given above in order to offer bridge courses to students.

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1909	Core Theory	Web Technologies	4	0	0	30	70	100	4
PGCA1920	Core Theory	Design & Analysis of Algorithms	4	0	0	30	70	100	4
PGCA1918	Core Theory	Advanced Java	4	0	0	30	70	100	4
PGCA1956	Core Theory	Linux Administration	4	0	0	30	70	100	4
PGCA1932	Core Theory	Information Security & Cyber Law	4	0	0	30	70	100	4
PGCA1914	Core Practical/Laboratory	Web Technologies Laboratory	0	0	4	70	30	100	2
PGCA1922	Core Practical/Laboratory	Advanced Java Laboratory	0	0	4	70	30	100	2
PGCA1957	Core Practical/Laboratory	Linux Administration Laboratory	0	0	4	70	30	100	2
TOTAL			20	0	12	360	440	800	26

Students will undergo 4 weeks Summer Training after 2nd semester. Examination will be conducted along with 3rd semester practicals.

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Third Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1925	Core Theory	Advanced Computer Networking	4	0	0	30	70	100	4
PGCA1926	Core Theory	Artificial Intelligence & Soft Computing	4	0	0	30	70	100	4
PGCA1927	Core Theory	Theory of Computation	4	0	0	30	70	100	4
	Elective - I		4	0	0	30	70	100	4
	Elective - II		4	0	0	30	70	100	4
PGCA1928	Core Practical/ Laboratory	Advanced Computer Networking Laboratory	0	0	4	70	30	100	2
PGCA1929	Core Practical/ Laboratory	Artificial Intelligence & Soft Computing Laboratory	0	0	4	70	30	100	2
	Elective - II Laboratory		0	0	4	70	30	100	2
PGCA1969		**Summer/Institutional Training	0	0	4	70	30	100	2
TOTAL			20	0	16	430	470	900	28

Elective - I

Course Code	Course Title
PGCA1930	Software Project Management
PGCA1971	Optimization Techniques
PGCA1972	Data Mining and Business Intelligence
PGCA1973	Enterprise Resource Planning

Elective - II

Course Code	Course Title
PGCA1933	Mobile Applications Development
PGCA1935	Simulation & Modelling
PGCA1921	e-Commerce and Digital Marketing
PGCA1931	Software Testing & Quality Assurance

Elective - II Laboratory

Course Code	Course Title
PGCA1934	Mobile Applications Development Laboratory
PGCA1936	Simulation & Modelling Laboratory
PGCA1974	e-Commerce and Digital Marketing Laboratory
PGCA1975	Software Testing & Quality Assurance Laboratory

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Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1976	Core Theory	Machine Learning & Data Analytics using Python	4	0	0	30	70	100	4
PGCA1958	Core Theory	Advanced Web Technologies	4	0	0	30	70	100	4
PGCA1977	Core Practical/ Laboratory	Machine Learning & Data Analytics using Python Laboratory	0	0	4	70	30	100	2
PGCA1960	Core Practical/ Laboratory	Advanced Web Technologies Laboratory	0	0	4	70	30	100	2
	Elective - III		4	0	0	30	70	100	4
	Elective - III Laboratory		0	0	4	70	30	100	2
PGCA1961		Research/Technical Seminar	0	0	2	0	100	100	1
PGCA1962		Project	0	0	8	180	120	300	4
TOTAL			12	0	22	480	520	1000	23

Elective - III	
Course Code	Course Title
PGCA1937	Cloud Computing
PGCA1963	Digital Image Processing
PGCA1965	NLP and Speech Recognition
PGCA1967	IOT & Blockchain Technology

Elective - III Laboratory	
Course Code	Course Title
PGCA1938	Cloud Computing Laboratory
PGCA1964	Digital Image Processing Laboratory
PGCA1966	NLP and Speech Recognition Laboratory
PGCA1968	IOT & Blockchain Technology Laboratory

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PROGRAM OUTCOMES (POs)

Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

Problem Analysis: Identify, formulate, research literature, and solve complex computing problem searching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

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.

Conduct investigations of complex Computing problems: User search-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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.

Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

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.

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.

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 practices.

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

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.

MCA Eligibility

THE GENERAL ELIGIBILITY CRITERIA FOR MCA 2 YEARS (FOUR SEMESTERS):

MCA ELIGIBILITY:

Passed any graduation degree (e.g.: B.E. / B.Tech./B.Sc./B.Com./B.A. / B. Voc. / BCA etc.,) preferably with Mathematics at 10+2 level or at Graduation level from the University recognized by the University Grants Commission (UGC) and also Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying examination shall be eligible to apply for admission to MCA Course.

(for students having no Mathematics background compulsory bridge course will be framed by the respective University/Institution and additional bridge courses related to computer subjects as per the norms of the concerned University)

Course Code: PGCA-B1

Course Name: Computer Programming using C

Program: MCA (Bridge Course)	L: 2 T: 0 P: 0
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 22 hours
Internal max. marks: 50	Theory/Practical: Theory
External max. marks: -	Duration of end semester exam (ESE): -
Total marks: 50	Elective status: No

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Student should be able to understand the logic building used in Programming.
CO2	Students should be able to write algorithms for solving various real life problems.
CO3	To convert algorithms into programs using C.

Detailed Contents	Contact hours
<p>Unit-I</p> <p>Logic Development: Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants.</p> <p>Operations and Expressions: Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.</p>	6
<p>Unit-II</p> <p>Data Input and Output: formatted & unformatted input output.</p> <p>Control Statements: While, Do-while and For statements, Nested loops, If-else, Switch, Break – Continue statements.</p>	8
<p>Unit-III</p> <p>Arrays: Defining, processing arrays, passing arrays to a function, multi-dimensional arrays.</p>	8

Strings: String declaration, string functions and string manipulation
Program Structure Storage Class: Automatic, external and static variables.

Functions: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion.

Objects and Classes: Introduction to Object Oriented Concepts, Features of OOP, Basic of classes and Objects.

Text Books:

1. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill.
2. Programming in C, Third Edition, Stephen G Kochan, Pearson.
3. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication.

Reference Books:

1. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.
4. Problem Solving and Programming in C, R.S. Salaria, Second Edition
5. Programming in C, Atul Kahate.

Course Code: PGCA-B2

Course Name: Computer Science Essentials

Program: MCA (Bridge Course)	L: 2 T: 0 P: 0
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 22 hours
Internal max. marks: 50	Theory/Practical: Theory
External max. marks: -	Duration of end semester exam (ESE): -
Total marks: 50	Elective status: No

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understanding the concept of input and output devices of Computers
CO2	Learn the basic concepts of Operating Systems and Database Systems
CO4	Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.

Detailed Contents	Contact hours
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<p>Unit-I</p> <p>Human Computer Interface Concepts of Hardware and Software; Data and Information.</p> <p>Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. (Brief introduction of all)</p> <p>Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks.</p> <p>Data Representation: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.</p>	7
<p>Unit-II</p> <p>Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.</p> <p>Spreadsheet: Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs.</p> <p>Presentation Graphics Software: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.</p>	7
<p>Unit-III</p> <p>DBMS: Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS.</p> <p>Fundamentals of Operating system: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems.</p> <p>Data communications concepts: Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex.</p>	8

Types of Networks: LAN, MAN, WAN, Topologies.

Text Books:

1. Fundamentals of Computers, V Rajaraman, NADabala, PHI.
2. Computer Fundamentals and Programming in C, Reema Thareja, Oxford University Press, 2016.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
4. Computer Fundamentals, A. Goel, 2010, Pearson Education.
5. Computer Course Windows 10 with MS Office 2016, Satish Jain (Author), BPB Publications.

Reference Books:

1. "Introduction to Computers", Peter Norton

Course Code: PGCA-B3

Course Name: Mathematics

Program: MCA (Bridge Course)	L: 2 T: 0 P: 0
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 22 hours
Internal max. marks: 50	Theory/Practical: Theory
External max. marks: -	Duration of end semester exam (ESE): -
Total marks: 50	Elective status: No

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.
CO2	This course enables the students to use mathematical models and techniques to analyze and understand problems in computer science.
CO3	This course demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.

Detailed Contents	Contact hours
Unit-I Set Introduction, Objectives, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, Difference of Set, Symmetric Difference of Set) Universal Sets, Complement of a Set.	6
Unit-II Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.	6
Unit-III Matrices Introduction, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, Null Matrix, Comparable Matrix, Equal Matrix), Scalar Multiplication, Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix.	6
Unit-IV Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities	4

Text Books

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen, Mc Graw Hill, 6th Edition. 2. College Mathematics, Schaum's Series, TMH.
2. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
3. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979.
4. Vasishtha A. R. and Vasishtha A. K., Matrices, Krishna Prakashan, 2022.

Reference Books

1. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

Web Resources

1. <https://nptel.ac.in/courses/106103205>
2. <https://nptel.ac.in/courses/111101115>

Course Code: PGCA1917

Course Name: Discrete Structures & Optimization

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 1 st	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: Basic Mathematical Knowledge

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Apply the operations of sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion
CO2	Apply rules of inference, proof by contradiction, proof by cases, and write proofs using symbolic logic and Boolean Algebra, Introduce the concept of Rings and Boolean Rings
CO3	Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, the pigeon-hole principle, Understanding of Recurrence relations and generating functions
CO4	Understand algebraic structures and their properties.
CO5	Apply advanced group concepts and relations.
CO6	Analyze graph theory concepts and applications.

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Sets, relations, and functions: Introduction, Combination of Sets, ordered pairs, proofs of general identities of sets, relations, operations on relations, properties of relations and functions, Hashing Functions, equivalence relations, compatibility relations, partial order relations.</p> <p>Rings and Boolean algebra: Rings, Subrings, Morphism of rings ideals and quotient rings. Euclidean domains, Integral domains and fields, Boolean Algebra, Direct product morphisms, Boolean sub-algebra, Boolean Rings, Application of Boolean algebra (Logic Implications, Logic Gates, Karnaughmap)</p>	<p>24 Hours</p>
<p>Combinatorial Mathematics: Basic counting principles, Permutations and combinations, Inclusion and Exclusion, Principle Recurrence relations, Generating Function, Pigeon Hole Principle, Application .</p>	
<p style="text-align: center;"><u>Part B</u></p> <p>Monoids and Groups: Groups, Semigroups and monoids, Cyclic semigroups and submonoids, Subgroups and Cosets.</p> <p>Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups.</p> <p>Graph Theory: Graph- Directed and undirected, Eulerian chains and cycles, Hamiltonian chains and cycles Trees, Chromatic number Connectivity, Graph coloring, Plane and connected graphs, Isomorphism and Homomorphism. Applications.</p>	<p>20 Hours</p>

Text Books:

1. Discrete Mathematics (Schaum series), Lipschutz (McGraw Hill).
2. Applied Discrete Structures for Computer Science, Alan Doerr and Kenneth Levarseur (Creative Commons) 2012.

Reference Books:

1. Discrete Mathematics and its Applications, Kenneth H Rosen.(McGraw Hill)
2. Discrete Mathematics and Graph Theory, Sartha, (Cengage Learning)
3. Elements of discrete mathematics. C L Liu (McGraw Hill)

Course Code: PGCA1951

Course Name: Programming in Python

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 1 st	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: -
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE:-NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Compare Python with other programming languages.
CO2	Explain environment, data types, operators used in Python.
CO3	Outline the use of control structures and numerous native data types with their methods.
CO4	Knowledge to learn how to write user define function and modules and packages.
CO5	Illustrate files and exception handling methods.
CO6	Write solutions for Object Oriented Programming Concepts.

Detailed Contents	Contact hours
<p style="text-align: center;">Part- A</p> <p>Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.</p> <p>Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command.</p> <p>Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.</p> <p>Control Structures: Decision making statements, Python loops, Python control statements.</p> <p>Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).</p>	22 hours
<p style="text-align: center;">Part- B</p> <p>Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.</p> <p>Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.</p> <p>Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.</p> <p>File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python.</p>	22 hours

Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Course Code: PGCA1952

Course Name: Advanced Data Structures

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 1 st	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Choose appropriate data structures to design a solution
CO2	Construct best algorithms and use it to design solution for a specific problem.
CO3	Execute the operations of hashing to retrieve data from data structure.
CO4	Design and analyze programming problem statements
CO5	Come up with analysis of efficiency and proofs of correctness
CO6	Comprehend and select algorithm design approaches in a problem specific manner.

Detailed contents	Contact hours
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<u>Part A</u>	22 Hours
<p>Introduction to Data Structures: Data Structures and its Types, Algorithms, Time Complexity, Recurrence, Probabilistic Analysis, Amortized Analysis, Competitive Analysis.</p> <p>Sorting Algorithms: Quick Sort, Heap Sort, Counting Sort, Bucket Sort, Multi-way Merge Sort.</p> <p>Hashing Techniques: Direct Address Tables, Hash Tables, Hash Functions, Open Addressing, Perfect Hashing.</p> <p>Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, Binomial Heaps, Fibonacci heaps, Data Structures for Disjoint Sets.</p>	
<u>Part B</u>	22 Hours
<p>Graphs & Algorithms: Graphs Representation, Minimum Spanning Tree (MST), Single Source Shortest Paths, All Pairs Shortest Paths, Maximum Flow. [CO5]</p> <p>String Matching: String, String Length, String Concatenation, String Copy, String-Matching, Brute Force algorithm, Rabin Karp algorithm, Knuth-Morris-Pratt (KMP) algorithm, Boyer-Moore algorithm.</p>	

Text Books:

1. Thomas Cormen, "Introduction to Algorithms", Third edition, Prentice Hall of India, 2009.

Reference Books:

1. Kleinberg J., Tardos E., "Algorithm Design", 1st Edition, Pearson, 2012.
2. Aho Alfred V., Hopcroft John E., Ullman Jeffrey D., "Data Structures and Algorithms", Addison Wesley, 2001.
3. Seymour Lipschutz, "Data structure", Indian Adapted Edition, Tata McGraw Hill, 200

Course Code: PGCA 1953

Course Name: Advanced Database Management System

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 1 st	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Express the basic concepts of DBMS and RDBMS.
CO2	Apply normalization theory to the normalization of a database
CO3	Apply the concept of Transaction Management & Recovery techniques in RDBMS.
CO4	Analyze various advanced databases prevailing in market, , Temporal Databases, Parallel and Distributed Databases
CO5	Demonstrate No SQL databases (Open Source), Big Data
CO6	XML Database and multidimensional Databases

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Need of DBMS over traditional Data storage mechanisms, Basic DBMS terminologies; Architecture of a DBMS: Data Independence, DBMS Component Structure, DBMS USERS, various DBMS Data Models,</p> <p>Conceptual Model: Entity Relationship Model, Importance of ERD, Symbols (Entity: Types of Entities, weak Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality).</p> <p>Normalization and its various forms, Functional Dependencies, Multi-valued Dependencies, Join Dependencies Database Integrity: Domain, Entity, Referential Integrity Constraints</p> <p>Relational Languages: Relational Algebra, Relational Calculus, Query Execution, optimization and evaluation Plans.</p> <p>Transaction Management and Concurrency Control techniques, Database Recovery Management Concepts and methods.</p> <p>Introduction and Need of Database Administration and activities of Database administration.</p>	22 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Parallel Databases : Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems-Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism</p> <p>Distributed Database Concepts : Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing</p> <p>Multidimensional Databases and their uses in data analytics.</p>	22 Hours

<p>Temporal Databases : Introduction to Temporality, Temporal relationships, temporal hierarchies.</p> <p>Spatial Databases: Spatial data types, spatial relationships, Topological Relationships, Spatial Data Structures and methods of storage.</p> <p>Big Data : introduction: introduction to NOSQL Databases (Open Source only).</p> <p>Need and usage of XML Databases: XML Data Model – DTD – XML Schema</p>	
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Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concept", Sixth Edition, 2013, McGraw-Hill
2. Bipin C. Desai, "An Introduction to Database System", Revised Edition, 2012, Galgotia Publications Pvt Ltd-New Delhi

Reference Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition, 2009, BPB Publications
2. Peter Rob Carlos Coronel, "Database Systems", Cengage Learning, 8th ed.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, 2006, Pearson Education.

Course Code: PGCA1905

Course Name: Technical Communication

Program: MCA	L:3 T:0 P:0
Branch: Computer Applications	Credits: 3
Semester: 1 st	Contact hours: 33 hours
Internal max. marks: 30	Theory/Practical: Theory
External max. marks: 70	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Ability Enhancement

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understand fundamental and basic knowledge of communication
CO2	Implement communication skills easily
CO3	Create thoughts and become proficient in writing skills
CO4	Plan and enhance Writing and Research skills
CO5	Generate innovative ideas and develop positive attitude
CO6	Understand the Basic computer skills and Artificial Intelligence

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Basics of Technical Communication: Functions of Communication- Internal & External Functions, Models-Shannon & Weaver's model of communication, Flow, Networks and importance, Barriers to Communication, Essential of effective communication (7C's and other principles), Non-verbal Communication.</p> <p>Basic Technical Writing: Paragraph writing (descriptive, Imaginative etc.), Precise writing, reading and comprehension, Letters- Format & various types.</p>	16 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Advanced Technical Writing: Memos, Reports, E-Mails & Net etiquettes, Circulars, Press Release, Newsletters, Notices. Resume Writing, Technical Proposals, Research Papers, Dissertation and Thesis, Technical Reports, Instruction Manuals and Technical Descriptions, Creating Indexes, List of References and Bibliography.</p> <p>Verbal Communication: Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences.</p> <p>Technical Communication: MS-Word, Adobe Frame maker and ROBO Help</p> <p>* Lab Exercises based on Listening and Speaking skills.</p>	17 Hours

Text Books:

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi.
2. K K Ramchandran, et al Business Communication, Macmillan, New Delhi.
3. Swati Samantaray, Business Communication and Communicative English, Sultan Chand, New Delhi.
4. S.P. Dhanavel English and Communication Skills for Students of Science and

Engineering (with audio CD).

Course Code: PGCA1954

Course Name: Data Structures using Python Laboratory

Program: MCA	L: 0T:0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): -
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite: -Understanding of concepts of Data Structures

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the concept of data structures, python and apply algorithm for solving problems like insertion and deletion of data.
CO2	Write programs to implement various types of searching and sorting algorithms.
CO3	Implement linked list data structures for processing of ordered data.
CO4	Analyze various algorithms based on the binary tree.
CO5	Implement the outcome of Graph traversing with the help of examples.
CO6	Implement non-linear data structures like AVL Tree for processing of unordered the data.

