



VGU/2021-22/5031

Date: 25/09/2021

Minutes of the Joint Meeting of BOF and BOS

Draft Minutes of the 5th Joint Meeting of Board of Studies and Board of Faculty, Faculty of Computer Application, held on 25th Sep, 2021 at 11:00AM in the Board Room of the University at Technology Block.

Following members were present:

1. Dr. Anil Choudhary, Professor, SKIT, - External Member
2. Mr. Sunil Kumar, Academic Manager, NextGen Courses - CIPLE External Member
3. Mr. Sitaram Gupta, HOD, CS
4. Mr. Dushyant Singh, Faculty, Internal Member
5. Mr. Jitender Kumar, Faculty, Internal Member
6. Mr. Sandeep Jain, Inter Disciplinary, Member, VGU

Leave of absence was granted to:

1. Mr. Ripu Daman, Director, Natural Group and Conserve InfoTech, Private Ltd- External Member
2. Prof. R. P. Kashyap, Professor, VGU, Internal Member

Convener welcomed the members of the meeting & thereafter Member discussed the scheme and syllabus of MCA (CTIS) and MCA (AI) program of Computer Science.




VIVEKANANDA GLOBAL UNIVERSITY, JAIPUR

(Established by Act 11/2012 of Rajasthan Govt. Covered U/s 2(f) of UGC Act 1956)
Recognised by UGC, Council of Architecture (COA), Bar Council of India, Pharmacy Council of India (PCI) and
(Provisional Member of AIU)

Following suggestions were given by the committee.

1. There should be a subject of Software Engineering and its Lab in I semester for both the courses.
2. Students should get the knowledge of cloud systems so include a subject of Cloud in I semester.
3. Database has an important impact in our daily life; hence knowledge of basic databases will be given to students.
4. In the present era we all are connected with internet which enables the demand of learning of computer networks.
5. Inclusion of more computer application based subjects should be in the curriculum as this course is based on computer applications.

Thereafter the Meeting Ended with a Vote of Thanks to the Chair.


Prof(Dr.) Baldev Singh
Convener, BOF

25/7/24

Copy to: Chairperson/ Vice Chairperson/CF&AO/President/Registrar/All Deans/Associate Deans/
HODs/Principal, Pharmacy/TPO/Accounts Office/Student Cell/Exam cell/ERP Cell/Office file

Sector - 36, NRI Road, Jagatpura, Jaipur (Raj.) - 303012
Ph.: 0141-2851000; E-mail: info@vgu.ac.in Website: www.vgu.ac.in



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Board of Faculty- Faculty of Computer Application

Attendance Sheet 25, 9, 2021

S.No	Name	Signature
1	Mr. Ripu Daman, Director, Natural Group and Conserve InfoTech, Private Ltd- External Member	
2	Prof. (Dr.) Anil Choudhary, Professor, SKIT, - External Member	
3	Mr. Sunil Kumar, Academic Manager, NextGen Courses - CTPL External Member	
4	Prof. R. P. Kashyap, Professor, VGU, Internal Member	
5	Mr. Sitaram Gupta, HOD, CS	
6	Mr. Dushyant Singh, Faculty, Internal Member	
7	Mr. Jitender Kumar, Faculty, Internal Member	
8	Mr. Sandeep Jain, Inter Disciplinary, Member, VGU	

Prof. (Dr.) Baldev Singh
Dean Engg. & Convener



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VGU/2021-22/5005

Date: 21/09/2021

Notice

To all members "Board of Faculty and Board of Studies"

The 5th joint meeting of the Board of Studies (BOS) and Board of Faculty (BOF) of the Faculty of Computer Application will be held at 11:00 am on 25th, Sep, 2021 in Board room of Technology Block. Following are the Agenda points of Meeting.


Item No.5.1-To review the New teaching scheme and syllabi of MCA(AI) and MCA(CT&IS) Program

Item No.5.2 - Approval of the Paper setter panel for MCA(AI) and MCA(CT&IS) Program.

Item No.5.3- Any other item with the permission of the Chair.

You are requested to kindly make it convenient to attend the said meeting of the Board of Studies and Board of faculty.

Kind Regards


21/9/21.
Prof. (Dr.) Baldev Singh
Dean & Convener BOF

Copy to:-

1. Mr. Ripu Daman, Director, Natural Group and Conserve Info Tech Private Ltd- External Member
2. Dr. Anil Choudhary, Professor, SKIT, - External Member
3. Mr. Sunil Kumar, Academic Manager, NextGen Courses - CTPL External Member
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VIVEKANANDA GLOBAL UNIVERSITY

(Established by Rajasthan State Legislature and covered u/s 2(f) of the UGC Act, 1956)

FACULTY OF COMPUTER SCIENCE & APPLICATION

Scheme & Syllabus

for

Bachelor of Computer Application

Total Credit of the Program

Sem	I	II	III	IV	V	VI	Total
Credits	22	24	23	21	27	20	137



Session 2021-22



Approved Scheme and Syllabus of programme

Bachelor of Computer Application

Under Faculty of

COMPUTER SCIENCE & APPLICATION

For session

2021-22

.....
Convener BOS/HoD

.....
Convener BOF/Dean Faculty

.....
President (VGU)



PROGRAM OUTCOMES

1. **Computational Knowledge:** Understand and Apply the knowledge of mathematics, science, computing fundamentals, and domain knowledge for the conceptualization of computing models from defined problems.
2. **Problem analysis:** Identify, formulate, and critically analyze and formulate complex computing problems using fundamentals of computer science and application domains.
3. **Design/development of solutions:** Design solutions to complex business scenarios and investigate, understand and propose integrated solutions using emerging technologies.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern science and IT tools necessary for modeling complex computer science domain activities.
6. **Professional Ethics:** apply and commit professional ethics and cyber regulations in a global economic environment
7. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
8. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
9. **Communication:** Communicate effectively on complex computer science activities with the science & application community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
10. **Environment and sustainability:** Understand the impact of the professional science and application solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
11. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
12. **Innovation and Entrepreneurship:** Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

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PROGRAM SPECIFIC OUTCOMES

PSO1: Explore technical comprehension in varied areas of Computer Applications and experience a conducive environment in cultivating skills for thriving career and higher studies.

PSO2: Comprehend, explore and build up computer programs in the allied areas like Algorithms, System Software, Multimedia, Web Design and Data Analytics for efficient design of computer-based systems of varying complexity.