LIST OF EXPERIMENTS

1	Write a Python program to create an array of 5 elements and display the array items. Access each individual element through indexes.
2	Write a Python program to reverse the order of the items in the array.
3	Write a Python program to append a new item to the end of the array.
4	Write a Python program to remove a specified item using the index from an array.
5	Write a Python program to get the length of an array.
6	Write a Python program for binary search.
7	Write a Python program for sequential or linear search.
8	Write a Python program to sort a list of elements using the bubble sort algorithm.
9	Write a Python program to sort a list of elements using the selection sort algorithm.
10	Write a Python program to sort a list of elements using the insertion sort algorithm.
11	Write a Python program to sort a list of elements using the quick sort algorithm.
12	Write a Python program to create a singly linked list, append some items and iterate through the list.
13	Write a Python program to find the size of a singly linked list.
14	Write a Python program to search a specific item in a singly linked list and return true if the item is found otherwise return false.
15	Write a Python program to delete the first item from a singly linked list.
16	Write a Python program to create circular single linked lists.
17	Write Python programs to implement stack and its operations using list.
18	Write Python programs to implement queue and its operations using list.
19	Write a Python program to create a Balanced Binary Search Tree (BST) using an array (given) elements where array elements are sorted in ascending order.
20	Write a Python program to find the kth smallest element in a given a binary search tree.
21	Write a Python program to traverse the binary tree using pre-order, post-order and in-order traversals.

22	Write a Python program to count the number of nodes in binary search tree.
23	Write a Python program to traverse the graph using Depth First Search and Breadth First Search
24	Write a Python program to create Red Black Tree and perform operations of Insertion and Deletion in it.
25	Write a Python program to implement AVL Trees as well as various operations of searching, insertion and deletion on AVL Trees.

Text Books:

1. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.
2. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
3. Rance D. Necaie, "Data Structures and Algorithms using Python", Wiley Student Edition.

Reference Books:

1. Hemant Jain, "Problem Solving in Data Structures and Algorithms using Python: programming interview guide", 2016.
2. Zed A. Shaw, "Learn Python the Hard Way: a very simple introduction to the terrifyingly beautiful world of computers and code", 3e, Addison-Wesley, 2014.

Course Code: PGCA1955

Course Name: Advanced Database Management System Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): -
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Implement query a database using SQL DML/DDDL commands.
CO2	Analyze integrity constraints on a database
CO3	Develop PL/SQL programs including stored procedures, stored functions, cursors
CO4	Implementation of Embedded SQL.
CO5	Design new database and modify existing ones for new applications and reason about the efficiency of the result.
CO6	Implement various DBA roles/techniques

S.No.	Practical Assignments
1.	Database design using E-R model and Normalization (Any 3 systems).
2.	Implementation of DDL Commands to perform creation of table, alter, modify and drop column operations.
3.	Implementation of Constraint <ul style="list-style-type: none"> ▪ Check Constraint ▪ Entity Integrity Constraint ▪ Referential Integrity Constraint ▪ Unique Constraint ▪ Null Value Constraint
4.	Implementation of DML and DCL Commands.
5.	Implementation of Data and Built in Functions in SQL.
6.	Implementation of Nested Queries and Join Queries.
7.	Implementation of Cursors.
8.	Implementation of Procedures and Functions.
9.	Implementation of Triggers.
10.	Implementation of Embedded SQL.
11.	Consider a Database applications, Design and Develop Conceptual Data Model (E-R Diagram) with all the necessary entities, attributes, constraints and relationships. Design and build Relational Data Model for application specifying all possible constraints.
12.	Implementation of various DBA roles/techniques <ul style="list-style-type: none"> ▪ Creation of user ▪ Granting of privileges to the users ▪ Creation of roles ▪ Loading of privileges into user defined roles. ▪ Import/Export data between various databases and flat files

Text Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition, 2009, BPB Publications.
2. Steven Feuerstein and Bill Pribyl, "Oracle PL/SQL Programming", 5th Edition, 2009, O'Reilly Media.

Course Code: PGCA1908

Course Name: Technical Communication Laboratory

Program: MCA	L:0 T:0 P:2
Branch: Computer Applications	Credits: 1
Semester: 1 st	Contact hours: 2 hours per week
Internal max. marks: 30	Theory/Practical: Practical
External max. marks: 20	Duration of end semester exam (ESE): -
Total marks: 50	Elective status: Ability Enhancement

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Enhance their listening skills and able to interpret message
CO2	Develop confidence and leadership qualities
CO3	Analyze employee's experience, skills and professional Background
CO4	Develop positive attitude and confidence
CO5	Build a strong communicative network
CO6	Execute their ideas and become independent user of English language

Assignments:

Interactive practice sessions in Language Lab on Oral Communication	
1.	Listening Comprehension
2.	Self-Introduction, Group Discussion and Role Play
3.	Common Everyday Situations: Conversations and Dialogues
4.	Communication at Workplace
5.	Interviews
6.	Formal Presentations

Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Code: PGCA1909

Course Name: Web Technologies

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: Student must have the basic knowledge of any text editor like Notepad, Notepad++ and Edit plus etc.

Co requisite: Student must know the background of Markup Language.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand the basics of Internet
CO2	Create pages with simple tags in HTML
CO3	Organise data in tabular form using HTML tables & Design forms with special controls using HTML
CO4	Design webpages with multiple sections or frames & explain how to link webpages through hypertext
CO5	Understand basic concepts of javascript
CO6	Outline the key web designing concepts using Database Connectivity.

Detailed Contents	Contact hours
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<u>Part-A</u>	
<p>Internet Basics: Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address, How IP addressing came into existence? A brief overview TCP/IP and its services, transmission control protocol.</p>	24 hours
<p>Introduction To HTML: Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags, Singular Tags), Commonly Used HTML Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines).</p>	
<p>Basic Formatting Tags: HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding.</p>	
<p>Basic Formatting Tags: HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing</p>	

<p>Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding.</p> <p>Lists Type of Lists (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists.</p> <p>Adding Graphics To HTML Documents: Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute.</p> <p>Tables: Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell padding Attribute, Using the Cell spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes Tag. .</p>	
<p style="text-align: center;"><u>Part-B</u></p> <p>Linking Documents: Links (External Document References, Internal Document References), Image As Hyperlinks.</p> <p>Frames: Introduction to Frames: The<FRAMESET> tag, The <FRAME> tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style</p> <p>Introduction to JavaScript: Introduction to JavaScript: JavaScript in Web Pages (Netscape and JavaScript, Database Connectivity, Client side JavaScript, Capturing User Input); The Advantages of JavaScript (an Interpreted Language, Embedded within HTML, Minimal Syntax -Easy to Learn, Quick Development, Designed for Simple. Small Programs, Performance, Procedural Capabilities, Designed for Programming User Events, Easy Debugging and Testing, Platform Independence/Architecture Neutral); Writing JavaScript into HTML.</p> <p>Forms Used by a Web Site: The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option. Element, The Multi Choice Select Lists Element) Other Built-In Objects in JavaScript (The String Object, The Math Object, The Date Object), User Defined Objects (Creating a User Defined Object, Instances, Objects within Objects).</p>	<p>20 hours</p>

Text Books:

1. Internet for Everyone: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Hepple, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.

3. RajKamal, "Internet & Web Technologies", edition Tata McGraw-Hill Education.2009.
4. Chris Payne, "Asp in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.
5. A Beginner's Guide to Html [Http://www.Ncsa.Nine.Edit/General/Internet/Www/Html.Prmter](http://www.Ncsa.Nine.Edit/General/Internet/Www/Html.Prmter)

E-Books/ Online learning material:

1. https://www.tutorialspoint.com/html/html_tutorial.pdf
2. <https://www.w3schools.com/js/>
3. <https://www.w3schools.com/html/>
4. https://www.cs.uct.ac.za/mit_notes/web_programming.html
5. http://www.pagetutor.com/table_tutor/index.html

Course Code: PGCA1920

Course Name: Design & Analysis of Algorithms

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -Student must have knowledge about Data Structures.

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Define algorithm and its complexity
CO2	Ability to design algorithms using standard paradigms like: Greedy, Divide and Conquer, Dynamic Programming
CO3	Develop Algorithms using iterative/Backtracking approach
CO4	Design algorithm using sorting and searching for solving a given problem
CO5	Ability to design algorithms using standard paradigms like: Merge sort, Quick sort, Heap Sort, and Radix sort
CO6	Categorize problems as Graphs, P, NP or NP Complete

Detailed contents	Contact hours
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<p style="text-align: center;"><u>Part A</u></p> <p>Algorithms:Analyzing algorithms, order arithmetic, Time and space complexity of an algorithm, comparing the performance of different algorithms for the same problem. Different orders of growth. Asymptotic notation. Polynomial vs. Exponential running time. Principles of Algorithm Design. Mathematical analysis of Recursive and Non-recursive algorithms.</p> <p>Basic Algorithm Design Techniques: Divide-and-conquer, Greedy approach, Randomization and dynamic programming.</p>	<p>24 Hours</p>
<p>Example problems on Backtracking: n-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and- Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.</p>	
<p style="text-align: center;"><u>Part B</u></p> <p>Sorting and searching: Insertion and selection sort, Binary search in an ordered array. Sorting algorithms such as Merge sort, Quick sort, Heap sort, Radix Sort, and Bubble sort with analysis of their running times. Lower bound on sorting. Exhaustive search and String Matching.</p> <p>Graphs and NP-completeness: Graph traversal: Breadth-First Search(BFS) and Depth-First Search (DFS). Applications of BFS and DFS. Shortest paths in graphs: Dijkstra algorithm. Definition of class NP, P, NP-hard and NP-complete problems.</p>	<p>20 Hours</p>

Text Books:

1. Horowitz E., Sahani S., Rajasekharan S.: Computer Algorithms, Galgotia Publication
2. A.V.Aho, J.E.Hopcroft, and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education India
3. J.Kleinberg and E.Tardos, Algorithm Design by, Pearson Education India
4. Coremen T.H., Leiserson C.E., and Rivest R.L.: Introduction to Algorithms, PHI

Reference Books:

1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson Education, 2nd Edition.
2. Michael T Goodrich and Roberto Tamassia : Algorithm Design, Wiley India
3. R C T Lee, S S Tseng, R C Chang, Y T Tsai : Introduction to Design and Analysis of Algorithms: A Strategic Approach, Tata McGraw Hill

Course Code: PGCA1918

Course Name: Advanced Java

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Learn the advanced features of Java and write the programs.
CO2	Explain the role of servlets.
CO3	Select the right technology/ tool for problem based solutions.
CO4	Implement web concepts using java server pages
CO5	Concept of database connectivity
CO6	Illustrate invocation of remote methods

Detailed contents	Contact hours
<p style="text-align: center;">Part A</p> <p>Servlets: The life cycle of Servlet, Java Servlet Development kit, Servlet API, Reading the servletparameters, Reading initialization parameters, Handling HTTP requests and responses, Using cookies, Session tracking and security issues.</p> <p>Java Server Pages (JSP): JSP Architecture, Life cycle of JSP, JSP syntax basics–Directives,Declarations, Scripting, Standard actions, Custom tag libraries, Implicit objects, Object scope. Synchronization issues, Session management.</p> <p>Struts : Introduction to struts framework, understanding basic architecture of Model, view, controller. Deploying the application in struts with database connectivity.</p>	22 Hours
<p style="text-align: center;">Part B</p> <p>Hibernate : Introduction to hibernate framework, understanding basic architecture of Model, view, controller. Basic concepts of creating pojo files, reverse mapping, object creation in hibernate ,database connectivity .</p> <p>Enterprise Java Bean: The bean developer kit (BDK), Use of JAR files, The java beans API,Creating a JavaBean, Types of beans, Stateful session bean, Stateless session bean, Entity bean.</p> <p>Remote Method Invocation: Defining the remote interface, Implementing the remote interface, Compiling and executing the server and the client.</p> <p>Common Object Request Broker Architecture (CORBA): Overview of technical architecture, CORBA basics, CORBA services.</p>	22 Hours

Text Books:

1. Herbert Schildt , “The Complete Reference Java 2” , Tata McGraw -Hill.
2. H.M. Deital, P.J. Dietal and S.E. Santry, “Advanced Java 2 Platform HOW TO PROGRAM”, Prentice Hall.

Reference Books:

1. Grey Cornell and Hortsman Cay S., “Core Java”, Sun Microsystems Press.
2. Philip Hanna, “JSP: The Complete Reference”, Tata McGraw –Hill.

Course Code: PGCA1956

Course Name: Linux Administration

Program: MCA	L:4	T:0	P: 0
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Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite:

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the technical details of Linux operating system
CO2	Work with various Linux command
CO3	understand file hierarchical structuring
CO4	Administrate user, manage and configure packages in Linux
CO5	Know and configure the various internet services (DNS, Web Server)
CO6	Know and configure the various internet services (E-Mail Server, Samba Server)

Detailed contents	Contact hours
<p style="text-align: center;">Part A</p> <p>Introduction: Linux: The Operating System: Linux Distributions, Difference Between Linux and Windows, Separation of the GUI and the Kernel, Understanding Linux Kernel, Installing Linux in a Server Configuration, Booting and Shutting Down Process, Concept of Root, Basic commands, working with vi Editor,</p> <p>Understanding files and File System: Understanding Files and Directories in Linux, File Structure and hierarchy, File Permissions, File Management and Manipulation, Managing File System</p> <p>Managing Packages & Users: Installing and removing Software in Linux, Getting and Unpacking the Package, Configuring the Package, Compiling the Package, Installing the Package, Managing Users and Groups</p>	22 Hours

Part B

22 Hours

DNS: Installing a DNS Server, Configuring a DNS Server, DNS Records Types, Setting Up BIND Database Files, The DNS Toolbox, Configuring DNS Clients.

Web Server: Understanding the HTTP Protocol, Installing the Apache HTTP Server, Starting Up and Shutting Down Apache, Configuring Apache

E-Mail Server: Understanding SMTP, Installing the Postfix Server, Configuring the Postfix Server, Running the Server, POP and IMAP Basics, Installing the UW-IMAP and POP3 Server

Samba Server: The Mechanics of SMB, Samba Administration, Using SWAT, Creating a Share, Mounting Remote Samba Shares, Creating Samba Users, Using Samba to Authenticate Against a Windows Server

Text Books:

1. Linux Administration: A Beginner's Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India

Course Code: PGCA1932

Course Name: Information Security and Cyber Law

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain the key security requirements of Confidentiality, Integrity & Availability
CO2	Describe User authentication and Access control
CO3	Explain database security and malicious software
CO4	Demonstrate the concept of Intrusion Detection & Intrusion Prevention.
CO5	Describe cryptographic algorithms and internet security protocols and standards
CO6	Describe the concept of security policies and cyber law

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Introduction to Information System, classification and components of information system, Computer Security Concepts, CIA (Confidentiality, integrity and availability), Security Functional Requirements.</p> <p>User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication.</p> <p>Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, File Access Control, Role-Based Access Control.</p> <p>Database Security: The Need for Database Security, Database Access Control, Database Encryption.</p> <p>Malicious Software: Types of Malicious Software (Malware)-Viruses, Worms, SPAM E-mail, Trojans, Zombie, Bots, Keyloggers, Phishing, Spyware, Backdoors, Rootkits, Preventive Measures. Denial-of-Service Attacks: Types of DoS attacks, Defenses Against Denial-of-Service Attacks.</p>	<p>22 Hours</p>
<p style="text-align: center;"><u>Part B</u></p> <p>Intrusion Detection: Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots.</p> <p>Firewalls & Intrusion Prevention Systems: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Intrusion Prevention Systems.</p> <p>Cryptographic Algorithms: Symmetric Encryption Principles, Data Encryption Standards (DES)</p> <p>Introduction to Internet Security Protocols & Standards: SSL, TLS, HTTPS, IPv4 and IPv6 Security protocols.</p> <p>Security Policies and Cyber Laws: Concept of Information Security Policy, ISO Standards, various Indian Cyber Laws, Information Technology Act 2000, Electronic Record and E-Governance, Classification and Provisions of Cyber Crimes, Regulation of Certifying Authorities, Patent, Copyright, Digital signature, Introduction to Cyberspace.</p>	<p>22 Hours</p>

Text Books:

1. William Stallings, Lawrie Brown, "Computer Security: Principles & Practice", 3rd Edition, Pearson, 2015.
2. Surya Prakash Tripathi, RitendraGoel, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Laws", Wiley India, 2014.

Reference Books:

1. Christof Paar, Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", 1st Edition, Springer, 2010
2. William Stallings, "Cryptography and Network Security Principles and Practices", 4th Edition, Prentice Hall, 2006.
3. Darren Death, "Information Security Handbook", Packt Publishing, 2017

Course Code: PGCA1914

Course Name: Web Technologies Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 2 nd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of End Semester Exam (ESE): 3hrs
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite: Students must have the knowledge of editors like Notepad etc. and basic understanding of Scripting Language/s.

Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand Static and Dynamic concepts of web designing.
CO2	Depict the movement from one web page to another.
CO3	Illustrate the data in tabular form using tables.
CO4	Develop ability to retrieve data from a database and present it online.
CO5	Design web pages that apply various dynamic effects on the web site.
CO6	Solve complex and large problems using Scripting Language & Markup Language

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Design index page of a book Titled Web Designing.
2.	Create a simple HTML page to demonstrate the use of different tags.
3.	Display Letter Head of your college on a web page & it must be scrolling Right to Left.
4.	Create a link to move within a single page rather than to load another page.
5.	Display "Name of University" using different Text formatting Tags.
6.	Design Time Table of your department and highlight most important periods.
7.	Use Tables to provide layout to your web page.
8.	Embed Audio and Video into your web page.
9.	Divide a web page vertically and display logo of your college in left pane and logo of university in right pane.
10.	Create Bio- Data of an employee.
11.	Design front page of a hospital with different styles.
12.	Design a web page and display horizontally two different web pages at a time.
13.	Write a program to create a login form. On clicking the submit button, the user should get navigated to a profile page.
14.	Write a HTML code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials.
15.	Write a HTML code to create website in your college or department and create link for Tutorial of specific subject.
16.	Write a program to perform following operations on two numbers input by the user: Addition 2) Subtraction 3) Multiplication 4) Division.
17.	Design a program to solve quadratic equations.
18.	Write a program to determine greatest number of three numbers.
19.	Write a script to compute, the Average and Grade of students marks.
20.	Design a scientific calculator and make event for each button using scripting language.
21.	Write a script to check whether a number is even or odd?
22.	Write a program to show whether a number is prime or not?
23.	Write a program to show multiplication table of any number.
24.	Write a program to find the factorial of any number.
25.	Write a program to show Fibonacci Series between 0 to 74.

Reference Books:

1. Greenlaw R; Hepp E, "Fundamentals of Internet and www", 2nd Edition, Tata. McGraw-Hill, 2007.
2. A Beginner's Guide to HTML [Http://www.Ncsa.Nine.Edit/General/Internet/www/html.prmter](http://www.Ncsa.Nine.Edit/General/Internet/www/html.prmter).