PSO 3: The ability to employ modern computer languages, environments, and platforms to build Project Development Skills & innovative career paths by understanding the structure and development methodologies of software systems

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Evaluation Scheme

Evaluation Component	Weightage to be given	Exam Duration
Theory Paper		
Mid Term 1	10 %	1.5 Hrs
Mid Term 2	10 %	1.5 Hrs
Session Components A1, A2, A3, A4, A5, Q1, Q2, Q3 (Average from each unit 1-5 out of 5% of each as Quiz Assignment, Seminars, Presentations, Attendance, Case study, Surprise class test, Lab record, Viva, Projects, and Observation	8 x 2.5 % = 20 %	
End Term Exam	60 %	3 Hrs
Practical Paper		
Mid Term 1	15 %	1.5 Hrs
Mid Term 2	15 %	1.5 Hrs
Assignments, Projects, and other 8 components	8x 3.75 % = 30	-
End Term Practical Exam	40%	3 Hrs

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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Common for Specialization CTIS and AI)****Semester I**

S. No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI101	ENG	English-I	3	0	0	3	3
2	BCAI102	BS	Theory of Mathematics	3	0	0	3	3
3	BCAI103	PC	Computer Architecture & Organization	3	0	0	3	3
4	BCAI104	PC	Programming in C	3	0	0	3	3
5	BCAI105	PC	Client Side scripting	3	0	0	3	3
6	BCAI106	PC	Office Automation Lab	0	0	4	4	2
7	BCAI107	PC	Programming in C Lab	0	0	2	2	1
8	BCAI108	PC	Client Side scripting Lab	0	0	4	4	2
9	BCAI109	HSM	Effective Communication Skills	0	0	4	4	2
TOTAL				15	0	14	29	22



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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Common for Specialization CTIS and AI)****Semester II**

S.No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI201	ENG	English-II	3	0	0	3	3
2	BCAI202	PC	Linux Shell Scripting	3	0	0	3	3
3	BCAI203	PC	Object Oriented Programming Using Java	2	0	0	2	2
4	BCAI204	PC	Operating Systems	3	0	0	3	3
5	BCAI205	PC	Data Structures using C	3	0	0	3	3
6	BCAI206	BS	Environmental Studies	3	0	0	3	3
7	BCAI207	PC	Data Structures using C Lab	0	0	4	4	2
8	BCAI208	PC	Linux Shell Scripting Lab	0	0	2	2	1
9	BCAI209	PC	Object Oriented Programming Using Java Lab	0	0	4	4	2
10	BCAI210	HSM	Personality Development	0	0	4	4	2
TOTAL				17	0	14	31	24



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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Cloud Technology and Information Security)****Semester III**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI301	PC	DBMS	3	0	0	3	3
2	BCAI302	PC	Computer Networks	3	0	0	3	3
3	BCAICT301	PC	Information Security	3	0	0	3	3
4	BCAICT302	PC	Principles of Virtualization	2	0	0	2	2
5	BCAICT303	PC	Cloud Computing	3	0	0	3	3
6		PE	Elective-I	3	0	0	3	3
7	BCAI303	PC	DBMS Lab	0	0	4	4	2
8	BCAICT306	PC	Principles of Virtualization Lab	0	0	2	2	1
9	BCAI304	HSM	Business communication and Presentation Skills	0	0	4	4	2
10	BCAI305	ST	Summer Project Seminar I	0	0	2	2	1
TOTAL				17	0	12	29	23

Course Code	Program Elective I
BCAICT 304	Server Administration
BCAICT 305	Linux Administration



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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Cloud Technology and Information Security)****Semester IV**

S.No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P		
1	BCAICT401	PC	Storage and Datacenter	3	0	0	3	3
2	BCAI401	PC	Python Programming	3	0	0	3	3
3	BCAICT402	PC	Cloud Web services	3	0	0	3	3
4	BCAICT403	PC	Ethical Hacking	3	0	0	3	3
5		PE	Elective-II	3	0	0	3	3
6	BCAICT406	PC	Ethical Hacking Lab	0	0	4	4	2
7	BCAI402	PC	Python Programming Lab	0	0	2	2	1
8	BCAICT407	PC	Cloud Web Services Lab	0	0	2	2	1
9	BCAI403	HSM	Logical Reasoning and Thinking	0	0	4	4	2
TOTAL				15	0	12	27	21

Course Code	Program Elective-II
BCAICT404	Network Security
BCAICT405	Database security fundamentals



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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Cloud Technology and Information Security)****Semester V**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAICT501	PC	Digital Forensics and Investigation	3	0	0	3	3
2	BCAICT502	PC	Cloud Migration	3	0	0	3	3
3		PE	Elective -III	3	0	0	3	3
4		PE	Elective - IV	3	0	0	3	3
5		PE	Elective -V	3	0	0	3	3
6		GE	Generic Elective – I	3	0	0	3	3
7	BCAICT511	PC	Digital Forensics and Investigation Lab	0	0	2	2	1
8		PE	Elective – III Lab	0	0	2	2	1
9	BCAI501	PR	Mini Project	0	0	8	8	4
10	BCAI502	HSM	Working Towards Placements	0	0	4	4	2
11	BCAI503	ST	Summer Project Seminar II	0	0	2	2	1
TOTAL				18	0	18	36	27

COURSE CODE	Program Elective-III
BCAICT503	PowerShell Scripting
BCAICT504	Infrastructure Automation

COURSE CODE	Program Elective-IV
BCAICT505	Cloud Security
BCAICT506	Application and Web Security

COURSE CODE	Generic-Elective-I
BCAICT509	Introduction to IoT
BCAICT510	Business Intelligence

COURSE CODE	Program Elective-III Lab
BCAICT512	PowerShell Scripting Lab
BCAICT513	Infrastructure Automation Lab

COURSE CODE	Program Elective-V
BCAICT507	IT Governance, Risk, & Information Security Management
BCAICT508	Infrastructure Solutions on Cloud



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TEACHING AND EXAMINATION SCHEME FOR

Bachelor of Computer Application

(Specialization in Cloud Technology and Information Security)

Semester VI

S.No .	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI601	ST	Major Project / Internship	-	-	40	40	20
TOTAL				-	-	40	40	20



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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Artificial Intelligence)****Semester III**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINT
				L*	T*	P*		
1	BCAI301	PC	DBMS	3	0	0	3	3
2	BCAI302	PC	Computer Networks	3	0	0	3	3
3	BCAI401	PC	Python Programming	3	0	0	3	3
4	BCAIIPA301	PC	Statistics and Probability	3	1	0	4	4
5	BCAIIPA302	PC	Digital Electronics	3	0	0	3	3
6		PE	Elective-I	3	0	0	3	3
7	BCAI303	PC	DBMS Lab	0	0	4	4	2
8	BCAI402	PC	Python Programming Lab	0	0	2	2	1
9	BCAI304	HSM	Business communication and Presentation Skills	0	0	4	4	2
10	BCAI305	ST	Summer Project Seminar I	0	0	2	2	1
TOTAL				18	1	12	31	25

Course Code	Program Elective-I
BCAIIPA303	Data Visualization
BCAIIPA304	Business Intelligence



TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Artificial Intelligence)****Semester IV**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAIIPA401	PC	Introduction to RPA Tools	3	0	0	3	3
2	BCAIIPA402	PC	Introduction to Intelligent Process Automation	3	0	0	3	3
3	BCAIIPA403	PC	Sensor Technology	3	0	0	3	3
4	BCAIIPA404	HSM	Business Process Management	3	0	0	3	3
5		PE	Elective-II	3	0	0	3	3
6	BCAIIPA407	PC	Introduction to Intelligent Process Automation Lab	0	0	4	4	2
7	BCAIIPA408	PC	Introduction to RPA Tools Lab	0	0	4	4	2
8	BCAI403	PC	Logical Reasoning and Thinking	0	0	4	4	2
TOTAL				15	0	12	27	21

Course Code	Program Elective – II
BCAIIPA405	Introduction to Data Science
BCAIIPA406	Pattern Recognition



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TEACHING AND EXAMINATION SCHEME FOR Bachelor of Computer Application

(Specialization in Artificial Intelligence)

Semester V

S. No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAIIPA501	HSM	Six Sigma and Lean Methods	3	0	0	3	3
2	BCAIIPA502	PC	Digital Image Processing	2	0	0	2	2
3		PE	Elective-III	2	0	0	2	2
4		PE	Elective-IV	3	0	0	3	3
5		PE	Elective-V	3	0	0	3	3
6		GE	Generic Elective-I	3	0	0	3	3
7	BCAIIPA511	PC	Digital Image Processing Lab	0	0	2	2	1
8		PE	Elective-III Lab	0	0	2	2	1
9	BCAI501	PR	Mini Project	0	0	8	8	4
10	BCAI502	HSM	Working Towards Placements	0	0	4	4	2
11	BCAI503	ST	Summer Project Seminar II	0	0	2	2	1
TOTAL				16	0	18	34	25

Course Code	Program Elective-III
BCAIIPA503	Test Automation using Selenium
BCAIIPA504	Software Testing

Course Code	Program Elective-IV
BCAIIPA505	Introduction to web Services
BCAIIPA506	Digital Signal Processing

Course Code	Program Elective-V
BCAIIPA507	Embedded Systems
BCAIIPA508	Design Thinking

Course Code	Program Elective-III Lab
BCAIIPA512	Test Automation using Selenium Lab
BCAIIPA513	Software Testing Lab

Course Code	Generic Elective-I
BCAIIPA509	Introduction to IoT
BCAIIPA510	Cloud Computing



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TEACHING AND EXAMINATION SCHEME FOR

Bachelor of Computer Application

(Specialization in Artificial Intelligence)

Semester VI

S.No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI601	ST	Major Project / Internship	-	-	40	40	20
TOTAL				-	-	40	40	20



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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Common for Specialization CTIS and AI)****Semester I**

S. No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI101	ENG	English-I	3	0	0	3	3
2	BCAI102	BS	Theory of Mathematics	3	0	0	3	3
3	BCAI103	PC	Computer Architecture & Organization	3	0	0	3	3
4	BCAI104	PC	Programming in C	3	0	0	3	3
5	BCAI105	PC	Client Side scripting	3	0	0	3	3
6	BCAI106	PC	Office Automation Lab	0	0	4	4	2
7	BCAI107	PC	Programming in C Lab	0	0	2	2	1
8	BCAI108	PC	Client Side scripting Lab	0	0	4	4	2
9	BCAI109	HSM	Effective Communication Skills	0	0	4	4	2
TOTAL				15	0	14	29	22



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First Semester

Core Theory Subjects

Code: BCA1101

English-I

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To train students to be comfortable with everyday communication. Training the students in English grammar.

COURSE OUTCOME: The student would be able:

- To comprehend and summarize various structural principles of English Grammar, prerequisite to English Communication.
- To evaluate and apply the acquired learning of remedial Grammar for self-expression and diverse communication purposes.
- To identify and analyze the nuances of English Language prerequisite to Scientific and Technical Writing.
- To apply appropriate Language skills for developing scientific and technical content using academic and experimental approaches.
- To comprehend and analyze receptive & productive skills based on various task-based and machine based activities.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Everyday Conversations	10
2.	Asking for	8
3.	Reporting/ Describing	9
4.	Meeting People	7
5.	Expressing	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Everyday Conversations <ul style="list-style-type: none"> Introducing self / others Weather Classroom Asking about facilities around Describing a person / thing <p>Points to cover: Vocabulary, grammar, Construction of sentences, listening</p> <p>Methodology: Role plays, Videos, Classroom conversation, worksheets</p>

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2.	Asking for
	<ul style="list-style-type: none"> • Help/ Suggestion/ ideas • Clarification/ Directions • Time/ food • Advice • Uses • Conclusion of Unit <p>Points to cover: Vocabulary, grammar, Construction of sentences, listening. Methodology: Role plays, Videos, Classroom conversation, worksheets.</p>
3.	Reporting/ Describing
	<ul style="list-style-type: none"> • Incidences • Personalities • Experiences • Wants/Needs • Intentions <p>Points to cover: Vocabulary, grammar, Construction of sentences, listening Methodology: Role plays, Videos, Classroom conversation, worksheets</p>
4.	Meeting People
	<ul style="list-style-type: none"> • Greetings • Starting the Conversation • Small talks • Closing the conversation <p>Points to cover: Vocabulary, grammar, Construction of sentences, listening Methodology: Role plays, Videos, Classroom conversation, worksheets</p>
5.	Expressing
	<ul style="list-style-type: none"> • Happiness/Displeasure • Preferences • Doubts, Views, Unawareness, Interests • Different Cultures, Clothes , cars, institutes, situations, Schedules, prices <p>Points to cover: Vocabulary, grammar, Construction of sentences, listening Methodology: Role plays, Videos, Classroom conversation, worksheets</p>




Sr. N	Reference Books	Author	Edition	Publication
1.	Speak Now Level I & II	Jack C Richards & David	Latest	Office Press
2.	Business Benchmark Level – Upper Intermediate	Cambridge University Press	Latest	Cambridge University Press
3.	Practical English Usage	Michel Swan	Latest	Oxford University
4.	Cambridge Grammar for English: A comprehensive Guide for spoken & written English (South Edition)	Beiser	South Asian edition	Cambridge University Press

CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	3	3	1	3	2	2	2
CO2	—	—	—	—	—	2	3	1	3	1	1	—
CO3	—	—	—	—	—	—	—	—	3	—	—	—
CO4	—	—	—	3	—	—	—	—	—	—	—	—
CO5	2	2	2	2	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCA1102

Theory of Mathematics

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To develop the skills in the areas of Matrices, Sets, relations and functions, Differentiation and Integration.
- Mathematics concepts serves as a pre-requisite for post graduate courses, specialized studies and research.