Online Experiment material:

1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

Course Code: PGCA1922

Course Name: Advanced Java Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 2 nd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): -
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Learn the advanced features of Java and write the programs.
CO2	Explain the role of servlets.
CO3	Select the right technology/ tool for problem based solutions.
CO4	Implement web concepts using java server pages
CO5	Concept of database connectivity
CO6	Illustrate invocation of remote methods

S.No.	Practical Assignments (Java)
1.	Create a Servlet to handle HTTP Requests and Responses.
2.	Implementation of the concept of Cookies and Session Tracking.
3.	Illustrate the concept of JavaServer Pages (JSP).
4.	Create a JavaBean by using Bean Developer Kit (BDK).
5.	Implementation of various types of beans like Session Bean and Entity Bean.
6.	Introduction to Struts platform with basic connectivity.
7.	Deploying first sample program using MVC architecture in struts.
8.	Implementing database connectivity in struts.
9.	Creating one sample application in struts.

10.	Introduction to Hibernate framework.
11.	Creating simple Hibernate application.
Practical Assignments (SEO)	
12.	Take a web site and prepare the SEO report of the website including status of following factors: Title tag, meta-description tag, header tags, keyword consistency, number of back links, robots.txt and xml sitemaps then after going through the steps of SEO prepare the report.
13.	Discuss any five tools to prepare the list of ten organic key words for SEO purpose.
14.	Optimize the images in the website using suitable methods and compare the reports before and after the SEO steps.
15.	Write the robot and sitemap file of a website under consideration.

Text Books:

1. Herbert Schildt , “The Complete Reference Java 2” , Tata McGraw -Hill.
2. H.M. Deital, P.J. Dietal and S.E. Santry, “Advanced Java 2 Platform How To Program”, Prentice Hall.
3. Laudon and Traver, “E-Commerce: Business, Technology & Society”, Pearson Education
4. Shivani Karwal, “Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing”, CreateSpace Independent Publishing Platform, 1st edition.

Reference Books:

1. Grey Cornell and Hortsman Cay S., “Core Java”, Sun Microsystems Press.
2. Philip Hanna, “JSP: The Complete Reference”, Tata McGraw –Hill..

Course Code: PGCA1957

Course Name: Linux System Administration Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 2 nd	Contact hours: 4 hours per week
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): -
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite:

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Install Linux desktop and Linux server operating system.
CO2	Use various commands for performing different operations
CO3	Work with various Linux administration commands
CO4	Install and configure DNS servers in Linux environment
CO5	Install and configure Mail servers and Apache Server in Linux environment
CO6	Install and configure Samba Server in Linux environment

Lab Practicals

S.No	Practical Assignments
1	Installation of Linux operating system. a. Partitioning drives b. Configuring boot loader (GRUB/LILO) c. Network configuration d. Setting time zones e. Creating password and user accounts f. Installing and removing packages g. Shutting down
2.	Working with basic commands
3.	Linux system administration a. Becoming super user b. Temporarily changing user identity with su command c. Using graphical administrative tools d. Administrative commands e. Administrative configuration files
4.	Configuring NICs with Network Device Configuration Utilities (ip and ifconfig)
5.	Install and configuring a DNS Server with a domain name of your choice.
6.	Install and configuring DHCP server and client
7.	Install and configuring Mail Server
8.	Install and configuring Apache Web Server for hosting websites
9.	Securing a simple network with Linux firewall (Netfilter/iptables)
10.	Setting up Samba Server to share files and printers with Windows-based and other operating systems

Text Books:

1. Linux Administration: A Beginner's Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education
3. Linux Command Line and Shell Scripting Bible, 3rd Edition Richard Blum, Christine Bresnahan, Wiley

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India.

Course Code: PGCA1925

Course Name: Advanced Computer Networking

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Familiar with different computer network models
CO2	Understand different protocols working at Medium Access Sub layer.
CO3	Understand different protocols working at Data Link layer.
CO4	Learn the concept of network routing through algorithms.
CO5	Highlight the benefits of Adhoc Network
CO6	Explain the protocols used in wireless communication systems.

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Computer Networks: Uses of computer Networks, Goals and applications of networks, Computer Network Structure and Architecture, Reference models: OSI model</p> <p>Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared)</p> <p>Data Link Layer: Design issues, Framing, Error detection and correction codes: parity, checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP.</p> <p>Network Layer: Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms</p> <p>Medium Access Sub-Layer: Static and dynamic channel allocation, Random Access: ALOHA, CSMA-CA/CD protocols, Controlled Access: Polling, Token Passing</p> <p>Transport Layer: Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and demultiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison.</p> <p>Application Layer: World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP) TCP/IP model, Comparison of TCP/IP and OSI models.</p>	<p>22 Hours</p>

Part B	22 Hours
<p>An Overview of Select Wireless and Mobile Networking Technologies: Principles, WLANs: IEEE 802.11, Cellular Networks, Issues in Seamless Mobility</p> <p>Adhoc networks: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies.</p> <p>Wireless Communication Systems: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA.</p> <p>Wireless System Design: Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.</p>	

Text Books:

1. A.S. Tannenbaum, "Computer Networks", 3rd Edition, Prentice Hall, 1999.
2. Data Communications & Networking by Forouzan, Tata McGraw Hills.
3. Larry L. Peterson & Bruce S. Davie: Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann / Elsevier, New Delhi, 2012, reprint 2016.
4. James F. Kurose & Keith W. Ross: Computer Networking: A Top-Down Approach, 7th Edition, Pearson Education Inc. Boston, 2016.

Reference Books:

1. D.E. Comer, "Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.
2. D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice-Hall, 1992.
3. Stevens W.R., "UNIX Network Programming," Prentice Hall, 1990.

Course Code: PGCA1926

Course Name: Artificial Intelligence & Soft Computing

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Highlight the significance of Artificial Intelligence in knowledge representation.
CO2	Examine the useful search techniques; learn their advantages, disadvantages and comparison
CO3	Highlight the significance of Natural Language Processing and Soft Computing
CO4	Apply artificial neural networks for various problems.
CO5	Apply and fuzzy logic theory for various problems.
CO6	Determine the use of Genetic algorithm to obtain optimized solutions to problem

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Introduction-What is intelligence? Foundations of artificial intelligence (AI).History of AI. AI problems: Toy Problems, Real World problems- Tic-Tac-Toe, Water Jug, Question-Answering, 8-puzzle, 8-Queens problem. Formulating problems, Searching for Solutions.</p> <p>Knowledge Representation: Propositional Logic, Propositional Theorem proving-Inference and Proofs, Proof by Resolution, Horn Clauses and definite Clauses, Forward and Backward chaining; First order Logic, Inference in First order Logic.</p> <p>Informed (Heuristic) Search Strategies-Hill Climbing, Simulated Annealing, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search.</p> <p>Natural language processing: Grammars, Parsing, Semantic Analysis and Pragmatics.</p>	22 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.</p> <p>Neural Networks: Introduction, What is Neural Network, Learning rules and various activation functions, Supervised Learning Networks, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP)Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative</p>	22 Hours

Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications. Unsupervised Learning Networks.

Fuzzy Systems: Fuzzy Set theory, Fuzzy vs. Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.
Introduction to Hybrid Systems.

Text Books:

1. Artificial Intelligence-A Modern Approach, Russel and Norvig, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and SB Nair, 3 Ed.,Tata McGraw-Hill.
3. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
4. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Artificial Intelligence-A new Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.
2. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
3. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

Course Code: PGCA1927

Course Name: Theory of Computation

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems:
Internal max. marks: 30	Duration of end semester exam (ESE):
External max. marks: 70	Elective status: core/elective Core
Total marks: 100	

Prerequisite: NA

Co requisite: NA

Additional material required in ESE:NA

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Use basic concepts of formal languages of finite automata techniques.
CO2	Design Finite Automata's for different Regular Expressions and Languages.
CO3	Construct context free grammar for various languages.
CO4	Solve various problems of applying normal form techniques, push down automata.
CO5	Turing Machines and its variants- Programming Techniques for TM UNDECIDABILITY.
CO6	Solve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.

Detailed contents	Contact hours
<p style="text-align: center;">Part A</p> <p>Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox.</p> <p>Theory of Automata: Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, Mealy and Moore Models, Minimization of Finite Automata.</p> <p>Regular Sets and Regular Grammars: Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis.</p> <p>Context Free Language: Properties of Context Free Language, Chomsky Classification of Languages, Context Free Grammar, Simplification of Context Free Grammar, Chomsky Normal Form, Greibach Normal Form.</p>	22 hours
<p style="text-align: center;">Part B</p> <p>Push Down Automata: Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA).</p> <p>Turing Machines (TM): Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis.</p> <p>Recursive and Recursively-Enumerable Languages; Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems.</p> <p>Unsolvable Problems and Computational Complexity: Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.</p>	22 hours

Text Books:

1. Jeffrey Ullman and John Hopcroft, Introduction to Automata Theory, Languages, and Computation, 3e, Pearson Education India (2008).
2. K.L.P. Mishra, Theory of Computer Science: Automata, Languages and Computation, Prentice Hall India Learning Private Limited (2006).

3. John Martin, Introduction to Languages and the Theory of Computation, McGraw-Hill Higher Education (2007).

Reference Books:

1. Introduction to Computer Theory, Daniel. I.A. Cohen , John Wiley & Sons.

Course Code: PGCA1928

Course Name: Advanced Computer Networking Laboratory

Program: MCA	L:0T:0 P:4
Branch: Computer Applications	Credits: 2
Semester: 3 rd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE):
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite: Computer Networks

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Demonstrate Networking components devices and LAN topologies
CO2	Demonstrate sharing of resources of network.
CO3	Prepare different types of network cables.
CO4	Write programs for simulating routing algorithms
CO5	Implement the configuration of Adhoc networks
CO6	Execute configuration of wireless access points

S.No.	Name of Experiment
1.	Familiarization with Networking Components and devices: LAN Adapters, Switches, Routers etc.
2.	Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
3.	Preparing Straight and Cross Cables.
4.	Study of various LAN Topologies and their creation using Network devices, Cables and Computers.
5.	Configuration of TCP/IP Protocols in Windows and Linux.
6.	Implementation of File and Printer sharing.
7.	Designing and Implementing Class A, B, C Network.
8.	Subnet Planning and its Implementation.
9.	Installation of ftp server and client.
10.	To develop programs for simulating routing algorithms for Adhoc networks.
11.	To install any one open source packet capture software like packet tracer etc.

12.	To configure Wireless Local Loop.
13.	To configure WLAN.
14.	To configure Adhoc Networks.
15.	To install and configure wireless access points.

Text Books:

1. A.S. Tannenbaum, "Computer Networks", 3rd Edition, Prentice Hall, 1999.
2. "Data Communications & Networking", Behrouz A. Forouzan, Fifth Edition, Tata McGraw Hill.

Reference Books:

1. D.E. Comer, "Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.
2. D. Bertsekas and R. Gallagar, "Data Networks", 2nd Edition, Prentice-Hall, 1992.
3. Stevens W.R., "UNIX Network Programming," Prentice Hall, 1990.

Course Code: PGCA1929

Course Name: Artificial Intelligence & Soft Computing Laboratory

Program: MCA	L: 0T: 0 P: 4
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): 3hrs
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Develop the skills to gain a basic understanding of neural network.
CO2	Examine the useful search techniques; Learn their advantages disadvantages and comparison.
CO3	Discuss the various statistical reasoning techniques to solve AI problem.
CO4	Determine the use of Genetic algorithm to obtain optimized solutions to problems.
CO5	Identify and apply Artificial Intelligence concepts to solve real world problems.
CO6	Describe fuzzy logic theory for various problems.

Instructions: Develop the assignments in MATLAB/Python.

Assignments:

1.	Use logic programming in Python to check for prime numbers.
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2.	Use logic programming in Python parse a family tree and infer the relationships between the family members.
3.	Python script for building a puzzle solver.
4.	Implementation of uninformed search techniques in Python.
5.	Implementation of heuristic search techniques in Python.
6.	Python script for tokenizing text data.
7.	Extracting the frequency of terms using a Bag of Words model.
8.	Predict the category to which a given piece of text belongs.
9.	Python code for visualizing audio speech signal
10.	Python code for Generating audio signals
11.	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
12.	Implement AND function using ADALINE with bipolar inputs and outputs.
13.	Implement AND function using MADALINE with bipolar inputs and outputs.
14.	Construct and test auto associative network for input vector using HEBB rule.
15.	Construct and test auto associative network for input vector using outer product rule.
16.	Construct and test heteroassociative network for binary inputs and targets.
17.	Create a back propagation network for a given input pattern. Perform 3 epochs of operation.
18.	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
19.	Maximize the function $f(x)=x^2$ using GA, where x ranges form 0-25. Perform 6 iterations.

Text Books:

1. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
2. Artificial Intelligence with Python, Prateek Joshi, Packt Publishing.
3. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications. S. Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
2. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

Course Code: PGCA1930

Course Name: Software Project Management

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 3rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3 hrs
External max. marks: 70	Elective status: Elective-I
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain project management fundamentals and stakeholders.
CO2	Apply project planning techniques like WBS, scheduling, and costing.
CO3	Analyze project planning methods and estimation models.
CO4	Evaluate scheduling and risk management techniques.
CO5	Demonstrate project execution, monitoring, and control methods.
CO6	Assess project closure, contracts, SCM, and people management.

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Project Management Fundamentals- Basic Definitions, Project Stakeholders and Organizational, Influences on Project Management, Project Management Processes, Project Initiating Processes.</p> <p>Planning and Resourcing a Project - Identifying Requirements, Creating the Work Breakdown structure, Developing the Project Schedule, Developing a Project Cost Estimate, Planning Quality, Organizing the Project Team, Planning for Potential Risks</p> <p>Project Evaluation and Planning - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.</p>	22 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Executing and Managing a Project -Project Executing Processes- Acquiring and Developing the Project Team, Managing the Project Team, Managing Stakeholder Expectations, Directing and Managing the Project while assuring Quality.</p> <p>Project Monitoring and Controlling Processes - Verifying and Controlling Scope, Managing Schedule and Cost, Controlling Quality, Monitoring and Controlling Risks. Integrated Change Control, Project Closing Process, Collecting Data, Visualizing Progress, Cost Monitoring review techniques, Project termination review, Earned Value analysis,</p>	22 Hours

Change Control, Software Configuration Management (SCM), Managing Contracts, Types of Contracts, Stages in Contract Placement, Typical Terms of a Contract, Contract Management and Acceptance.

Quality Management and People Management- Introduction, Understanding Behaviour, Organizational Behaviour, Selecting The Right Person for The Job, Motivation, The Oldman – Hackman Job Characteristics Model, working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. Overview of project management tools for software.

Text Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill.
2. Royce, "Software Project Management: A Unified Framework, Pearson Education.

Reference Books:

1. Robert K. Wysocki, "Effective Software Project Management", Wiley
2. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
3. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.

Course Code: PGCA1971

Course Name: Optimization Techniques

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective-I
Total marks: 100	

Prerequisite: - NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:Students will be able to:

CO#	Course outcomes
CO1	Explain Operations Research concepts and model formulation.
CO2	Apply graphical and simplex methods for LP problems.
CO3	Analyze duality, dual simplex, and sensitivity analysis.
CO4	Apply integer programming using branch and bound.
CO5	Solve transportation and assignment problems.
CO6	Evaluate CPM, network analysis, and game theory models.

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Scope of Operations Research: Introduction to linear and non-linear programming formulation of different models.</p> <p>Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis.</p> <p>Integer Programming: Branch and bound technique.</p>	24 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Transportation and Assignment Problem: Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions.</p> <p>Project Management: Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM), Crashing.</p> <p>Game Theory: Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.</p>	20 Hours

Text Books:

1. Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).
2. Taha H.A., Operations Research-An Introduction, PHI (2007).

Reference Books:

1. Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)
 2. Bazaarra Mokhtar S., Jarvis John J. and Shirali Hanif D., Linear Programming and Network flows, John Wiley and Sons (1990)
 3. Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).
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Course Code: PGCA1972

Course Name: Data Mining and Business Intelligence

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective-I
Total marks: 100	

Prerequisite: - NA

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Highlight the need of Data Warehousing & Mining
CO2	Differentiate between the Transactional and Analytical data models
CO3	Identify the real life applications where data mining can be applied.
CO4	Apply different data mining algorithms on wide range of data sets.
CO5	Identifying Data Mining for Business Intelligence Applications
CO6	Comment on latest tools for data mining and big data analysis

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Introduction: Reporting and Analysing data, Raw data to valuable information-Lifecycle of Data, The building Blocks: Defining Features – Data Warehouses (DW) and Data Marts - Overview of the components – Metadata, Need, Basic elements, trends. Business Intelligence (BI) Definitions and Concepts, BI Process and Technology, BI Roles and Responsibilities</p> <p>The Architecture of BI and DW: BI and DW architectures and its types, Relation between BI and DW - OLAP and OLTP definition and its differences, Dimensional analysis: Drill-down and roll-up – slice and dice or rotation, schemas: Stars, snowflakes and fact constellations</p> <p>Introduction to data mining (DM) and Data Preprocessing: Motivation for Data Mining, Data Mining Definition, and Functionalities, Classification of DM Systems - DM task and its applications, Integration of a Data, KDD Process, Steps of pre-processing data - Data cleaning: Missing Values, Noisy Data - Data, Integration, and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression</p>	24 Hours
<u>Part B</u>	20 Hours

Concept Description and Association Rule Mining: Introduction, Data Generalization and summarization-based characterization, Association Rule Mining; Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm

Classification and Prediction: Introduction, Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression

Data Mining for Business Intelligence Applications: Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc.,

Introduction to Advance Topics Clustering, Spatial mining, web mining, text mining, Data Analytics Life Cycle: Big data Business Analytics, State of the practice in analytics role of data scientists, Hadoop architecture .

Text Books:

1. J. Han, M. Kamber, "Data Mining Concepts and Techniques"
2. Arun K. Pujari, "Data Mining Techniques".
3. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley & Sons Inc.

Reference Books:

1. Paulraj Ponnian, "Data Warehousing Fundamentals", John Willey.
2. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", Wiley India.

Course Code: PGCA1973

Course Name: Enterprise Resource Planning

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective-I
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO1	Explain the fundamental concepts of ERP, including its evolution, structure, benefits, risks, and conceptual models.
CO2	Describe ERP-related technologies such as Business Process Reengineering (BPR), Data Warehousing, Data Mining, OLAP, SCM, CRM, and PLM.
CO3	Illustrate the functionalities of core ERP modules including Finance, Manufacturing, Human Resource, Plant Maintenance, and Material Management.
CO4	Analyze ERP implementation strategies, methodologies, challenges, and the roles of project teams, vendors, and consultants.
CO5	Evaluate post-implementation aspects such as ERP maintenance, success and failure factors, ROI calculation, and organizational impact.
CO6	Assess emerging trends in ERP, including extended ERP, e-commerce, e-governance, and real-world case studies of ERP implementation.
Detailed contents	
	Contact hours

<p style="text-align: center;"><u>Part A</u></p> <p>Basic ERP Concepts: Enterprise-An overview, Benefits & Risk, Evolution and Structure, Conceptual Model of ERP.</p> <p>ERP & Related Technologies: Business Process Reengineering (BPR), Data Warehousing and Data Mining, OLAP, Product Life Cycle Management, Supply Chain management, CRM.</p> <p>ERP Functional Module: Introduction, Finance, Manufacturing, Human Resource, Plant maintenance, Material Management, Integration of ERP, Supply Chain and Customer Relationship Application.</p>	22 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>ERP Implementation: Implementation Challenges / Strategies / Methodologies, ERP Project Teams, Vendors and Consultants, Dealing with employee resistance, Training and Education, data migration, Project Management and monitoring.</p> <p>Strategic Grid: Useful guidelines for ERP Implementations.</p>	22 Hours

Post Implementation : Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Calculation of ROI of ERP implementation, Hidden costs, ERP success inhibitors and accelerators.

Emerging Trends on ERP: Technologies in ERP Systems and Extended ERP, ERP Market Place and Dynamics, Future Directives in ERP; ERP E Commerce & E – Governance: Concept, frame work, area of application like public sector, service industry.

Case Studies: Development and Analysis of ERP Implementations

Text Books:

1. Alexis Leon, "Enterprise Resource Planning", TMH, 2nd Ed.
2. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning Concepts and Practice". PHI
3. V.K. Garg & N.K. Venkita Krishnan. "ERP Ware: ERP Implementation Framework", PHI.

Reference Books:

1. S Sadagopan, "ERP A Managerial Prospective" TMH
2. Rahul V. Altekar "Enterprise wide Resource Planning" , TMH
3. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology
4. Sandoe, Corbitt, and Boykin, "Enterprise Integration", John Wiley, ©2001, ISBN 0-471-35993-9
5. Motiwalla and Thompson, "Enterprise Systems For Management", Pearson/Prentice Hall 2011

Course Code: PGCA1933

Course Name: Mobile Application Development

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective II
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain the fundamentals of mobile applications, including characteristics, types, frameworks, and application models..

CO2	Describe the building blocks of mobile applications such as UI design, layouts, and basic data handling techniques.
CO3	Apply testing strategies, debugging techniques, and test automation for mobile applications.
CO4	Analyze mobile operating systems, their features, and differences among platforms like Android, iOS, and others.
CO5	Develop basic mobile applications using Android tools, components, and deployment methods.
CO6	Illustrate iOS architecture, development environment, UI design, and application styling techniques

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Introduction: Mobile Applications –Characteristics and Benefits – Frameworks and Tools, Types, Application Model. Profiles of Mobile devices.</p> <p>Building Blocks of Mobile Applications: User Interface Designing, Layout, User Interface elements, Functionality based user interface, Naïve Data Handling, Sprucing up Mobile applications</p> <p>Testing Mobile Applications:Debugging Applications, Testing Strategies, Test Automation of Applications.</p>	22 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Mobile Operating System --Introduction to Mobile Operating Systems and why they are needed, Open Platforms, Mobile OS Features, Symbian, BlackBerry, Android, iOS, Windows, Tizen, Ubuntu, etc.</p> <p>Android programming:Android toolkit, Components of an Android application, Android Software Development using Eclipse – Concepts, Terminology, Views and Perspectives, memory management, communication protocols, application development methods, deployment.</p> <p>IOS:Development environment, iOS Layers, Architecture, User Interface tool kit interfaces, Event handling, Graphics services, Layer Animation,BasiciPhone Styling, Advanced iPhone Styling.</p>	22 Hours

Text Books:

1. Anubhav Pradhan, Anil V Deshpande, “ Mobile Apps Development” Edition: I
2. Jeff McWherter, Scott Gowell “Professional Mobile Application Development”, John Wiley & Sons, 2012.

Reference Books:

1. ZigurdMednieks, L. Dornin, G. Blake Meike, M. Nakamura," Programming Andriod, 1st Edition, O'Relly Publication, 2011.
2. A. Allan" Learning iPhone Programming", 1st Edition, O'Relly Publication, 2010.

3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons.
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS.

Course Code: PGCA1934

Course Name: Mobile Application Development Laboratory

Program: MCA	L: 0T:0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 3 rd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): 3hrs
External max. marks: 30	Elective status: Elective-II
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Demonstrate the use of emulators to deploy and execute mobile applications.
CO2	Develop basic Android applications using user input, UI components, fonts, and colors.
CO3	Apply layouts, event handling, and graphical primitives in Android application development.
CO4	Design and implement functional Android applications such as login systems with external integrations
CO5	Evaluate mobile applications using testing techniques including unit testing, black-box testing, and automation.
CO6	Build iOS applications incorporating multimedia, graphical rendering, alarms, and database operations (CRUD).

List of Assignments

Sr. No.	Assignments
1	Using emulator to deploy and run mobile apps
2	Create an Android application that shows Hello + name of the user and run it on an emulator.
3	Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
4	Develop an ANDRIOD application that uses GUI components, Font and Colors.
5	Write an application that draws basic graphical primitives on the screen.
	Develop an application that uses Layout Managers and event listeners.
7	Create and Login application as above. On successful login, open browser with any URL.
8	Testing mobile app - unit testing, black box testing and test automation.
9	Create an iOS application that can play audio and video files.

10	Write an iOS application that creates alarm clock.
11	Devise an iOS application that draws basic graphical primitives (rectangle, circle) on the screen.
12	Build an iOS mobile application that create, save, update and delete data in a database.

Text Books:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition: I
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.

Reference Books:

1. ZigurdMednieks, L. Dornin, G. Blake Meike, M. Nakamura," Programming Andriod, 1st Edition, O'Relly Publication, 2011.
2. A. Allan" Learning iPhone Programming", 1st Edition, O'Relly Publication, 2010.
3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons.
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS.

Course Code: PGCA1935

Course Name: Simulation & Modelling

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective-II
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain fundamental concepts of simulation, system modeling, and Monte Carlo methods.
CO2	Apply numerical computation techniques for discrete and continuous simulation models.
CO3	Analyze input data using statistical methods, distribution fitting, and goodness-of-fit tests.

CO4	Evaluate simulation models through verification, validation, and output analysis techniques.
CO5	Design and simulate queuing systems and interpret their performance measures.
CO6	Utilize simulation software and languages (e.g., GPSS, MATLAB, C++/Java) for modeling and experimentation.

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Inventory Concept: The technique of Simulation, Major application areas, concept of a System, Environment, Continuous and discrete systems, systems modeling types of models progress of a Simulation Study, Monte Carlo Method, Comparison of Simulation and Analytical Methods. Numerical Computation Technique for discrete and continuous models, Continuous System Simulation.</p> <p>Input Modeling- Data collection, Identifying the Distribution with Data: Histograms, Selection of the Appropriate Family of Distributions, Quantile-Quantile Plots. 100 Parameter Estimation: Sample Mean and Sample Variance and various biased and unbiased Estimators. Goodness of Fit Tests applied to Simulation inputs: Chi-Square and Chi-Square with Equal Probabilities, Kolmogorov-Smirnov Tests, pValues and Best Fits.</p> <p>Verification and Validation of Simulation Models- Verification and Validation of Simulation Models. Calibration and Validation: Face Validity, Validation of Assumptions, Input-Out Transformation Validation.</p> <p>Output Analysis of a Single Model- Output analysis and types of simulation. Stochastic Nature of the Output Data. Measures of Performance and Estimation: Point Estimation and Confidence-Interval Estimation. Output Analysis for Terminating Simulations and Estimation of Probabilities. Output Analysis of Steady State Simulations: Initialization Bias, Error Estimation, Replications, Sample Size and Batch Means for Interval Estimation.</p>	26 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Simulation of Queuing Systems: Rudiments of queuing theory, Simulation of single-server queue, Simulation of two-server queue.</p> <p>Simulation Software- Integrated environments. Examples and review of some existing software popular and useful in the industry, e.g., Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc. Simulation using languages and environments like C++/Java/GPSS/SSF etc. Experimentation and Statistical-Analysis Tools: common features and relevant current products.</p> <p>Simulation Languages: Basic Introduction to Special Simulation Languages:-GPSS/ MATLAB/ Network Simulators.</p>	18 Hours

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, Discrete-Event System and Simulation, Prentice Hall of India, New Delhi, 2005
2. Gordon, G: System Simulation, Prentice-Hall; 2 edition (1979).

Reference Books:

1. Gabriel A. Wainer, Discrete-event modeling and simulation: a practitioner's approach, CRC Press, 2009
2. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems, Academic Press, 2000.
3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons. Bhat, U. Narayan, An Introduction to Queueing Theory: Modeling and Analysis in Applications, Springer 2008 (Birkhäuser Boston).
4. James J. Nutaro, Building software for simulation: theory and algorithms, with applications in C++. Wiley, 2010.

Course Code: PGCA1936

Course Name: Simulation & Modelling Laboratory

Program: MCA	L: 0T:0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 3 rd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): 3hrs
External max. marks: 30	Elective status: Elective-II
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Demonstrate MATLAB basics and branching statements.
CO2	Apply MATLAB for matrix operations and computations.
CO3	Develop programs for data visualization and plotting.
CO4	Analyze and simulate real-time and dynamic systems.
CO5	Evaluate random numbers using statistical tests.
CO6	Design and simulate queuing and inventory systems.

Sr. No.	Assignments
1	Installation of MATLAB.
2	Write a program in MATLAB using different types of branching statements.
3	Write a program to perform basic matrix operations.
4	WAP to plot different types of graphs in MATLAB.
5	Write a MATLAB code to plot with the elements of its vector representation
6	Programs on simulation of real time systems for automation purpose.
7	Simulation of continuous and discrete systems.
8	Programs on testing the random number set for uniformity and independence – Kolmogorov-Smirnov test, Chisquare test, Runs test and Autocorrelation test.
9	Programs on simulation of single and two-server queuing systems..
10	Programs on simulation of an inventory system.

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, Discrete-Event System and Simulation, Prentice Hall of India, New Delhi, 2005
2. Gordon, G: System Simulation, Prentice-Hall; 2 edition (1979).

Reference Books:

1. Gabriel A. Wainer, Discrete-event modeling and simulation: a practitioner's approach, CRC Press, 2009
2. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems, Academic Press, 2000.

Course Code: PGCA1921

Course Name: E-Commerce & Digital Marketing

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective-II
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand various applications and scope of ecommerce.
CO2	Acquire knowledge of various payment modes used in ecommerce today.
CO3	Learn the usage of Electronic Data Interchange in detail .
CO4	Describe how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy, Developing effective digital and social media Strategies
CO5	Understand the major digital marketing channels - online advertising: Search Engine Optimization (SEO) and Social Engine Marketing (SEM and social media
CO6	Learn to develop strategy and plan of website

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Introduction to Electronic Commerce: Technical Components of E-commerce, E-Commerce Framework, E-Commerce Applications and Electronic Business. Internet Service provider and World wide web. Architectural Framework for Electronic Commerce, WWW as the Architecture and Hypertext publishing.</p> <p>Electronic payment System : Types and Traditional payment, Value exchange system, Electronic funds transfer, Digital Token Based Electronic Payment System, Smart Cards – Credit Cards, Risk in Electronic Payment Systems, Designing Electronic Payment Systems.</p> <p>Electronic Data Interchange : Concepts and applications of EDI and Limitation. EDI and Electronic Commerce standardization and EDI – EDI Software Implementation. EDI Applications in Business – EDI: Legal, Security and Privacy issues. E- Governance for India : Indian customer EDI system and Service centres.</p>	22 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Introduction to Digital Marketing : Components of Online Marketing (Email, Forum, Social network, Banner, Blog) , Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing, Online Advertising, Mobile Marketing, Web analytics and Email Marketing.</p> <p>Search Engine Optimization (SEO) and Social Engine Marketing (SEM): Importance of Internet and Search Engine and Role of Keywords in SEO, On-Page Optimization (Onsite) and Off Page Optimization. Introduction to Social Media Marketing (SMM).</p> <p>Website Planning & Creation : Content Marketing Strategy, Keywords Research and Analysis. Web Presence and Creating content. Successful content marketing strategies and case studies.</p>	22 Hours

Text Books:

4. Whitley, David, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill.
5. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education
6. Damian Ryan, Calvin Jone, Kogan Page; "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation".

Reference Books:

1. Seema Gupta, Digital Marketing, McGraw Hill
2. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.

3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.
4. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
5. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.

Course Code: PGCA 1955

Course Name: e-Commerce and Digital Marketing Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 3 rd	Contact hours: 4 hours per week
Internal max. marks: 70	Theory/Practical: Practical
External max. marks: 30	Duration of End Semester Exam (ESE): 3hrs
Total marks: 100	Elective status: Elective-II

Prerequisite: --

Co requisite: --

Additional material required in ESE:--

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand of implementation of ecommerce applications.
CO2	Learn to develop and implement digital marketing strategy and plan
CO3	Implement and developing effective digital and social media strategies
CO4	Implementation and working on the social, and security issues concerning the digital marketing and e-commerce.
CO5	Learn about how increase sale, attract new customer and enhance brand perception
CO6	Learn to develop blogs

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

Develop Strategy/ Case Study for a Company/ Website enhancing its Online visibility using following tools/channels:

1.	Social media marketing and optimization
2.	YouTube Marketing
3.	Facebook marketing
4.	Email marketing
5.	LinkedIn
6.	Twitter
7.	Google Analytics
8.	Mobile Advertising

9.	Content Marketing: Optimize customer and user experience
10.	Creating & publishing Blogs

Text Books:

1. Whitley, David, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill.
2. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education
3. Seema Gupta, "Digital Marketing", McGraw Hill
4. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson.
5. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

Course Code: PGCA1931

Course Name: Software Testing & Quality Assurance

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 3 rd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3 hrs
External max. marks: 70	Elective status: Elective-II
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain software testing fundamentals and testing levels.
CO2	Apply black-box and white-box testing techniques.
CO3	Analyze object-oriented testing methods.
CO4	Evaluate testing for web, real-time, and other systems.
CO5	Assess software quality standards and metrics.
CO6	Apply risk management and configuration management
Detailed contents	Contact hours
<u>Part A</u>	26 Hours
<p>Software Testing: Testing, Verification and Validation, Test Strategies for Conventional and Object Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha and Beta Testing, System Testing, Recovery Testing, Security Testing, Stress Testing, Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies.</p> <p>Testing Techniques: Software Testing Fundamentals, Black Box and White Box Testing, Basis Path Testing, Flow Graph Notation, Independent Program Paths, Graph Matrices, Control Structure Testing, Condition Testing, Data Flow Testing, Loop Testing, Graph Based Testing Methods, Equivalence Partitioning,</p> <p>Object Oriented Testing Methods: Applicability of Conventional Test Case Design Methods, Issues in Object Oriented Testing, Fault-</p>	

<p>Based Testing, Scenario-Based Testing, Random Testing and Partition Testing for Classes, InterClass Test Case Design.</p> <p>Testing Process and Specialized Systems Testing: Test Plan Development, Requirement Phase, Design Phase and Program Phase Testing, Testing Client/Server Systems, Testing Web based Systems, Testing Off-the-Shelf Software, Testing in Multiplatform Environment, Testing for Real Time Systems, Testing Security.</p>	
<p style="text-align: center;"><u>Part B</u></p> <p>Software Quality Assurance Concepts and Standards: Quality Concepts, Quality Control, Software Quality Attributes, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, Review Guidelines, Software Reliability, Software Safety, Quality Assurance Standards, ISO 9000, ISO 9001:2000, ISO 9126 Quality Factors, CMM, CMMI, PCMM, TQM, Six Sigma, SPICE, Software Quality Assurance Metrics.</p> <p>Risk Management and Change Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, The RMMM Plan, Software Configuration Management, Baselines, Software Configuration Items, SCM Process: Version Control, Change Control, Configuration Audit, Configuration Management for Web Engineering.</p>	18 Hours

Text Books:

1. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education
2. Software Testing Techniques, Boris Beizer, Dream Tech Press.

Reference Books:

1. Roger S. Pressman, Software Engineering, 8/e, McGraw Hill, 2014.
2. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India.
3. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press
Walker Royce, Software Project Management: A Unified Frame Work, Pearson Education.

Course Code: PGCA1956

Course Name: Software Testing & Quality Assurance Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 3 rd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): 3 hrs
External max. marks: 30	Elective status: Elective-II
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Demonstrate test case creation and documentation.
CO2	Apply manual testing for basic functionalities.
CO3	Analyze test scenarios for web applications.
CO4	Apply data flow, path, and boundary testing.
CO5	Design test cases for dynamic features and performance.
CO6	Utilize automated testing tools for test automation.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Introduction to Test Cases, How to create a simple test case and record it in the excel file.
2.	Developing Login functionality and testing them manually and storing the data in the sheet.
3.	Testing the registration functionality
4.	Testing flight reservation system and recording test cases
5.	Testing the date field scenario programmatically and recording test cases.
6.	Taking scenario of product description functionality in ecommerce website.
7.	Taking a scenario of payment functionality and order history in ecommerce website.
8.	Practicing the data flow testing taking some another logic and implying path testing
9.	Taking up path testing
10.	Developing a logical code to test boundary value exemptions
11.	Create an image upload functionality and make their test cases
12.	Teams will make HTML CSS design templates in hours and perform load and performance testing
13.	Developing applications to automate basis path testing.
14.	Exposure to automated testing tools such as Rational test manager, Selenium, Loadrunner or any other similar tools

Text Books:

3. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education
4. Software Testing Techniques, Boris Beizer, Dream Tech Press.

Reference Books:

4. Roger S. Pressman, Software Engineering, 8/e, McGraw Hill, 2014.
5. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India.
6. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press
Walker Royce, Software Project Management: A Unified Frame Work, Pearson Education.

Course Code: PGCA1976

Course Name: Machine Learning and Data Analytics using Python

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 4 th	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain basic machine learning concepts.
CO2	Apply regression techniques for prediction.
CO3	Analyze clustering and classification algorithms.
CO4	Understand PCA and neural networks basics.
CO5	Apply Python, NumPy, and Pandas for data analysis.
CO6	Create data visualizations using Matplotlib.

Detailed contents	Contact hours
Part A	22 Hours
Machine Learning: Introduction, supervised, unsupervised, reinforcement learning.	
Regression: Linear Regression, linear classification, logistic regression.	
Clustering: K nearest neighbour, decision trees, Random forest.	
Classification: Naïve Bayes, principal component analysis, Introduction to neural networks.	
Part B	22 Hours
Introduction to Python Programming: Data types, operators, control structures, functions, modules.	
Numpy: Introduction to numpy, arrays, array indexing, operations	

<p>Pandas: Introduction to pandas, series, group by, DataFrames, missing data, merging, joining, concatenating, operations, data input and output.</p> <p>Matplotlib: Plotting, markers, line, labels, grid, subplot, scatter, bars, histograms, pie charts.</p>	
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Text Books:

1. Simplified Machine Learning, Pooja Sharma, BPB Publications, 2024.
2. Machine Learning using Python, M Pradhan, U Dinesh Kumar, Wiley, 2015.
3. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas Muller, O'Reilly, 2016.
4. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, William Mckinney, O'Reilly, 2017.