COURSE OUTCOME: After completion of the course the student will be able:

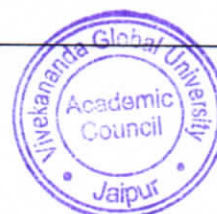
- To know and define the use of basic concepts of Matrices.
- To apply the concept of set relation and functions in functions.
- To know the methods and rules of calculus.
- To understand the basics 2D Cartesian Co-ordinate system, Straight line.
- To know the basics of statistics and probability for computer science.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Sets, relations and functions	10
2.	Matrices and Determinants	6
3.	Limits, Continuity & Differentiation	10
4.	Coordinate Geometry	7
5.	Statistics and Probability	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Sets, relations and functions
	<ul style="list-style-type: none"> • Definition of Set, Type of Sets, • Operations on Sets, • Venn diagram, • Cartesian Product, • Relations, • Functions, • Types of function, • Some elementary functions with their graphs (Exponential, logarithmic, modulus), • Limit & continuity of a function (Simple Problems).



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2.	Matrices and Determinants
	<ul style="list-style-type: none"> • Types of Matrices, • Operations of addition, • Scalar Multiplication and Multiplication of Matrices, • Determinant of a Square Matrix, • Minors and Cofactors, • Transpose, • adjoint and inverse of a matrix, • solving system of linear equations, in two or three variables using inverse of a matrix.
3.	Limits, Continuity and Differentiation
	<ul style="list-style-type: none"> • Limit at a Point, Properties of Limit, • Computation of Limits of Various Types of Functions, • Continuity at a Point, Continuity Over an Interval, • Intermediate Value Theorem, • Type of Discontinuities. • Derivative, • Derivatives of Sum, • Differences, Product & Quotients, • Chain Rule, Derivatives of Composite Functions
4.	Coordinate Geometry
	<ul style="list-style-type: none"> • 2D Cartesian Co-ordinate system, • Straight line: (Equation & Slope of a line), • Circle: Equation of Circle, • Equation to Tangent, • Conic Sections: Focus, • Eccentricity, • Directrix, Axis of a conic section, • Parabola & Ellipse: (Definitions, equations and shape of curve only)
5.	Statistics and Probability
	<ul style="list-style-type: none"> • Introduction, • Definition, • Terminologies in statistics and probability, • Measure of central tendency and dispersion, • Probability distribution – continuous and discrete, • Bayes theorem, • Testing of hypothesis, • Basics of ANOVA, • Correlation and Regression Analysis.

Sub



Sr. N	Reference Books	Author	Edition	Publication
1.	Mathematics for BCA	G. C. Sharma & Madhu Jain	Latest	Oscar Publication
2.	Mathematics Vol-2	R. D. Sharma	Latest	Dhalpat Raj & Sons
3.	The Elements of Co-ordinate Geometry Part-I	S. L. Loney	Latest	Book Palace

CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	2	3	2	3	3	—	—	—	—	—	—	—
CO2	3	2	3	2	2	—	—	—	—	—	—	—
CO3	3	3	2	3	3	—	—	—	—	—	—	—
CO4	1	2	1	1	2	—	—	—	—	—	—	—
CO5	2	1	2	1	1	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	1	3	1
CO-2	—	—	—
CO-3	1	3	1
CO-4	—	—	—
CO-5	1	3	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Code: BCA1103

Computer Architecture & Organization 3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the fundamentals of computer organization and architecture and to relate these to contemporary design issues. Understanding the performance characteristics of computer system.

COURSE OUTCOME: After completion of the course the student will be able to:

- Explain the use of basic concepts of Computer components.
- Discuss the Register Transfer and different Micro-operations
- Illustrate the flowchart for Instruction cycle
- Describe the function of Control Unit and Central Processing Unit
- Explain the characteristics of multi-processors and discuss the modes of Data transfer and Memory organization

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Register Transfer and Micro-Operation	9
2.	Basic Computer Organization	9
3.	Micro Programmed Control Unit	9
4.	Computer Arithmetic	9
5.	Modes of Data Transfer and Memory Organization	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Register Transfer and Micro-operation
	<ul style="list-style-type: none"> Register Transfer Language, Register Transfer, Bus and Memory Transfer: Three state bus buffers, Memory Transfer. Arithmetic Micro-operations: Binary Adder, Binary Adder-Subtractor, Binary Incrementor, Logic Micro-operations: List of Logic micro operations, Shift Micro-operations (excluding H/W implementation), Arithmetic Logic Shift Unit.

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2.	Basic Computer Organization
	<ul style="list-style-type: none"> • Instruction Codes, • Computer Registers: Common bus system, • Computer Instructions: Instruction formats, • Instruction Cycle: Fetch and Decode, • Flowchart for Instruction cycle, • Register reference instructions.
3.	Micro Programmed Control Unit
	<ul style="list-style-type: none"> • Control Memory • Address Sequencing • Conditional branching • Mapping of instruction • Subroutines • Design of Control Unit • Central Processing Unit: Introduction • General Register Organization • Stack Organization: Register stack • Memory stack; Instruction Formats • Addressing Modes.
4.	Coordinate Geometry
	<ul style="list-style-type: none"> • Introduction, • Addition and Subtraction, • Multiplication Algorithms (Booth algorithm), • Division Algorithms, • Input – Output Organization: Peripheral devices, • Input – Output interface, • Introduction of Multiprocessors: Characteristics of multi-processors.
5.	Modes of Data Transfer and Memory Organization
	<ul style="list-style-type: none"> • Modes of Data Transfer: Priority Interrupt • Direct Memory Access • Memory Organization: Memory Hierarchy • Main Memory • Auxiliary Memory • Associative Memory • Cache Memory • Virtual Memory




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Sr. N	Reference Books	Author	Edition	Publication
1	Computer System Architecture	Morris Mano	Latest	PHI
2	Computer Organization and Architecture	William Stallings	Latest	PHI
3	Digital Computer Electronics: An Introduction to Microcomputers	Malvino	Latest	TMH
4	PC Hardware in a Nutshell	Barbara Fritchman Thompson, Robert Bruce Thompson,	2 nd Edition	O'Reilly
5	Fundamentals of Computer Organization and Architecture	Mostafa AB-EL-BARR and Hesham EL-REWNI	Latest	John Wiley and Sons

CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	—	—	—	—	—	1	—	1	—	—	—
CO2	2	—	—	—	—	—	1	—	1	—	—	—
CO3	1	3	—	—	—	—	1	—	1	—	—	—
CO4	3	—	—	—	—	—	1	—	1	—	—	—
CO5	2	—	—	—	—	—	1	—	1	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	—	—
CO-2	2	—	—
CO-3	—	3	—
CO-4	2	—	—
CO-5	—	2	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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Code: BCA1104

Programming in C

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- Even with the introduction of several high level languages and frameworks, the development of procedural codes is important in several commercial app developments.
- The object oriented platforms and event driven systems use procedural languages for coding integral command content. C is an important procedural language and was developed initially to write the UNIX operating system.
- UNIX operating system, C compiler and all UNIX application programs are written in C. C is popular because, it is easy to learn, produces efficient programs, can handle low-level activities, and can be compiled on a variety of platforms.
- This course focuses on all the basic concepts, syntax and constructs of the C language. For students, who are new to programming, this unit can be considered as the starting point before taking up any other programming oriented units.
- The students will be implementing the concepts explained here to create simple to complex programs.