Reference Books:

1. Data Preparation and Analysis, Pooja Sharma, 2025.
2. Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance, Puneet Mathur, Apress, 2019.
3. Python for Data Science For Dummies, John Paul, Luca, Massron, Wiley, 2019.

Course Code: PGCA 1958

Course Name: Advanced Web Technologies

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 4 th	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand client-side and server-side programming.
CO2	Learn to represent web data and XML document handling.
CO3	Understand AJAX and relevance.
CO4	Develop a dynamic webpage by the use of java PHP and MySQL.
CO5	Able to learn how to perform basic CRUD database operations in a Dynamic Website.
CO6	Learn about web services and their development.

Detailed contents	Contact hours
<p style="text-align: center;">Part A</p> <p>PHP: Server-side web scripting, Installing PHP, Adding PHP to HTML, Syntax and Variables, Passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors/ problems.</p> <p>Advanced PHP and MySQL: PHP/MySQL Functions, Displaying queries in tables, Introduction to PHP OOPs concepts, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, Type and Type Conversions, E-Mail</p> <p>Introduction to Web Services: Use of Web Services, Types of Web Services, Introduction to Content Management System CMS (Types, Usages, Benefits).</p>	22 Hours
<p style="text-align: center;">Part B</p> <p>XML: Introduction to XML, XML Basics, XML Syntax and Editors, documents, Elements, Attributes. Creating XML documents.</p> <p>Ajax : Introduction and Use of Ajax in Website.</p> <p>jQuery : Introduction, jQuery UI: Date picker, auto complete, tooltip, accordion, retrieving page content, manipulating page content, working with events.</p> <p>Introduction to Bootstrap : Components of Bootstrap</p> <p>Introduction to Node.js: Node Package Manager (NPM), Node.js Webservice – Server and Clients.</p> <p>React: Introduction to ReactJS, Environment Setup, JSX, Components, State, Props, Validating Props, Component API, Component Life Cycle, Forms, Events</p>	22 Hours

Text Books:

5. Steven Holzner, "PHP: The Complete Reference", TATA McGraw Hill, 2015.
6. Roger S Pressman, David Lowe, "Web Engineering: A Practitioner's Approach", TMH.
7. W. Jason Gilmore, "Beginning PHP and MySQL: From Novice to Professional", Apress.
8. "Learning PHP, MySQL, JavaScript, CSS and HTML 5", Robin Nixon, O'Reilly publication
9. Web Technologies, Black Book, dreamtech Press
10. Alex Young, "Node.js in Action", 2ed, Bradley Meck

Reference Books:

1. Jesus Caspagnetto, "Professional PHP Programming", Wrox Publication.
2. P.J. Deitel & H.M. Deitel, "Internet and World Wide Web How to program", Pearson
3. Harwani, "Developing Web Applications in PHP and AJAX", McGrawHill
4. Ralph Moseley and M. T. Savaliya, "Developing Web Applications", Wiley-India
5. HTML 5, Black Book, Dreamtech Press

Course Code: PGCA1977

Course Name: Machine Learning and Data Analytics using Python Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 4 th	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): 3hrs
External max. marks: 30	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Develop knowledge of various learning models of data.
CO2	Implement a wide variety of learning algorithms.
CO3	Understand how to evaluate models generated from data.
CO4	Apply the algorithms to a real-world problems.
CO5	Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
CO6	Analyse data using Python matplotlib.

Instructions:

1. Students may develop the assignments in Python.
2. Standard data sets or assumed data sets may be used for developing ML programs.

Assignments:

1.	Design and evaluate a data model using Linear Regression.
2.	Design and evaluate a data model using Logistic Regression.
3.	Design and evaluate a data model using KNN.
4.	Design and evaluate a data model using K Means Clustering.
5.	Design and evaluate a data model using SVM.
6.	Design and evaluate a data model using PCA.
7.	Design and evaluate a data model using Decision Trees.
8.	Design and evaluate a data model using Random Forest.
9.	Compare the performance of all the above ML techniques on a similar data set using matplotlib.

Reference Books:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.

2. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.

Course Code: PGCA 1960

Course Name: Advanced Web Technologies Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 4 th	Contact hours: 4 hours per week
Internal max. marks: 70	Theory/Practical: Practical
External max. marks: 30	Duration of End Semester Exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: --

Co requisite: --

Additional material required in ESE:

- Install the following on local machine
 - Apache web server OR Tomcat application server locally
 - Install MySQL
 - PHP and configure it to work with Apache web server and MySQL

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand the advance concepts of website development.
CO2	Provide skills to design and develop dynamic web sites.
CO3	Work independently for database programming for web applications
CO4	Understand concepts of jQuery methods, AJAX, Bootstrap and REACT
CO5	Connect Website with an Database Server and perform basic CRUD operations.
CO6	Develop market ready website, to be used by clients.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments: All the Practical Assignments need to be carried on specific applications. (Example: Inventory Management System, Bus/Airline/Railway Reservation System, Student Management System etc.)

Practice Programs with PHP	
26.	PHP Code to display today's date in dd-mm-yyyy format.
27.	PHP Code to check if number is prime or not.
28.	PHP Code to print first 10 Fibonacci Numbers.
29.	PHP Code to read data from txt file and display it in html table (the file contains info in format Name: Password: Email)
30.	PHP Script for login authentication. Design an HTML form which takes username and password from user and validate against stored username and password in file.
31.	PHP Script for storing and retrieving user information from MySql table. <ul style="list-style-type: none"> • Design A HTML page which takes Name, Address, Email and Mobile No. From user (register.php)

	<ul style="list-style-type: none"> • Store this data in MySql database / text file. • Next page display all user in html table using PHP (display.php)
32.	PHP Script for user authentication using PHP-MYSQL. Use session for storing username.
Implement the following with specific web applications	
33.	Create HTML page for chosen application that contain textbox, submit / reset button. Write php program to display this information and also store into text file.
34.	Create XML documents for chosen application and validate using DTD and schema. Also render the content of XML document using XSL. Scenarios include <ul style="list-style-type: none"> • XML document must have attributes and elements so that they can be validated against DTD/Schema. • Check the data types of variables declared in XML document using Schema. • Display the details of data contained in XML document in a table using XSL.
35.	Embed the JQuery features for the application chosen. Perform the Scenarios using JQUERY ready function <ul style="list-style-type: none"> • In login form, define username and password constraints and ensure that the credentials follow them. • In registration form, username must be of atleast 6 characters. Password must be of atleast 8 characters and follow password constraints. Password and confirm password fields must match with each other. E-mail id must be of the form "yourname@domain.com". Mobile number must be of 10 digits only and starting digit must be any number from 6-9 etc... • Use the get and post methods for server side communication.
36.	Modify the specific web applications to use AJAX to show the result on the same page.
37.	Enhance functionality of the specific web applications using BOOTSTRAP
38.	Create a responsive Photo Gallery in BOOTSTRAP
39.	Suppose you have a list of Students having Student's Name, Roll Number, Marks in five subjects, Show this list in a responsive table in BOOTSTRAP
40.	Modify your answer for above question with PHP and MYSQL database and Perform CRUD operations with AJAX
41.	Build a Password Strength Check App with JQuery. You can use AJAX for form validation and add an alert when the user enters a weak password.
42.	Build a Registration Form and Validate it with JQuery. Registration Form must have at least 10 elements.
43.	Design a Sign In, Sign Up and Forgot Password Page with BOOTSTRAP. Use PHP and MYSQL to store Sign Up data in Database.
44.	Create a Star Rating System in JQuery.
45.	Create a simple To-do list Application with REACT
46.	Create a Calculator with REACT
47.	Create a Photo Gallery with REACT. Also implement search operation
48.	How can you create a Portfolio App with Node.js?
49.	Create a simple Shopping Cart with REACT and Node.js
50.	Modify your Shipping Cart with JQuery, JSON and AJAX functionality.

Reference Books:

11. Roger S Pressman, David Lowe, "Web Engineering: A Practitioner's Approach", TMH.
12. Steven Holzner, "PHP: The Complete Reference", TATA McGraw Hill, 2015.
13. W. Jason Gilmore, "Beginning PHP and MySQL: From Novice to Professional", Apress.
14. Learning PHP, MySQL, JavaScript, CSS and HTML 5, Robin Nixon, O'Reilly publication

Course Code: PGCA1937

Course Name: Cloud Computing

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 4 th	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems:
Internal max. marks: 30	Duration of end semester exam (ESE):
External max. marks: 70	Elective status: core/elective Elective-III
Total marks: 100	

Prerequisite:

Co requisite:

Additional material required in ESE:

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Explain cloud computing fundamentals and paradigms.
CO2	Compare cloud with grid, cluster, and distributed computing.
CO3	Apply cloud migration and virtualization techniques.
CO4	Analyze capacity planning and resource management.
CO5	Evaluate SLA, security, and cloud storage.
CO6	Assess advanced cloud technologies and platforms.

Detailed contents	Contact hours
<p style="text-align: center;">Part A</p> <p>Overview of Computing Paradigm: Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing.</p> <p>Introduction to Cloud Computing: Vision of Cloud Computing, Defining a Cloud, Cloud Reference Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud computing vs. Cluster computing vs. Grid computing.</p> <p>Migrating into a Cloud: Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration Into a Cloud.</p>	22 hours

<p>Virtualization: Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples- Xen, VMware, Microsoft Hyper-V.</p> <p>Capacity Planning: Introduction, Defining Baseline and Metrics- Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.</p>	
<p style="text-align: center;">Part B</p> <p>SLA Management in Cloud Computing: Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management.</p> <p>Securing Cloud services: Cloud Security, Securing Data- Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance.</p> <p>Cloud Storage: Provisioning Cloud Storage, Virtual storage containers, Cloud Storage Interoperability (CDMI, OCCI), Database Storage, Resource Management,</p> <p>Advance Topics in Cloud: Energy Efficiency in cloud, Market Oriented Cloud Computing, Federated Cloud Computing, Mobile Cloud Computing, Fog computing, BigData Analytics, Basics of IoT.</p> <p>Cloud Platforms in Industry: Amazon Web Services-Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life Cycle. Cost Model. Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.</p>	<p>22 hours</p>

Text Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India, Feb 2013.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-2980-3, New Delhi, India, 2011.
3. Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6, New Delhi, India, 2011

Reference Books:

1. Cloud Computing For Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights Into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

E Books/ Online learning material:

1. P.D. Kaur, I. Chana, Unfolding the distributed computing paradigm, in: Proceedings of the IEEE International Conference on Advances in Computer Engineering, ACE, Bangalore, Karnataka, India, 2010, pp. 339-342.
2. P. Mell and T. Grance, "The NIST definition of cloud computing (draft), NIST Spec. Publ. 800 (2011) 7.

Course Code:PGCA 1938

Course Name: Cloud Computing Laboratory

Program: MCA	L:0 T:0 P:4
Branch: Computer Applications	Credits: 2
Semester:4 th	Contact hours:4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: -
Internal max. marks: 70	Duration of end semester exam (ESE): -
External max. marks: 30	Elective status: core/elective Elective-III
Total marks: 100	

Prerequisite: Working Knowledge of Linux Operating system

Co requisite:

Additional material required in ESE:

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Develop knowledge of various learning models of data.
CO2	Implement a wide variety of learning algorithms.
CO3	Understand how to evaluate models generated from data.
CO4	Apply the algorithms to a real-world problems.
CO5	Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
CO6	Analyse data using Python matplotlib.

Sr. No.	Experiment Name
1.	Enlist various companies in cloud business and the corresponding services provided by them and tag them under SaaS , PaaS & IaaS.
2.	Create a warehouse application using tools supplied by any SaaS provider.
3.	Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S. Learn creation, migration, cloning and managing of virtual machines.
4.	Using public cloud service providers tools for exploring the usage of IaaS, PaaS and SaaS cloud services.
5.	Interact with Cloud Storage and conduct typical management tasks such as bucket creation, file transfers, Access Control Lists (ACL) permissions and Identity and Access Management (IAM) configuration.
6.	Setting up a private cloud using open source tools (Eucalyptus/Open Stack etc.).

Reference Books:

1. Cloud Computing For Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights Into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

Course Code: PGCA1963

Course Name: Digital Image Processing

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 4 th	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks:30	Duration of end semester exam (ESE): 3hrs
External max. marks:70	Elective status: Elective-III
Total marks: 100	

Prerequisite: -Student must have knowledge about Computer Graphics.

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain image processing fundamentals.
CO2	Apply image processing operations and transformations.
CO3	Analyze image enhancement techniques.
CO4	Evaluate image restoration methods.
CO5	Apply image compression techniques.
CO6	Analyze image segmentation methods.

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Introduction: Fundamental steps in Digital Image Processing, Components of an image processing system, Image sampling and quantization, Color models</p> <p>Digital Image Processing Operations: Pixel relationships and distance metrics -Image coordinate system, Image topology, Connectivity, Relations, Distance measures. Classification of image processing Operations - Arithmetic, Logical, Geometrical (Translation, Scaling, Zooming, Linear Interpolation, Mirror or Reflection, Shearing, Rotation, Affine and Inverse transformation) Operations, Image interpolation Techniques (Downsampling and upsampling), Set operations, Statistical operations, Convolution and Correlation operations.</p> <p>Image Enhancement in Spatial Domain: Image enhancement point operations- Linear and non-linear functions, Piecewise linear functions, Histogram processing. Spatial filtering - basics of filtering in the spatial domain, Vector representation, Smoothing linear and non-linear filters, sharpening filters.</p> <p>Image Enhancement in Frequency Domain: Basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain filters.</p>	24 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Image Restoration: A model of the image degradation/restoration process, Noise models, Noise filters, Degradation function.</p>	20 Hours

Multiresolution Analysis: Wavelet analysis, Continuous wavelet transform, Discrete wavelet transform, Wavelet decomposition and reconstruction in two dimensions, Wavelet packet analysis, Wavelet based image denoising.

Image Compression: Image compression model, Compression measures, Compression algorithm and its types (Entropy, Predictive, Transform and layered coding), Types of redundancy (Coding, Inter-pixel, Psycho-visual and Chromatic), Lossless compression algorithms – Run-length, Huffman, Bit-plane, Arithmetic, Predictive coding. Lossy compression algorithms – Lossy predictive, Block transform coding.

Image Segmentation: Classification of image segmentation algorithms, Point, Line and Edge detection, Hough transforms, Corner detection, Global thresholding, Otsu's method, Multivariable thresholding, Region-based segmentation, Watershed segmentation,

Text Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 2013.
2. S. Sridhar, "Digital Image Processing", Oxford University Press, 2011.

Reference Books:

1. M. Sonka, V. Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Thomas Learning, 2007
2. K. R. Castleman, "Digital Signal Processing", Pearson Education, 2007.

Course Code: PGCA1964

Course Name: Digital Image Processing Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 4 th	Contact hours: 4 hours per week
Internal max. marks: 70	Theory/Practical: Practical
External max. marks: 30	Duration of End Semester Exam (ESE): 3hrs
Total marks: 100	Elective status: Elective-III

Prerequisite: Students must have the knowledge of computer graphics.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Demonstrate basic image processing operations.
CO2	Generate and manipulate images and matrices.
CO3	Apply color conversion and histogram techniques.

CO4	Analyze image enhancement and restoration.
CO5	Apply feature detection methods.
CO6	Develop image processing applications.

Instructions: For implementation, software such as Python/SciLab/MATLAB or any other image processing software can be used and instructor may increase/decrease the experiments as per the requirement.

Sr no.	Assignments
51.	Installation of image processing software and use of basic image processing commands.
52.	Generation of lines, array, matrix and image
53.	Reading and displaying images in different formats using different color models
54.	Converting color images into monochrome images
55.	Displaying of image Histogram
56.	Image color enhancements using pseudo coloring techniques
57.	Image restoration techniques.
58.	Application of image processing operations
59.	Point, Line, and Edge Detections in images
60.	Boundary Detections in images
61.	Color image processing
62.	Wavelet transforms.
63.	Image compression techniques
64.	A minor project based on above taught image processing techniques.

Reference Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 2013.

Course Code: PGCA1965

Course Name: NLP and Speech Recognition

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 4 th	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective-III
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain NLP fundamentals and text processing.
CO2	Apply n-gram language models.
CO3	Analyze text classification techniques.
CO4	Evaluate classification performance metrics.
CO5	Analyze chatbot and dialogue systems.
CO6	Explain speech processing and ASR/TTS concepts.

Detailed contents	Contact hours
<p style="text-align: center;"><u>Part A</u></p> <p>Introduction to Natural Language Processing</p> <p>Regular Expressions, Text Normalization, Edit Distance: Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit Distance</p> <p>N-gram Language Models: N-Grams, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, Huge Language Models and Stupid Backoff, Advanced: Perplexity's Relation to Entropy</p> <p>Naive Bayes and Sentiment Classification: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Optimizing for Sentiment Analysis, Naive Bayes for other text classification tasks, Naive Bayes as a Language Model, Evaluation: Precision, Recall, F-measure, Test sets and Cross-validation, Statistical Significance Testing, Avoiding Harms in Classification</p> <p>Logistic Regression: Classification: the sigmoid, Learning in Logistic Regression, The cross-entropy loss function, Gradient Descent, Regularization, Multinomial logistic regression, Interpreting models, Advanced: Deriving the Gradient Equation</p>	22 Hours
<p style="text-align: center;"><u>Part B</u></p> <p>Chatbots & Dialogue Systems: Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State Architecture, Evaluating Dialogue Systems, Dialogue System Design</p> <p>Phonetics: Speech Sounds and Phonetic Transcription, Contents, Articulatory Phonetics, Prosody, Acoustic Phonetics and Signals, Phonetic Resources</p> <p>Automatic Speech Recognition and Text-to-Speech: The Automatic Speech Recognition Task, Feature Extraction for ASR: Log Mel Spectrum, Speech Recognition Architecture, CTC, ASR Evaluation: Word Error Rate, TTS, Other Speech Tasks</p>	22 Hours

Text Books:

15. Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Daniel Jurafsky, James H. Martin, Pearson, 2020
16. The Oxford Handbook of Computational Linguistic, Ruslan Mitkov, Oxford
17. Taming Text, Grant Ingersoll, Thomas Morton and Drew Farris, Manning

Reference Books:

4. Natural Language Processing with Python by Steven Bird, Ewan Klein and Edward Loper, O'Reilly, 2009

Course Code: PGCA1966

Course Name: NLP and Speech Recognition Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 4 th	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 70	Duration of end semester exam (ESE): 3hrs
External max. marks: 30	Elective status: Elective-III
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Demonstrate word analysis, generation, and morphology processing techniques.
CO2	Apply n-gram models and smoothing techniques for language modeling.
CO3	Implement POS tagging using Hidden Markov Models and Viterbi decoding.
CO4	Design and evaluate data models using linear and logistic regression.
CO5	Analyze vocabulary structures including segmental variations and minimal pairs.
CO6	Develop NLP applications using various language processing techniques.

Instructions:

3. Students may develop the assignments in Python.
4. Standard data sets or assumed data sets may be used for developing ML programs.

Assignments:

10.	Write a Program for Word Analysis.
11.	Write a Program for Word Generation.
12.	Write a program to implement Morphology.
13.	Write a Program to implement N-Grams.

14.	Write a Program to implement N-Grams Smoothing.
15.	Write a Program to implement POS Tagging: Hidden Markov Model.
16.	Write a Program to implement POS Tagging: Viterbi Decoding
17.	Design and evaluate a data model using Linear Regression.
18.	Design and evaluate a data model using Logistic Regression.
19.	Design a vocabulary of about 20 words. Choose words with a variety of segmental structure and length: place names or animal names for example. Add in a few minimal pairs.

Reference Books:

3. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.
4. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.

Course Code: PGCA1967

Course Name: IOT & Blockchain Technology

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	Credits: 4
Semester: 4 th	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 30	Duration of end semester exam (ESE): 3hrs
External max. marks: 70	Elective status: Elective-III
Total marks: 100	

Prerequisite: - NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain IoT fundamentals and architecture.
CO2	Apply IoT enabling technologies.
CO3	Analyze IoT components and frameworks.
CO4	Evaluate IoT applications in various domains.
CO5	Explain blockchain concepts and mechanisms.
CO6	Analyze Bitcoin and blockchain applications.
Detailed contents	
Part A	
Contact hours	
24 Hours	

<p>Introduction to Internet of Things (IoT): Definitions & Characteristics of IoT, Physical Design of IoT-Things in IoT, Protocols, Logical Design of Functional Blocks, Communication Models, Communication APIs.</p> <p>Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates.</p> <p>Elements of IoT : Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- familiarity with API's for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP. Solution Framework for IoT applications.</p> <p>Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle</p>	
<p style="text-align: center;">Part B</p> <p>Concept of Blockchain: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain</p> <p>Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.</p> <p>Enterprise Application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade — Trade Finance Network, Supply Chain Financing, Identity on Blockchain</p>	20 Hours

Text Books:

5. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
6. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
7. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

Reference Books:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press).
2. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
3. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.
4. Iran Bashir "Mastering Blockchain", Second Edition Paperback. 2018.
5. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.

Course Code: PGCA1968

Course Name: IOT & Blockchain Technology Laboratory

Program: MCA	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 4 th	Contact hours: 4 hours per week
Internal max. marks: 70	Theory/Practical: Practical
External max. marks: 30	Duration of End Semester Exam (ESE): 3hrs
Total marks: 100	Elective status: Elective-III

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Demonstrate Arduino/Raspberry Pi setup and programming.
CO2	Apply sensor interfacing and device control.
CO3	Analyze IoT communication using Bluetooth and cloud.
CO4	Develop IoT monitoring and alert systems.
CO5	Demonstrate blockchain platform setup.
CO6	Develop IoT-blockchain integrated applications.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

65.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
66.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
67.	Interfacing Rain Sensing Automatic Wiper System
68.	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
69.	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
70.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
71.	Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to and from thingspeak cloud.
72.	Interfacing smoke sensor to give alert message to fire department.
73.	Install and understand Docker container, Node.js, Java and Hyperledger Fabric/Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
74.	Create and deploy a blockchain network using Hyperledger Fabric SDK/Ethereum for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
75.	Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
76.	Develop an IOT asset tracking app using Blockchain. Use an IOT asset tracking device to improve a supply chain by using Blockchain, IOT devices and Node-RED

e-Resources:

1. GitHub repository.
2. IBM library for IoT.

Course Code: PGCA1961

Course Name: Research/Technical seminar

Program: MCA	L: 0 T: 0 P: 2
Branch: Computer Applications	Credits: 1
Semester: 4 th	Contact hours: 2 hours per week
Internal max. marks: 0	Theory/Practical: Practical
External max. marks: 100	Duration of End Semester Exam (ESE): 3hrs
Total marks: 100	Elective status:

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Project:

Students may be encouraged to take up internship projects in industry or research/academic institutions.

Students may be offered software/hardware development or research oriented projects if taken in house.

Faculty members may offer project proposals from their side and students may choose from them.

Students may also submit project proposals not covered in the faculty provided list, which may be guided by the interested faculty members.

Co-guidance with external institutes/industry may also be allowed.

Same project ideas may be submitted by more than one student group, but may be unique at the implementation level, as per the judgment of the department.

Students may be encouraged to take up more innovative projects involving contemporary technologies, leading to research paper and/or patent publications.

Minor Projects from the previous semester may also be carrying forwarded with significant up gradations.

Technical seminar:

Industry seminars are suggested to enable the students of MCA to appreciate the software developments which are going on in industries in India. These seminars will help the students to

face interviews with some confidence. The students should attend these and submit a report. The following points are listed to enable the college to organize these seminars.

1. Three to four organizations (Industry, Public sector organizations, Govt. organizations) are requested to present a detailed case study of one or many applications in their organization.
2. Presentation covers in detail all aspects of a project from conception to implementation and maintenance. Design is discussed to cover all factor that influenced the design. Planned and achieved benefits of the application are also stressed.
3. In order that the students take the presentations seriously, groups of students are assigned to prepare a detailed synopsis of each presentation, copies of which are distributed to others.
4. One session could be a survey of new applications in the Indian environment during the past year, as ascertained from a survey of news paper articles. This is to be done by a group of students.
5. College can invite potential employers to participate in the inauguration- and valediction of the seminar so that the efforts of the college get noticed by employers.
6. It is neither necessary nor possible to have an examination on the seminar. Idea is that the motivated students get an opportunity to seek answers to questions on worthwhile computerization on our economy.

Course Code: PGCA1962

Course Name: Project

Program: MCA	L: 0 T: 0 P: 8
Branch: Computer Applications	Credits: 4
Semester: 4 th	Contact hours: 8 hours per week
Internal max. marks: 180	Theory/Practical: Practical
External max. marks: 120	Duration of End Semester Exam (ESE): 3hrs
Total marks: 300	Elective status:

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Annexure A

OBJECTIVE

The objective of the project course is to help the student develop ability to apply multi-disciplinary concepts, tools and techniques to analyze and logically approach the organizational problems.

PROJECT PROPOSAL EVALUATION:

The project proposal/Synopsis will be submitted within 2 weeks from start of semester and evaluated by the panel of three teachers in the presence of student, who will give the presentation to the panel.

In case of non-approval of the Synopsis the comments/suggestions for reformulating the Synopsis will be communicated to the student. In such case, the revised Synopsis should be submitted within 7 days, which shall be evaluated on similar guidelines.

Then after period of 1 Month Progress report 1 has been evaluated by Guide on the basis of following:

1. Problem Definition
2. Need & Scope of the Study
3. Methodology & Objectives
4. Data Analysis & Findings

Then after period of 2 Month Progress report 2 has been evaluated by Guide on the basis of following:

1. Testing & Implementations
2. Suggestions and Conclusions
3. Overall Report Writing & Layout

PROJECT PRE-SUBMISSION:

After approval of the Synopsis, student shall complete their projects and submit the completed Project Report (Spiral bound) for final internal evaluation before 2nd MST.

The guidelines for project report are as follows:

- The length of the report may be about 60 to 80 double spaced typed pages not exceeding approximately 18,000 words (excluding appendices and exhibits). However, rational variation on either side is permissible.
- The Project Report may have the following:
 - o Cover Page – must have the Title of the Project, Name & logo of college / university, Name and University Roll No of the Student and the Name of the Guide, along with the designation and department.
 - o Detailed table of contents with page nos.
 - o All pages of the Project Report must be numbered as reflected in the table of contents.
 - o Project Proposal, properly bound in the project and not just stapled. Please note that project with stapled Proposal will not be accepted.
 - o Certificate of originality- duly signed by the student and the guide with dates.
 - o Introduction to the Project and Review of Literature along with brief details of the organization/s understudy.
 - o Rationale
 - o Statement of problem
 - o Objectives of the Project
 - o Scope of the study
 - o Research Methodology
 - Research Design
 - Nature and Source of data/information collected
 - Sample and Sampling method with rationale

- Details of the tools:
 - The Questionnaire and other methods used and their purpose
 - Reliability and Validity of the tools used
 - Administration of tools and techniques
 - Data collection
 - Data Handling, Statistical tools used for Data Analysis
 - Data Interpretation and Findings
 - Recommendations
 - Summary and Conclusion
 - Limitations of the Project
 - Direction for further research (optional)
 - Reference/Bibliography
 - Annexures/Appendices (Questionnaire used etc.)
- ✓ Note: Research Methodology of the Project Report must have elaborate detail of all the components of the methodology.

The spiral bound project report will be evaluated by the panel of three teachers before second MST in presence of student, who will give the presentation to the panel before second MST.

In case of non-approval of the final project report, the comments/suggestions for revising the project report will be communicated to the student. In such case, the revised project report should be submitted within 7 days, which shall be evaluated on similar guidelines.

SUBMISSION OF FINAL PROJECT REPORT:

After incorporating changes, if any, pointed out during internal evaluation, the final Project Report in Hard Bound form (3 copies) shall be submitted by the student at least 3 working days before final viva voce. After signing of certificate by student and supervisor, one copy will be retained by the supervisor, second copy by the student and third copy shall be produced at the time of viva-voce, which shall be maintained by the department as record.

Note:

1. Wherever it is felt that there is not sufficient time to complete the project after approval of Synopsis, the phases of Project till "Project Proposal Evaluation" may be completed in third semester at department level.
2. Minor Projects from the previous semester may also be carrying forwarded with significant up gradations with the consent of HOD.
3. For further details on references, bibliography and formatting of the report, you may refer the Guidelines for Project Report.

EVALUATION CRITERIA FOR PROJECT REPORT (MCA-PGCA1962)

S.No.	Name	Roll No. & Date of Presentation	Synopsis	Problem Definition / Need & Scope of the Study	Methodology & Objectives		Data Analysis & Findings	Testing and Implementation	Suggestions & Conclusion	Overall Report Writing & Layout	Total Earned Marks out of (170)	Signature of the Evaluator with Date	Attendance Marks (in accordance to the criteria)	Total Earned Marks out of (180)
					Progress Report 1	Progress Report 2								
			60	20	15	15	15	20	20	20	160		10	180
1														
2														
3														

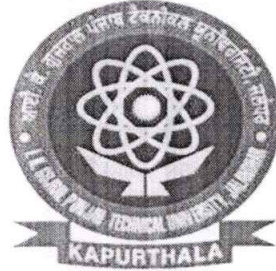
Note:

- 1) Total marks of "Project Report (MCA PGCA1962)" = 180
- 2) Attendance Marks (from a total of 5 marks) to be given on the basis of percentage of lectures attended of MCA during the academic term as per the following criteria:
 - i. Above 75% = NIL
 - ii. 76% - 80% = 1
 - iii. 81% - 85% = 2
 - iv. 86% - 90% = 3
 - v. 91% - 95% = 4
 - vi. 96% and above = 5

Guidelines for Project Report

Project Report on
"PROJECT TITLE"

Submitted to



I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY
KAPURTHALA

In partial fulfillment of the requirement for the
award of degree of
Master of Computer Applications (MCA)

Submitted by

Name of the Student

University Roll no.

Supervisor

Name (Guide)

Designation

Logo of the Institute

DEPARTMENT OF COMPUTER
APPLICATIONS

NAME OF THE INSTITUTE

NAME OF THE CITY

(Batch)

CERTIFICATE (On a Separate Page)

*Certificate of Project from Institute/Company/Industry shall be attached herewith.

STUDENT DECLARATION (On a Separate Page)

I, “_____ (Student Name)”, hereby declare that I have undergone my Project at “_____ (Institute/Industry Name)” from __ (start date) to __ (end date). I have completed a research project titled “_____ (Project Title)” under the guidance of Mr. /Ms. _____ (Name of Supervisor).

Further I hereby confirm that the work presented herein is genuine and original and has not been published elsewhere.

(Student name and Signature)

FACULTY DECLARATION (On a Separate Page)

I hereby declare that the student Mr. / Ms. _____ of MCA has undergone his/her Project under my periodic guidance on the Project titled “_____ (Project Title)”.

Further I hereby declare that the student was periodically in touch with me during his/her training period and the work done by student is genuine & original.

(Signature of Supervisor)

ACKNOWLEDGEMENT (On a Separate Page)

*Acknowledge the support and guidance provided to you by various persons during your Project Training

TABLE OF CONTENTS (On a Separate Page)

Certificate by Guide		ii
Student Declaration		iii
Faculty Declaration		iv
Abstract		v
Acknowledgment		v
CHAPTER NO.	CHAPTER TITLE	PAGE NO.
1	Synopsis	
2	Introduction to the Research Problem	
3	Need, Scope and Objectives of the Study	
4	Research Methodology	
5	Data Analysis and Interpretation	
6	Findings of the Study	
7	Testing and Implementation	
8	Conclusion, Suggestions & Recommendations of the Study	
References and Bibliography		
Appendix (Questionnaire, Glossary of Terms, Abbreviations, Documents, Performa, Financial statements, etc.)		

LIST OF TABLES

TABLE NO.	TABLE TITLE	PAGE NO.

LIST OF FIGURES

FIGURE NO.	FIGURE TITLE	PAGE NO.

General Guidelines for Layout and format

1. Paper Size must be A4 and margins should be maintained on all pages as follows: **Left margin = 1.5"** (wider for binding) **Top, right & bottom margins = 1"**
2. Use **Times New Roman** font, **12 pointsize**, for text. and **14 point** size for headings
3. Use **1.5 line spacing** for all text in the main body of the thesis.
4. Report should contain page numbers (1, 2, 3....) starting from Introduction Chapter. Preliminary pages should be numbered: i., ii., iii, iv, v, vi, etc. A page number should not be shown on the inside title page even though it is counted as i.
5. Page number should be placed at the **bottom- center of page**.

Imp Note:

1. Students are required to prepare two Hard Bound copies of their Project report to be submitted within 10 days of commencement of 3rd Semester
2. Questionnaires in original to be retained by the students for the final presentation if required.

Guidelines on Faculty Guide-Student Interaction

1. The Student is required to be in constant touch with their Faculty Guide through email, telephone, personal interactions etc.
2. It is mandatory for the student to provide a weekly progress report to their Faculty Guides for each week of their Project.
3. The Topic for the Project should be chosen in consultation with their Faculty guide and after their due approval.
4. Same topics having any sort of duplicacy shall not be acceptable.
5. Institute will be conducting surprise visits of the organization where the Student is undergoing Project from time to time and any students found to be irregular / not attending their Project then the Project report of the said student shall stand cancelled .

Preparing References/Bibliography

- ✓ While preparing the Bibliography, in case of website as a source, ensure that the date and the timing of accessing the website is mentioned along with.
- ✓ While preparing bibliography student must adopt the following method:

Article in a Magazine

Henry, W. A., III. (1990, April 9). Making the grade in today's schools. *Time*, 135, 28-31.

Article in a Newspaper

Unlike other periodicals, p. or pp. precedes page numbers for a newspaper reference in APA style. Single pages take p., e.g., p. B2; multiple pages take pp., e.g., pp. B2, B4 or pp. C1, C3-C4.

Schultz, S. (2005, December 28). Calls made to strengthen state energy policies. *The Country Today*, pp. 1A, 2A.

Basic Format for Books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Location: Publisher.

Note: For "Location," you should always list the city, but you should also include the state if the city is unfamiliar or if the city could be confused with one in another state.

Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.

Government Document

National Institute of Mental Health. (1990). *Clinical training in serious mental illness* (DHHS Publication No. ADM 90-1679). Washington, DC: U.S. Government Printing Office.

Report From a Private Organization

American Psychiatric Association. (2000). *Practice guidelines for the treatment of patients with eating disorders* (2nd ed.). Washington, D.C.: Author.

Conference Proceedings

Schnase, J.L., & Cunnius, E.L. (Eds.). (1995). Proceedings from CSCL '95: *The First International Conference on Computer Support for Collaborative Learning*. Mahwah, NJ: Erlbaum.

Article From an Online Periodical

Author, A. A., & Author, B. B. (Date of publication). Title of article. *Title of Online Periodical*, volume number (issue number if available). Retrieved month day, year, (if necessary) from <http://www.someaddress.com/full/url/>

Bernstein, M. (2002). 10 tips on writing the living Web. *A List Apart: For People Who Make Websites*, 149. Retrieved May 2, 2006, from <http://www.alistapart.com/articles/writeliving>

Online Newspaper Article

Author, A. A. (Year, Month Day). Title of article. *Title of Newspaper*. Retrieved <http://www.someaddress.com/full/url/>

Parker-Pope, T. (2008, May 6). Psychiatry handbook linked to drug industry. *The New York Times*. Retrieved from <http://www.nytimes.com>

Electronic Books

De Huff, E.W. *Taytay's tales: Traditional Pueblo Indian tales*. Retrieved from <http://digital.library.upenn.edu/women/dehuff/taytay/taytay.html>

Davis, J. *Familiar birdsongs of the Northwest*. Available from <http://www.powells.com/cgi-bin/biblio?inkey=1-9780931686108-0>

Online Encyclopedias and Dictionaries

Feminism. (n.d.) In *Encyclopaedia Britannica online*. Retrieved March 16, 2008, from <http://www.britannica.com>

Annexure B

Guidelines for Research/ Technical Seminar:

OBJECTIVE

The objective of the Research /Technical Seminar is to help the student develop ability to apply multi- disciplinary concepts, tools and techniques to analyze and logically approach the organizational problems.

The Research topic may be from any one of the following types, however, it should preferably be from your area of specialization in MCA:

- i) Survey of Literature/Comprehensive case study (covering single organization/multifunctional area problem formulation, analysis and recommendations).
- ii) Inter-organizational study aimed at inter-organizational comparison/validation of theory/survey of management practices.
- iii) Field study / Conclusion (empirical study).

REPORT PROPOSAL

Proposal should be prepared in consultation with the supervisor and submitted before the routine first MST in department. The length of the report may be about 25 to 30 double spaced typed pages not exceeding approximately 5000 words (excluding appendices and exhibits). However, rational variation on either side is permissible.