COURSE OUTCOME: After completion of the course the student will be able:

- To be able to design, implement, test, debug and document programs in C.
- To be able to use functions, and functions with parameters passing option.
- To be able to use pointers and arrays, perform pointer arithmetic.
- To be able to understand the advance topics in C like file handling functions and the concept of Standard C library.
- To be able to learn the concept of C preprocessor and its application in program development.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Programming	10
2.	Fundamentals of C programming	8
3.	Arrays and Functions	8
4.	Storage Classes, Structures, Unions and Pointers	8
5.	Files, Preprocessor, standard library and header files	8



B. DETAILED SYLLABUS

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Unit	Unit Details
1.	Introduction to Programming
	<ul style="list-style-type: none"> • Problem Solving Using Computers: Language Classification, • Problem Analysis, • Algorithm and Flowchart design. • Algorithms: Steps in developing algorithms, advantages and disadvantages. • Flowcharts: Symbols used in developing flowcharts, advantages and disadvantages. • Coding, testing, debugging, • Documentation and maintenance. • Program development and modular design.
2.	Fundamentals of C programming and Control Structures
	<ul style="list-style-type: none"> • History, Structure of a C program, C Conventions, Character Set, Identifiers, Keywords, Simple Data types, Modifiers, Variables, Constants, • Operators (Arithmetic operator, relational operator, logical operator, ternary operator, unary operator, shorthand operator, bit-wise operator and arithmetic operator) Operator precedence. • Input and Output operation: Single character input and output, formatted input and output, Buffered input. • Control Structures: Introduction, Conditional statement, if statement, if-else statement, nested if statement, else-if statement and switch statement. • Goto statement. Looping statement, while statement, do-while statement, for statement, break and continue, nested for statement
3.	Arrays and Functions
	<ul style="list-style-type: none"> • Arrays: Introduction (One and multi-dimensional), Declaration of arrays, Initialization of arrays, processing with arrays. String manipulation, declaration of string arrays, string operations. • Functions: Introduction, advantages of subprograms, Function definition, function call, Actual and formal arguments, local and global variables, function prototypes, types of functions, recursive functions, arrays and functions.
4.	Storage Classes, Structures, Unions and Pointers
	<ul style="list-style-type: none"> • Storage Classes, Structures and Unions: Introduction, types of storage classes, Introduction to structures, Advantages of structures, accessing elements of a structure, nested structures, array of structures, functions and structures, Unions, bit-fields, enumerated data types. • Pointers: Introduction, pointer variable, pointer operator, pointer arithmetic, pointers and arrays, pointers and strings, array pointers, dynamic allocation

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5.	Files, Preprocessor, standard library and header files
	<ul style="list-style-type: none"> Files: Introduction, File data type, opening and closing a file, file functions (getc, putc, getw, putw, fscanf, fprintf, fread, fwrite, fgets, fputs, feof). Preprocessor: #define, #include, #undef, Conditional compilation directives, C standard library and header files: Header files, string functions, mathematical functions, Date and Time functions

Sr. N	Reference Books	Author	Edition	Publication
1.	A Structured Programming Approach using C	Forouzon A Behrouz, Gilberg F Richard	3rd	BPB Publication
2.	"Let Us C"	Kanetkar, Yashavant	6th	BPB Publication
3.	"Programming in ANSI C"	Balagurusamy, E	3rd	Tata McGraw-Hill
4.	The C programming Language	Richie and Kernighan	Latest	BPB Publication
5.	"Programming with C"	Gottfried, Byron S	Latest	Tata McGraw-Hill
6.	"C How to Program"	Deitel, H M and Deitel P J	2nd	Prentice-Hall

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

Code: BCA1105

Client Side Scripting

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To introduce students to web technologies such as HTML, CSS, XML, Java Script teach them to create static and simple dynamic web pages or applications using these technologies and to understand web application deployment and software architectures.
- Students will learn basic web application design, development and testing skills.
- On completion of this course the learner should be able to design and implement a variety of dynamic Website

COURSE OUTCOME: Students will gain the knowledge and skills required to develop Simple Web Applications. They should be able to:

- Explain basic Client-Server web architecture.
- Understand working of web protocols like HTTP, TCP/IP, DNS as well as IP and web address resolution schemes such as URIs/URLs and DNS.
- Use and recognize commonly used HTTP request and response messages
- Differentiate and create both static and dynamic web applications
- Understand and use HTML/CSS and XML; Student will be able to create static web pages using HTML & CSS & Java Script; Student will be able to understand and use PHP for server side scripting

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to the Internet and the World Wide Web	10
2.	HTML, CSS & JavaScript and Control Structures	10
3.	XML and HTML5, CSS3	7
4.	Practical website development	8
5.	PHP Server side scripting	7



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B. DETAILED SYLLABUS

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Unit	Unit Details
1.	Introduction to the Internet and the World Wide Web
	<ul style="list-style-type: none"> • Introduction, History of internet, Internet Design Principles, Internet Protocols - FTP, TCP/IP, SMTP, Telnet, etc., Client Server Communication, Web System architecture • Evolution of the Web, Web architectures, Web clients and servers, Static and Dynamic Web Applications, • Front end and back end web development. HTML, CSS, JS, XML; HTTP, secure
2.	HTML, CSS & JavaScript
	<ul style="list-style-type: none"> • Introduction to Html, Html Document structure, Html Editors, Html element/tag & attributes, Designing simple page - Html tag, Head tag, Body tag; • More Html tags - Anchor tag, Image tag, Table tag, List tag, Frame tag, Div tag ; Html forms - Input type, Text area, Select , Button, Images. • Introduction to CSS, Syntax, Selectors ,Embedding CSS to Html, Formatting fonts, Text & background colour, Inline styles, External and Internal Style Sheets, Borders & boxing. • Introduction to JavaScript: Data types, variables, operators, expressions, statements, functions, objects, arrays, date, math, error handling, flow control, loops
3.	XML and HTML5, CSS3
	<ul style="list-style-type: none"> • Introduction to XML, Difference b/w Html & XML, XML editors, XML Elements & Attributes XML DTD, XML Schema, XML Parser, Document Object Model (DOM), XML DOM. • Introduction to HTML5, CSS3, New features, Local storage, Web Sockets, Server events, Canvas, Audio & Video, Geolocation, Microdata, Drag and Drop. Browser life cycle and browser rendering stages. Service workers.
4.	Practical website development
	<ul style="list-style-type: none"> • Commonly used Web Servers and browsers, Setting up a server and domain name, • website types and structures, web authoring tools, • Web hosting, website maintenance, generating traffic to your website.
5.	PHP Server side scripting
	<ul style="list-style-type: none"> • Introduction to PHP, Basic Syntax, Variables, constants and operators, Loops, Arrays and Strings, Environment & environment variables, responding to HTTP requests, Files, Cookies, Sessions, Examples.