The Proposal may have the following components:

- a) Introduction, brief background, and Rationale of the topic chosen for the Research.
- b) Brief Introduction and vital details of the organization/s understudy.
- c) Statement of the Research problem.
- d) Objectives of the Research (clearly stated in behavioral terms).
- e) Research Methodology:
 - ✓ Research Design
 - ✓ Survey of Literature
 - ✓ Nature and source of data / information to be collected.
 - ✓ Sample and sampling technique. Rationale of chosen organization and the sample.
 - ✓ Tools and Techniques to be used for data collection – details of the tools/questionnaire to be used and its relevance with the objectives of the project.
 - ✓ Method/s to be used for data collection
 - ✓ Data handling and analysis
 - ✓ Statistical tools to be used for analysis
 - ✓ Conclusion.
- f) Limitation of the proposed research work, if any.
- g) Any other relevant detail which will help better appreciation and understanding of the research study.

EVALUATION CRITERIA FOR Research/Technical Seminar

S.N.	Name	Roll No. & Date of Presentation	Introduction & Review of Literature	Rationale, Problem Definition, Scope & Objectives	Research Methodology	Data Analysis & Findings	Suggestions & Conclusion & Scope for Future research	Overall Report Layout and Viva Performance	Total Earned Marks (out of 100)	Signature of the Evaluator with Date
1										
2										
3										

Name of Student:..... Roll No:

.....

Research/ Technical Seminar
(Title).....

Estimated
duration.....

Name of Organization &
Address.....

.....

..

.....

..

Nature of
Research.....

..

(Application/Network/Web based) Research Description (Additional Pages is to be attached to
give description of the work under the following
heads).....

.

.....

..

Features of the
Research.....

Existing
Papers.....

Proposed
Papers.....

.

Tools.....

.....

Requirements: Hardware & Software
Requirements.....

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Signature of student
charge)

(Signature of Guide In-

(Annexure-IV)

 AMRITSAR GROUP OF COLLEGE NAAC Grade "A" 3 rd Cycle under Autonomous Category Autonomous Status (Since 2014) Conferred by UGC	Proceedings 14th BoS Meeting	Department of Computer Applications
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Offering up to 40% of the courses through SWAYAM platform
(for 3rd semester of BCA applicable to 2025 admitted batch and onwards)

BCA-3rd Sem									
Course Code	Course Type	Course Title	Load			Marks		Total Marks	Credits
			Allocation			Distribution			
			L	T	P	Internal	External		
BCA25301	Core Theory	Computer Networks	4	0	0	40	60	100	4
BCA25302	Core Theory	Data Structures	4	0	0	40	60	100	4
BCA25303	Skill Enhancement	Web Designing	3	0	0	40	60	100	3
BCA25304	Core Practical/ Laboratory	Computer Networks Laboratory	0	0	2	60	40	100	1
BCA25305	Core Practical/ Laboratory	Data Structures Laboratory	0	0	2	60	40	100	1
BCA25306	Skill Enhancement Practical/ Laboratory	Web Designing Laboratory	0	0	2	60	40	100	1
BCA25307	Value Added Course/ Theory	Introduction to Artificial Intelligence	3	0	0	40	60	100	3
	Professional Elective-I		3	0	0	40	60	100	3
EMC-25201	Skill Enhancement Course Laboratory		0	0	4	60	40	100	2
TOTAL			17	0	10	440	460	900	22

Professional Elective-I	
BCA24308	Software Engineering
BCA24309	Data Security and Privacy


Course Name	SME Name	Institute	Duration	Start date	End date	Exam date	Enrollment End date	Exam Registration End Date
Software Engineering	Prof. Rajib Mall	IIT Kharagpur	12 Weeks	Jul 20, 2026	Oct 9, 2026	Oct 23, 2026	Jul 27, 2026	Aug 14, 2026

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(Annexure-IV)

 AMRITSAR GROUP OF COLLEGE NAAC Grade "A" 3 rd Cycle under Autonomous Category	Proceedings 14th BoS Meeting	Department of Computer Applications
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Offering up to 40% of the courses through SWAYAM platform
(for 5th semester of BCA applicable to 2024 admitted batch and onwards)

BCA-5 th Sem									
Course Code	Course Type	Course Title	Load			Marks		Total Marks	Credits
			Allocation			Distribution			
			L	T	P	Internal	External		
BCA24501	Skill Enhancement	Information Security	4	0	0	40	60	100	4
BCA24502	Skill Enhancement	Information Security Laboratory	0	0	2	60	40	100	1
BCA24503	Core Theory	Programming in Java	4	0	0	40	60	100	4
BCA24504	Core Practical/Laboratory	Programming in Java Laboratory	0	0	2	60	40	100	1
	Professional Elective-III Theory		4	0	0	40	60	100	4
	Professional Elective-III Laboratory		0	0	2	60	40	100	1
	Professional Elective-IV Theory		3	0	0	40	60	100	3
	Professional Elective-IV Laboratory		0	0	2	60	40	100	1
BCA24505	Skill Enhancement	Minor Project	0	0	2	60	40	100	1
	TOTAL		15	0	10	460	440	900	20

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(Annexure-IV)

Professional Elective-III Theory		
Course Code	Course Title	Discipline
BCA24506	Web Programming-I	Full Stack Development
BCA24508	Introduction to Machine Learning	Data Science
BCA24510	Introduction to Data Science	AIML

Professional Elective-III Laboratory		
Course Code	Course Title	Discipline
BCA24507	Web Programming-I Laboratory	Full Stack Development
BCA24509	Introduction to Machine Learning Laboratory	Data Science
BCA24511	Introduction to Data Science Laboratory	AIML

Professional Elective-IV Theory		
Course Code	Course Title	Discipline
BCA24512	Digital Marketing	Full Stack Development
BCA24514	Natural Language Processing	Data Science
BCA24516	Neural Network	AIML


Professional Elective-IV Laboratory		
Course Code	Course Title	Discipline
BCA24513	Digital Marketing Laboratory	Full Stack Development
BCA24515	Natural Language Processing Laboratory	Data Science
BCA24517	Neural Network Laboratory	AIML

Course Name	SME Name	Institute	Duration	Start date	End date	Exam date	Enrollment End date	Exam Registration End Date
Programming in Java	Prof. Debasis Samanta	IIT Kharagpur	12 Weeks	Jul 20, 2026	Oct 9, 2026	Oct 25, 2026	Jul 27, 2026	Aug 14, 2026

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 AMRITSAR GROUP OF COLLEGE <small>NAAC Grade "A" 3rd Cycle under Autonomous Category</small>	Proceedings 14th BoS Meeting	Department of Computer Applications
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Offering up to 40% of the courses through SWAYAM platform
 (for 3rd semester of MCA applicable to 2025 admitted batch and onwards)

MCA-3rd Sem									
Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1925	Core Theory	Advanced Computer Networking	4	0	0	30	70	100	4
PGCA1926	Core Theory	Artificial Intelligence & Soft Computing	4	0	0	30	70	100	4
PGCA1927	Core Theory	Theory of Computation	4	0	0	30	70	100	4
	Elective – I		4	0	0	30	70	100	4
	Elective – II		4	0	0	30	70	100	4
PGCA1928	Core Practical/ Laboratory	Advanced Computer Networking Laboratory	0	0	4	70	30	100	2
PGCA1929	Core Practical/ Laboratory	Artificial Intelligence & Soft Computing Laboratory	0	0	4	70	30	100	2
	Elective – II Laboratory		0	0	4	70	30	100	2
PGCA1969		**Summer/Institutional Training	0	0	4	70	30	100	2
	TOTAL		20	0	16	430	470	900	28

Elective – I	
Course Code	Course Title
PGCA1930	Software Project Management
PGCA1971	Optimization Techniques
PGCA1972	Data Mining and Business Intelligence
PGCA1973	Enterprise Resource Planning

Elective – II	
Course Code	Course Title
PGCA1933	Mobile Applications Development
PGCA1935	Simulation & Modelling
PGCA1921	e-Commerce and Digital Marketing
PGCA1931	Software Testing & Quality Assurance

Elective – II Laboratory	
Course Code	Course Title
PGCA1934	Mobile Applications Development Laboratory
PGCA1936	Simulation & Modelling Laboratory
PGCA1974	e-Commerce and Digital Marketing Laboratory
PGCA1975	Software Testing & Quality Assurance Laboratory

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(Annexure-IV)

Course Name	SME Name	Institute	Duration	Start date	End date	Exam date	Enrollment End date	Exam Registration End Date
Artificial Intelligence: Concepts and Techniques	Prof. V. Susheela Devi	IISc Bangalore	12 Weeks	Jul 20, 2026	Oct 9, 2026	Oct 24, 2026	Jul 27, 2026	Aug 14, 2026

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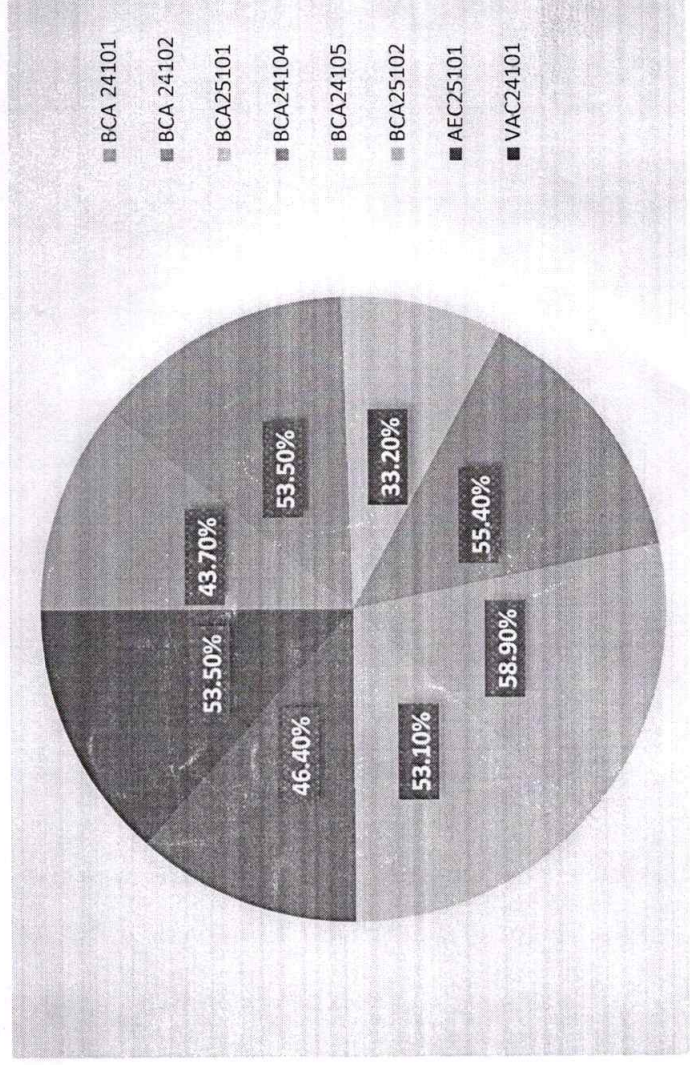
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Subject Code	BCA 24101	BCA 24102	BCA 24104	BCA 24105	BCA 25101	BCA 25102	AEC25101	VAC24101
Student Appeared	256	256	256	256	256	256	256	256
Student Pass	112	137	142	151	85	136	119	137
Student Fail	144	119	114	105	171	120	137	119
Result Late	-	-	-	-	-	-	-	-
Pass Percentage	43.7%	53.5%	55.4%	58.9%	33.2%	53.1%	46.4%	53.5%

Two fifty six (256) students of BCA-1st Sem has appeared in November 2025 examination, and as per the number of students appeared in Nov'2025 examination, the pass percentage result of the class is 22.2%. Among Two fifty six (256) students, only fifty seven (57) students passed in all subjects. The list of top three

Roll No.	Name	CGPA
2551349	Aditi	9.10
2551380	Arpit singh	8.45
2551525	Prabhjot singh	8.40



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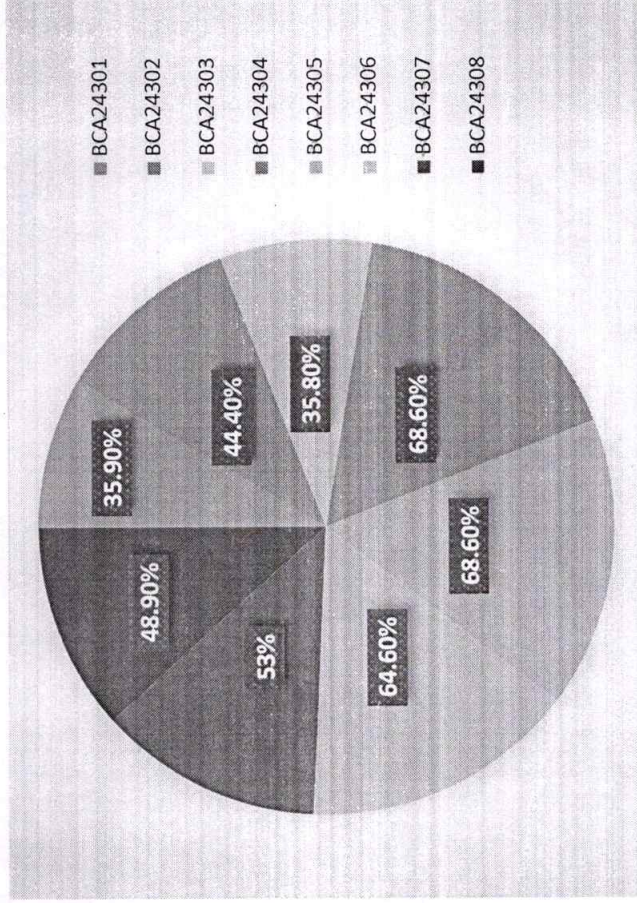
Result Analyst, DCA

HOD, DCA

Subject Code	BCA24301	BCA24302	BCA24303	BCA24304	BCA24305	BCA24306	BCA24307	BCA24308
Student Appeared	198	198	198	198	198	198	198	198
Student Pass	71	88	71	136	136	128	105	97
Student Fail	127	110	127	62	62	70	93	101
Result Late	-	-	-	-	-	-	--	-
Pass Percentage	35.9%	44.4%	35.8%	68.6%	68.6%	64.6%	53%	48.9%

One ninety eight (198) students, students of BCA-3rd Sem appeared in November 2025 examination. As per the number of students appeared in Nov'2025 examination, the pass percentage result of the class is 24.2%. Among One ninety eight (198) students, only forty-eight (48) students passed in all subjects. The list of top three students is as below:

Roll No.	Name	CGPA
2412296	Mehakdeep kaur	9.05
2412304	Navjot kaur	8.85
2412274	Komalpreet kaur	8.55



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Result Analyst, DCA

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HOD, DCA

 AMRITSAR GROUP OF COLLEGES <small>NAAC Grade "A" 3rd Cycle Autonomous College <small>(Since 2010) Gated Road, GGC</small> </small>	Result Analysis of BCA- 5th Sem November 2025	Department of Computer Application
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Subject Code	UGCA1929	UGCA1932	UGCA1935	UGCA1936	BMPD502-18	TUGCA1999	TUGCA1998	UGCA1930	UGCA1938	UGCA1941
Student Appeared	123	123	123	123	123	123	123	123	123	123
Student Pass	79	87	62	96	120	96	101	107	100	101
Student Fail	44	36	61	27	3	27	22	16	23	22
Result Late	-	-	-	-	-	-	-	-	-	-
Pass Percentage	64.2%	70.7%	50.4%	78%	97.5%	78%	82.1%	87%	81.3%	82.1%

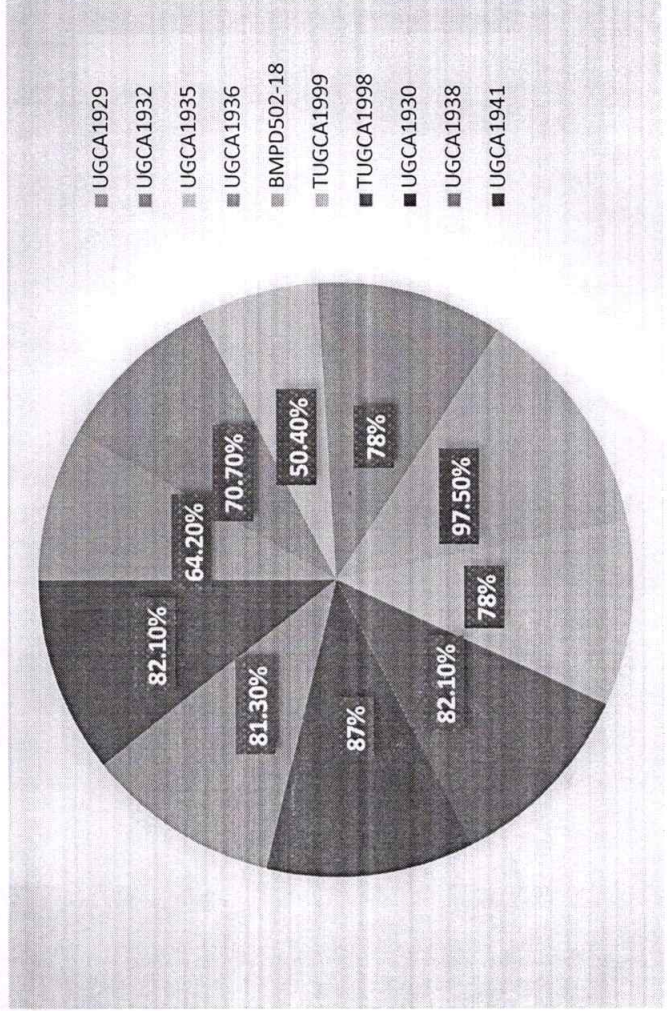
One twenty three (123) students of BCA-5th Sem has appeared in November 2025 examination, and as per the number of students appeared in Nov'2025 examination, the pass percentage result of the class is 41.4%. Among One twenty three (123) students, only fifty one (51) students passed in all subjects. Result of Top3 student is late. The

Roll No.	Name	CGPA
2333814	Sarabjeet singh	8.83
2333789	Rajni	8.70
2333685	Harmanpreet kaur	8.52
2333693	Himanshu kapoor	8.52

Result Analyst, DCA

(Signature)

HOD, DCA



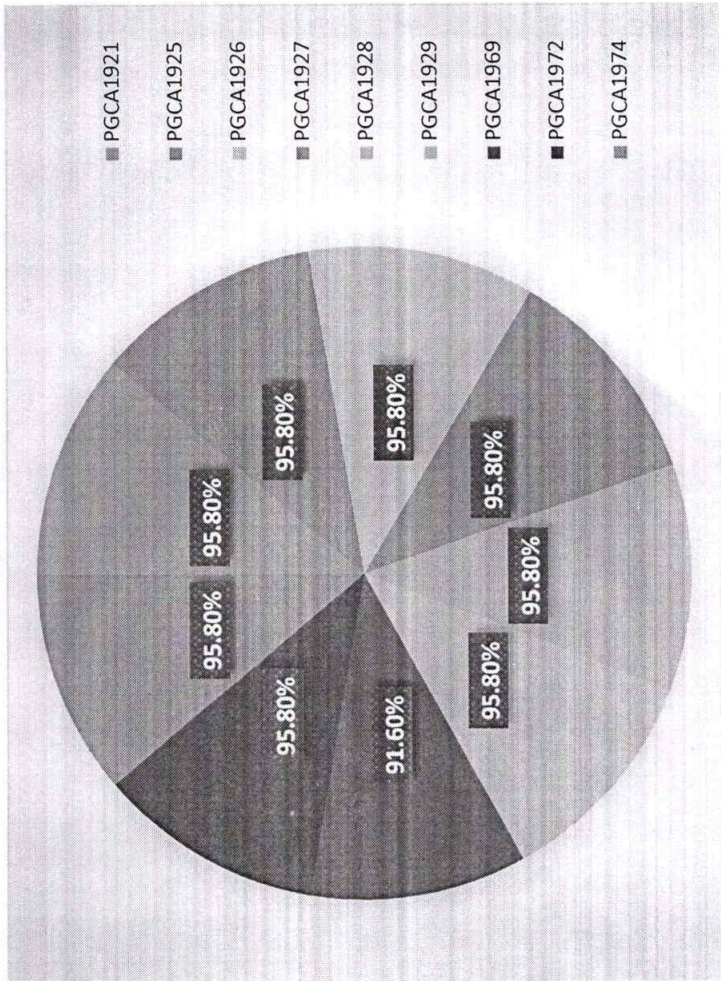
Subject Code	PGCA1921	PGCA1925	PGCA1926	PGCA1927	PGCA1928	PGCA1929	PGCA1969	PGCA1972	PGCA1974
Student Appeared	24	24	24	24	24	24	24	24	24
Student Pass	23	23	23	23	23	23	22	23	23
Student Fail	-	-	-	-	-	-	2	-	-
Result Late	-	-	-	-	-	-	-	-	-
Pass Percentage	95.8%	95.8%	95.8%	95.8%	95.8%	95.8%	91.6%	95.8%	95.8%

Twenty-four (24) students of MCA-3rd Sem has appeared in November 2025 examination, and as per the number of students appeared in Nov'2025 examination, the pass percentage result of the class is 91.66%. Among Twenty-four (24) students, only twenty two (22) students passed in all subjects. The list of top three

Roll No.	Name	CGPA
2411958	Navreen kaur	9.07
2411963	Samridhi	9.00
2411956	Muskan mahajan	8.86

Result Analyst, DCA

HOD, DCA



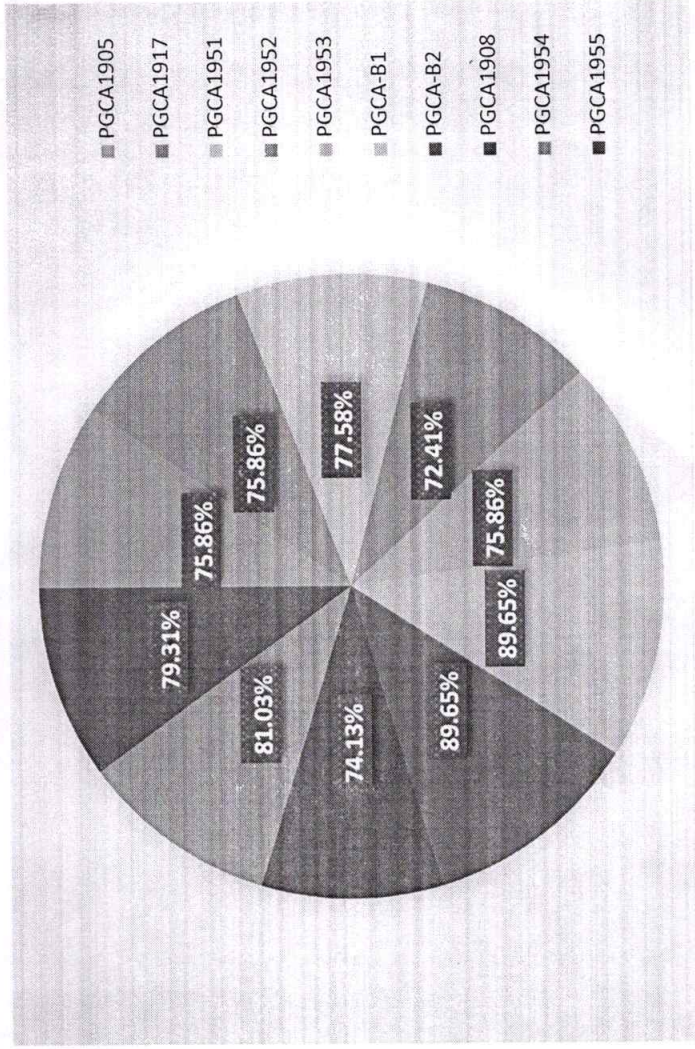
Subject Code	PGCA1905	PGCA1917	PGCA1951	PGCA1952	PGCA1953	PGCA-B1	PGCA-B2	PGCA1908	PGCA1954	PGCA1955
Student Appeared	58	58	58	58	58	58	58	58	58	58
Student Pass	44	44	45	42	44	52	52	43	47	46
Student Fail	14	14	13	16	14	6	6	15	11	12
Result Late	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Pass Percentage	75.86%	75.86%	77.58%	72.41%	75.86%	89.65%	89.65%	74.13%	81.03%	79.31%

Fifty eight (58) students of MCA-1st Sem has appeared in November 2025 examination, and as per the number of students appeared in Nov'2025 examination, the pass percentage result of the class is 62.06%. Among Fifty eight (58) students, Thirty six (36) students passed in all subjects. The list of top three students is :

Roll No.	Name	CGPA
2551021	Avneet kaur	9.17
2551041	Janvi chawla	8.83
2551052	Parth vijay	8.75

Result Analyst, DCA

HOD, DCA



(Annexure-VI)

 AMRITSAR GROUP OF COLLEGE NAAC Grade "A" 3 rd Cycle Under Autonomous Category	Toppers List Nov-2025 ESE Examination	Department of Computer Applications
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Sr.No	U_Roll No.	Student's Name	Position	SGPA	Course/Sem
1	2551021	Avneet Kaur	1 st	9.17	MCA 1 st sem
2	2411958	Navreen Kaur	1 st	9.07	MCA 3 rd sem
3	2333814	Sarabjeet Singh	1 st	8.83	BCA 5 th sem
4	2333789	Rajni	2 nd	8.70	BCA 5 th sem
5	2333685	Harmanpreet Kaur	3 rd	8.52	BCA 5 th sem
6	2551349	Adivi	1 st	9.10	BCA 1 st sem
7	2551380	Arpit Singh	2 nd	8.45	BCA 1 st sem
8	2551525	Prabhjot Singh	3 rd	8.40	BCA 1 st sem
9	2412296	Mehakdeep Kaur	1 st	9.05	BCA 3 rd sem
10	2412304	Navjot Kaur	2 nd	8.85	BCA 3 rd sem
11	2412274	Komalpreet Kaur	3 rd	8.55	BCA 3 rd sem

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HOD, DCA

AMRITSAR GROUP OF COLLEGES

Autonomous status conferred by UGC under UGC act-1956, (2f), NAAC-A Grade,
(Formerly Known as Amritsar College of Engineering & Technology | Amritsar Pharmacy College)

Catering Request Form

Date: 4/5/2026

Catering Date: 6/5/2026	Breakfast/Afternoon Tea/ Lunch/ Hi-Tea/ Dinner:	
Start Time: 1:00 Pm	End Time: 2:00 Pm	
Total No. of pax attending: 06	No. of Internal pax: 03	No. of External Pax: 03
Event: BOS Meeting	Venue: SWAGTAM	
Name of the Event Coordinator: Sahil Luthra	Department Organizing: DCA	Mob: 8558986286
Email: sluthra423@gmail.com	Name & Contact No. (Supporting Staff):	

Particulars	
Dal Makhani	
Shahi Paneer	
Raita	
Rice	
Salad	
Chapati	
Sweet Dish	
Tea	
Biscuit	Approx Cost: 2600/-

HOD

Sk
4/5/26

Principal

Sk

Request Instructions:

1. The request should be placed at least one day in advance and before 11 am.
2. All the above signatures are mandatory.
3. From the stated number of persons attending only an increase of 5% will be accommodated at the last hour.
4. Please send the above form duly signed to the Department of Hotel Management in either hard or soft format.

Cc: OSD

Sk

Received
Singh
04/05/26

Requisition Form
for Reading Hall 4

Central
Library

Department: DCA

Event: BoS Meeting

Date: 06/5/2026 Time & Duration: 9:30 am to 2:00 Pm

I shall be responsible for overall handling of Reading Hall 4 (Central Library) during the event and shall return it in the same condition (cleaning etc.) any breakage/ mishandling/ lost items will be paid by our department.

Sahil Luthra
Name of the event co-ordinator

Sahil Luthra
Signature

Recommendation

Date: 4/5/2026

Sp
4/5/26
Member Secretary/Organizing Secretary

Allotment

Reading Hall is vacant on the mentioned date so may be allowed.

Sp
In-charge Reading Hall-4
4/5/26

[Signature]
04/05/2026
Head Librarian

Relinquishment

The venue has been returned in the same condition as it was originally allotted, with no signs of mishandling.

Remarks in case of mishandling:

Date: _____

In-charge Reading Hall-4

Amritsar Group of Colleges, Amritsar
NBA & NAAC Accredited

Name Dr. Kamal Nam Sham Designation Asst. Prof. LPU Basic Pay Rs
Purpose of Journey BOS Meeting
Journey From LPU, Jalandhar To AGC, Amritsar
Date of Departure from Resi/AGC 6/5/2026 Time 10:30 am
Date of Arrival at Resi/AGC 6/5/2026 Time of Arrival 2:45 Pm
Total Days of Journey/Visit 01

Daily Allowance for _____ day/s @ Rs. _____ per day Rs

Total km of journey undertaken in own car (if eligible to do so) 87 Km + 87 Km = 174 Km

Total Amount claimed @ Rs 16 per km

Rs 2784/-
PB-08-B50082

Bus / Railway Fare (if journey not undertaken in college conveyance)

A. [UP] From _____ To _____ Rs.
B. [Down] From _____ To _____ Rs.

Honorarium (If any)

Rs. 4000/-

Local Conveyance Toll

Rs

Taxi (attach Slip) Total

Rs

Amount Journey

Rs. 6784/-

Verified [Signature]
6/5/26
(Signatures & Designation)

[Signature]
(Signature)
Dated 6/5/2026

For Accounts Branch

Amount claimed above is as per college rules norms. Payment of Rs.

allowed to be made please

Payment Approved

[Signature]
7/5/26

Registrar

Principal

Name: Kamal Nain Sharma


Bank Name: SBI

Account No: 3028 9676 893

IFSC: SBIN 000 8301

Contact No: 9888 432 109

Branch: SBI, Harbans Nagar, Jalandhar, City

 <p>AMRITSAR GROUP OF COLLEGE</p> <p>NAAC Grade "A" 3rd Cycle Under Autonomous Category</p> <p>Autonomous Status (Since 2011) Govt. of Punjab</p>	<p align="center">Renumeration for External Members (14th Meeting BoS)</p>	<p align="center">Department of Computer Applications</p>
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Ref No: AGC/DCA/2894

Date:06-May-2026

The Registrar(Finance),

AGC, Amritsar

Subject: Renumeration of External Experts for attending 14th BoS meeting in Online mode

Respected Sir,

It is humbly submitted that we conducted 14th meeting of Board of Studies of our department in Hybrid Mode on 06-05-2026. Our two nominated External Experts join us in the meeting. Kindly transfer Rs. 3000/- in their respective accounts as per our college policy. The bank details of the External Experts are shared below for the process of renumeration.

Sno.	Name of the Experts	Designation	Account Details
1.	Dr. Sandeep Sharma	Professor and Head CSE, GNDU, Amritsar	Account No: 04761000087168 IFSC Code: HDFC0000476 Bank Name & Branch: HDFC Bank, Kabir Park, Amritsar
2.	Dr. Neha Sethi	Professor, Hindu College, Amritsar	Account No: 50100665055808. IFSC Code: HDFC0008615 Bank Name & Branch: HDFC Bank, Hindu College Branch, Amritsar

With Regards

Sb
6/5/26

Dr. Sachin Khurana

Head & Chairman Board of Studies

Department of Computer Applications

AGC, Amritsar

Am
7/5/26

Amritsar Group of Colleges, Amritsar
NBA & NAAC Accredited

Name Mr. Gaurav Gupta Honorarium/TA / DA Bill
Designation _____ Basic Pay Rs _____

Purpose of Journey BoS Meeting

Journey From Majitha Road, Amritsar To AGC, Amritsar

Date of Departure from Resi/AGC 6/5/2026 Time 10:00 am

Date of Arrival at Resi/AGC 6/5/2026 Time of Arrival 2:50 pm

Total Days of Journey/Visit 01

Daily Allowance for _____ day/s @ Rs. _____ per day Rs _____

Total kms if journey undertaken in own car (if eligible to do so) 24 Km + 24 Km = 48 Km
PB02 CQS 388

Total Amount claimed @ Rs 16 per km Rs 768/-

Bus / Railway Fare (if journey not under taken in college conveyance)

A. [UP] From _____ To _____ Rs. _____

B. [Down] From _____ To _____ Rs. _____

Honorarium (If any) Rs. 4000/-

Local Conveyance Toll Rs _____

Tax(attach Slip)Total Rs _____

Amount Journey Rs. 4768/-

Verified [Signature]
6/5/26
(Signatures & Designation)

Gaurav Gupta
(Signature)
Dated 6/5/2026

For Accounts Branch

Amount claimed above is as per college rules / norms Payment of Rs. _____ allowed to be made please

Payment Approved
[Signature]
2/5/26

Registered
[Signature]
Principal

Name: Gaurav Gupta

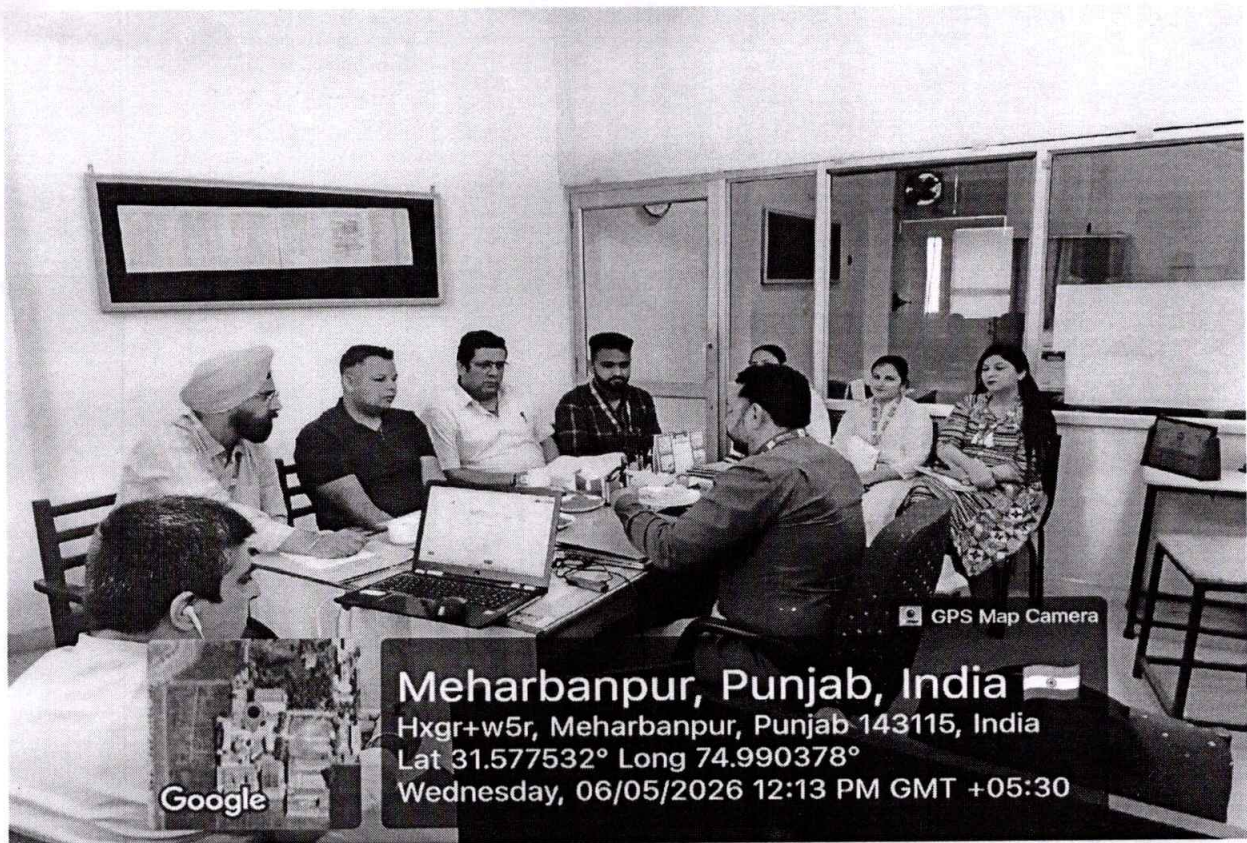
Bank Name: ICICI

Account No: 00660537995

IFSC: ICIC0000066

Contact No: 9780898201

Branch: Mall Road



SP



Meharbanpur, Punjab, India

Hxgr+w5r, Meharbanpur, Punjab 143115, India

Lat 31.57756° Long 74.990374°

Wednesday, 06/05/2026 12:13 PM GMT +05:30

SR

11:41 73%

← 14th Bos Meeting 2026

People Information Tools

Search for someone in this ...

In call

- SAHIL LUTHRA (You)
Meeting host
- SAHIL LUTHRA
Meeting host
- SAHIL LUTHRA (Presenting...)
Meeting host
- Dr. Neha Tejpal
- Dr. Sandeep Sharma

You

11:40 74%

← 14th Bos Meeting 2...

SAHIL is presenting

Handwritten signature

14th Bos Meeting 2026

Meeting host: SAHIL LUTHRA

Item	Value
Meeting ID	1234567890
Meeting Link	https://meet.google.com/1234567890
Meeting Name	14th Bos Meeting 2026
Meeting Type	Video Conference
Meeting Status	Active
Meeting Duration	00:00:00
Meeting Start Time	11:40:00
Meeting End Time	11:40:00
Meeting Location	Virtual Meeting
Meeting Organizer	SAHIL LUTHRA
Meeting Attendees	SAHIL LUTHRA, Dr. Neha Tejpal, Dr. Sandeep Sharma