Sr. N	Reference Books	Author	Edition	Publication
1	Practical Web Design for Absolute Beginners	Adrian W. West.	2016	Apress
2	Introducing Web Development	Jorg Krause	2017	Apress
3	HTML & CSS: The Complete Reference	Thomas Powell	5th	McGraw Hill
4	Creating a Website: The Missing Manual	Mathew Macdonald	3rd	O'Reilly
5	HTML, XHTML & CSS Bible	Brian Pfaffenberger, Steven M. Schafer, Charles White, Bill Karow	Latest	Wiley Publishing Inc
6	HTML5 & CSS3 for the Real World	Alexis Goldstein, Estelle Weyl, Louis Lazaris	2nd	Apress

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	2	—	—	—	3	—	—	—	2	1	1	—
CO2	3	—	—	—	2	—	—	—	2	1	1	—
CO3	3	—	—	—	2	—	—	—	2	2	—	—
CO4	2	3	—	—	3	—	—	—	2	1	1	—
CO5	3	—	3	—	2	—	—	—	3	2	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	—	3
CO-2	—	—	—
CO-3	2	—	2
CO-4	2	—	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

APPROVED

First Semester

Practical Subjects

Code: BCA1106

Office Automation Lab

2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- To introduce students practical knowledge of MS word, prepare documents, reports, bio-data etc. and practical knowledge to apply mathematical formula in Excel sheets.
- To introduce practical knowledge to use MS-powerpoint and prepare presentations, using proper images and formatting.

COURSE OUTCOME: After completion of this course the students will be able to:

- Acquire practical knowledge to use MS word, prepare documents, reports, bio-data etc.
- Acquire practical knowledge to prepare and use MS-Excel sheets.
- Acquire practical knowledge to apply mathematical formula in Excel sheets.
- Acquire practical knowledge to use MS-powerpoint and prepare presentations, using proper images and formatting.
- Acquire practical knowledge to install Operating system and Basic Software.

A. List of Experiments

Experiments

1. Installing Operating Systems and Basic Software
2. MS Word
 - i) Prepare a document about any tourist destination of your choice with appropriate pictures and editing features.
 - ii) Prepare a News Paper Layout. Insert appropriate pictures wherever necessary. Use the following Features:
 - iii) Three Column and Four Column setting
 - iv) Set One or Two Advertisements
 - v) Use Bullets and Numbering.
 - vi) Create a Document consisting of Bio-data. It includes
 - vii) A table giving your qualification and/or experience of work. Table should be Bordered and Shaded.
 - viii) A Multilevel list giving your areas of interest and further areas of interest. The sub areas should be numbered as
 - ix) 'a', 'b', etc while the areas should be numbered as '1', '2', etc.
 - x) The information should be divided in "General" and "Academic" sections.
 - xi) The header should contain "BIO-DATA" while the footer should have page numbers in the format Page 1 of 10.
 - xii) Assign a password for the document to protect it from unauthorized access.

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B. DETAILED SYLLABUS

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Experiments

- xiii) Assume that you are coordinating a seminar in your organization. Write a letter to 10 different IT companies asking them to participate in the seminar using mail merge facility.
- xiv) Prepare a document about any tourist destination of your choice with appropriate pictures and editing features.
- xv) Prepare a document which contains template of marks card of students. Assume that there are 10 students. The footer for the document should be ' University Name '.
- xvi) Prepare a document about any topic In mathematics which uses mathematical symbols. (At least 5 mathematical symbols should be used). Assign a password for the document to protect it from unauthorized access. Demonstrate the use of Hyperlink Option. Sets margins to your document, a font of size and double spaced document.

3. MS – Excel

- (i) Open a new workbook, save it as JavaCoffeeBar.xls. In sheet1 write following sales data for Java Coffee bar to show their first 6 months sales.
- (ii) Select cell B4:D4 and change the horizontal alignment to center and text to 90 degree.
- (iii) All titles should be in bold
- (iv) Format all cells numbers to currency style and adjust width as necessary.
- (v) Add border to data.
 - a. Select the cell range A1:H1, merge and center these cells. Apply same format to A2:H2, Give border, shading and pattern to data in sheet
 - b. Apply different font settings for all titles in sheet
 - c. Apply green color and bold setting to sales above 10000 (use conditional formatting), Rename current worksheet as FirstHalfSales
- (vi) Prepare a worksheet to maintain student information. The work sheet should Contain Roll Number, Name and marks in 5 subjects. (Max Marks is 100). Validate the marks. Calculate the total marks. Assign the grade according to the following. Assign grade 'A' if the total marks is above 450. From 401 to 449 assign the grade as 'B'. From 351 to 400 assign the Grade as 'C'. From 300 to 350 the grade to be assigned is 'D'. For the total marks less than 300 No grade is assigned. A student is eligible to get a grade only when he gets 40 and above in all the subjects. In such cases the grade is "FAIL". (Assume that there are 10 students).
- (vii) Prepare a pay-bill using a worksheet. The work sheet should contain Employee Id, Name, Designation, Experience and Basic Salary and Job ID. If Job Id is 1 then DA is 40% of the basic salary. HRA is Rs. 4500. If Job Id is 2 then DA is 35% of the basic salary. HRA is Rs. 3500. If Job Id is 3 then DA is 30% of the basic salary. HRA is Rs. 2500. If Job Id is 4 then DA is 25% of the basic salary and HRA is RS.2500. For all the other Job ids DA is 20% of the basic salary and HRA is Rs. 1500. For all the above Job ids PF to be deducted is 4%. For the job ids between 1-4Rs. 100 to be deducted as Professional Tax. Find the net pay.

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Experiments

- (viii) For the above employee worksheet perform the following operations
 - a. Use filter to display the details of employees whose salary is greater than 10,000.
 - b. Sort the employees on the basis of their net pay
 - c. Use advance filter to display the details of employees whose designation is "Programmer" and Net Pay is greater than 20,000 with experience greater than 2 yrs
- (ix) Using Excel project the Product sales for any five products for five years.
 - a. Compute the total sales of each product in the five years.
 - b. Compute the total sales of all the products in five year.
 - c. Compute the total sales of all products for each year.
 - d. Represent annual sale of all the products using Pie-Chart.
 - e. Represent annual sales of all products using Bar Chart.
 - f. Represent sale of a product for five years using Pie-Chart.
 - g. Label and format the graphs
- (x) Create a statement of Telephone Bill Charge for a customer.
 - a. Telephone Calls
 - b. Up to 150 calls- free
 - c. 151 to 500 calls- 0.80 per call
 - d. 501 to 1000 calls- 1.00 per call
 - e. 1001 to 2000 - 1.25 per call
 - f. Above 2000- 1.40 per call
- (xi) Perform Following:
 - a. Using Excel write sales data with columns product, month and sales. Write at least 5 records. Create Pivot Table chart and Report for the data.
 - b. Create a macro to change the name of worksheet as Macro Example, merge first three columns of first row and write heading as DATA in green color with yellow background
 - c. Link word document in excel worksheet to show the usage of linking and embedding.

4. MS – PowerPoint

- (i) Assume that you are going to give a presentation about Information Technology. (Choose some latest technologies). The presentation should have minimum 10 slides. Insert appropriate images wherever necessary. Use proper formatting, Diagrams and tables. Show the usage of action buttons, hyperlinks, and animations.

Signature



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	1	2	1	2	1	1	2	1	2	1	—
CO2	1	2	2	1	1	1	1	1	2	1	2	—
CO3	2	1	2	1	2	1	1	2	1	2	1	—
CO4	1	2	1	2	1	2	1	2	1	2	1	—
CO5	1	1	1	2	1	1	2	2	1	1	2	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



COURSE OVERVIEW AND OBJECTIVES:

- To introduce students practical knowledge of programming in C exercises with functions, pointers union.

COURSE OUTCOME: After completion of this course the students will be able to:

- To demonstrate a clear understanding of the basic C programming concepts.
- To use functions, storage class specifiers, pointers and dynamic memory allocation.
- To implement the basic data structures like arrays, structures, linked lists, stacks and queues.
- To classify and analyze the complexities associated with sorting/searching algorithms and demonstrate a clear understanding of the file handling concepts.
- To develop skills to design and evaluate solutions to real time problems.

A. List of Experiments**Experiments**

- Printing the reverse of an integer.
- Printing the odd and even series of N numbers.
- Get a string and convert the lowercase to uppercase and vice-versa using `getchar()` and `putchar()`.
- Input a string and find the number of each of the vowels appear in the string.
- Accept N words and make it as a sentence by inserting blank spaces and a full stop at the end.
- Printing the reverse of a string.
- Checking whether the given matrix is an identity matrix or not.
- Finding the first N terms of Fibonacci series.
- Declare 3 pointer variables to store a character, a character string and an integer respectively. Input values into these variables. Display the address and the contents of each variable.
- Recursive program to find the factorial of an integer.
- Finding the maximum of 4 numbers by defining a macro for the maximum of two numbers.
- Arranging N numbers in ascending and in descending order using bubble sort.
- Addition and subtraction of two matrices.
- Multiplication of two matrices.
- Converting a hexadecimal number into its binary equivalent.
- Check whether the given string is a palindrome or not.
- Demonstration of bitwise operations.
- Applying binary search to a set of N numbers by using a function.

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Experiments

19. Define a structure with three members and display the same.
20. Declare a union with three members of type integer, char, string and illustrate the use of union.
21. Create a sequential file with three fields: empno, empname, empbasic. Print all the details in a neat format by adding 500 to their basic salary.

CO-PO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

CO-PSO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




COURSE OVERVIEW AND OBJECTIVES:

- To introduce students practical knowledge of web technologies such as HTML, CSS, XML, Java Script teach them to create static and simple dynamic web pages or applications using these technologies and to understand web application deployment and software architectures.

COURSE OUTCOME: After completion of this course the students will be able:

- To create interactive web-pages.
- To work on web protocols like HTTP, TCP/IP, DNS as well as IP and web address resolution schemes such as URIs/URLs and DNS.
- To use PHP for server side scripting.
- To create both static and dynamic web applications
- To use HTML/CSS and XML; Student will be able to create static web pages using HTML & CSS & Java Script;

A. List of Experiments**Experiments**

- Design a simple web page with head, body and footer, with heading tags, image tag
- Design a web site for book information, home page should contain books list, when particular book is clicked, information of the books should display in the next page.
- Design a page to display the product information such as name, brand, price and etc with table tag
- Design a web site for book information using frames, home page should contain two parts, left part should contain books list, and right part should contain book information.
- Design a web page with nice formatting like background image, text colors and border for text using external CSS.
- Design a web page to perform mathematical calculations such as addition, subtraction, multiplication, and division using form elements and Java Script.
- Design a web page to capture the user information such as name, gender, mobile number, mail id, city, state, and country using form elements and display them into other pages using Java Script.
- Design a web page to display timer in the left side of the web page using Java Script.
- Design a web page to capture the student details such as student number, name, age, marks using Java Script Object.
- Design a web page to read data from an XML file and display the data in tabular format, take the data as employee information.
- Design a web site for online purchase using CSS, JS and XML, web site should contain the following web pages (Home page, Login page, Signup page, Product details page)
- Design a web site for Student details using PHP, web site should contain the following web pages. (Home page, Login page, Signup page, Product details page)

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	2	—	—	—	3	—	—	—	2	1	1	—
CO2	3	—	—	—	2	—	—	—	2	1	1	—
CO3	3	—	—	—	2	—	—	—	2	2	—	—
CO4	2	3	—	—	3	—	—	—	2	1	1	—
CO5	3	—	3	—	2	—	—	—	3	2	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	—	3
CO-2	—	—	—
CO-3	2	—	2
CO-4	2	—	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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COURSE OVERVIEW AND OBJECTIVES:

- To train students in how to be effective communicators by practicing various skills and also help them in becoming well-groomed individuals in terms of both verbal and non-verbal communication.

COURSE OUTCOME: After completion of this course the students will be able:

- To channelize areas of communication in which they need to improve and use communication more effectively to get their messages across to people more clearly.
- To develop effective listening skills and effective communication skills.
- To feature a good communication skill by improving questioning skills and asking right questions.
- To build effective communication skills.
- To learn basic telephone etiquettes with formal vs informal tone, pitch and vocabulary etc.

B. List of Experiments

Experiments
<p>1. Communication Process: What is communication? The communication model, elements of communication, Importance of effective communication skills in the business world, Components of Communication Process, practicing effective communication, good communication Vs effective communication, styles of communication, intercultural communication skills- need for attitude change and benefits Design a web page to capture the user information such as name, gender, mobile number, mail id, city, state, and country using form elements.</p>
<p>2. Types of Communication & Barriers to communication: Verbal Communication, Non Verbal Communication, Written Communication, Do's and don'ts of each type, barriers to effective communication and how to overcome them, interaction of verbal and non-verbal communication, talents of a corporate communicator, silence- merits and limitations of each type.</p>
<p>3. Listening Skills & Reading Skills: What is listening, various types of listening – Active, passive, selective, listening and note taking, listening and comprehending, listening to speak, principles of good listening techniques to develop effective listening skills, Reading Skills- skimming, scanning and inferring- common reading techniques, practicing smart reading.</p>




4. **Conversation Skills:** Importance of conversation skills, features of a good conversation, Tips to improve Conversation skills, importance of questioning skills, techniques to ask right questions- role play situations to practice the same, discussing issues (social, political and cultural), formal and informal conversation.
5. **Telephone Etiquette:** Basic rules of telephone etiquette- formal vs. informal; tone, pitch and vocabulary related to formal ways of speaking over the phone, leaving voice messages; practice sessions (role plays)
6. **Persuasive communication** What is persuasive communication, different techniques of persuasive communication, How to negotiate using persuasive communication, the act of negotiation, negotiation style and their contexts, fundamentals of negotiation, common hurdles in negotiation and how to overcome them.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	3	3	1	3	2	2	2
CO2	—	—	—	—	—	2	3	1	3	1	1	—
CO3	—	—	—	—	—	—	—	—	3	—	—	—
CO4	—	—	—	3	—	—	—	—	—	—	—	—
CO5	2	2	2	2	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Common for Specialization CTIS and AI)****Semester II**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI201	ENG	English-II	3	0	0	3	3
2	BCAI202	PC	Linux Shell Scripting	3	0	0	3	3
3	BCAI203	PC	Object Oriented Programming Using Java	2	0	0	2	2
4	BCAI204	PC	Operating Systems	3	0	0	3	3
5	BCAI205	PC	Data Structures using C	3	0	0	3	3
6	BCAI206	BS	Environmental Studies	3	0	0	3	3
7	BCAI207	PC	Data Structures using C Lab	0	0	4	4	2
8	BCAI208	PC	Linux Shell Scripting Lab	0	0	2	2	1
9	BCAI209	PC	Object Oriented Programming Using Java Lab	0	0	4	4	2
10	BCAI210	HSM	Personality Development	0	0	4	4	2
TOTAL				17	0	14	31	24



Second Semester

Core Theory Subjects

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Code: BCAI201

English -II

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To teach students in English Grammar and make them proficient in usage of grammar.

COURSE OUTCOME: After completion of this course students should be able to:-

- Understand of usage of English Grammar in written communication.
- Understand of comprehension reading and construction of sentences.
- Understand of review writing and short paragraph writing.
- Understand about the points to consider while writing on social media.
- Understand the differences between formal presentation, debate, and discussion etc.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Comprehension passage	10
2.	Short Paragraph Writing	9
3.	Review writing	7
4.	Writing for Social Media	8
5.	Presentations	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Comprehension (Can be taken any passage and identify the below points)
	<ul style="list-style-type: none"> Comprehension passage 1 Comprehension passage 2 Comprehension passage 3 Comprehension passage 4 Comprehension passage 5 <p>Points to cover: Vocabulary, grammar, Construction of sentences.</p>



2.	Short Paragraph Writing
	<ul style="list-style-type: none"> • Topic 1 - Punctuality • Topic 2 - Nutrition • Topic 3 - Exercise • Topic 4 - Global Warming • Topic 5 - Disciple Inflation • Topic 6 - Demonetization <p>Points to cover: Vocabulary, grammar, Construction of sentences.</p>
3.	Review writing
	<ul style="list-style-type: none"> • Topic 1 – Book [can be a story review for average students] • Topic 2 - Movie review [different kinds of movies can be suggested too for practice] • Topic 3 – Another Movie review • Topic 4 – Hotel / Café / Recreations centre Review • Topic 5 – Electronic Gadget Review (Laptop/smart phone / speakers/ PSP/ etc.) <p>What is a review? How to write a review. Different types of reviews. Points to cover: Vocabulary, grammar, Construction of sentences.</p>
4.	Writing for Social Media
	<ul style="list-style-type: none"> • Writing for social media: Face book, Linked-in • Points to remember while writing on the social media. How to write Profile summary. • What is a blog? How to write a blog? <p>Points to cover: Vocabulary, grammar, Construction of sentences.</p>
5.	Presentations
	<ul style="list-style-type: none"> • Formal Informal • Debate • Discussions • Pick & Speak <p>Points to cover: Vocabulary, grammar, Construction of sentences. Miscellaneous, Usage of Phrases & Idioms, Revision of English I & II</p>

Sr. N	Reference Books	Author	Edition	Publication
1.	Practical English Usage	Michel Swan	Latest	Oxford University Press
2.	Cambridge Grammar for English: A comprehensive Guide for spoken & written English	Jorg Krause	South Asian	Cambridge University Press
3.	How English Works	Michael Swan & Catherine Walter	Latest	Oxford University



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	3	3	1	3	2	2	2
CO2	—	—	—	—	—	2	3	1	3	1	1	—
CO3	—	—	—	—	—	—	—	—	3	—	—	—
CO4	—	—	—	3	—	—	—	—	—	—	—	—
CO5	2	2	2	2	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



COURSE OVERVIEW AND OBJECTIVES:

- The course provides an overview of the Linux Operating System, geared toward new users as an exploration tour and getting started guide.
- This unit provides examples to help the learners get a better understanding of the Linux system. The unit also provides the guidelines for the learners to take up vendor certifications.
- The unit explores the basics of Linux, the underlying management of the Linux operating system and its network configuration. The complete system services of Linux is explained along with the troubleshooting.

COURSE OUTCOME: After completion of this course students should be able to:-

- Get an overview of the Linux Operating System, geared toward new users as an exploration tour and getting started guide.
- Understand basics of Linux, the underlying management of the Linux operating system and its network configuration.
- Understand and work with processes and system services of Linux along with the troubleshooting.
- Acquire the knowledge to work on vi editor.
- Have a hands on practical exposure to the Linux Red Hat Enterprise and make them prepared for the RHCE Certification.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to UNIX	10
2.	UNIX file system	8
3.	UNIX Process Management	8
4.	Vi Editor	8
5.	Shell programming	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to UNIX
	<ul style="list-style-type: none"> • History of UNIX - Unix Components/Architecture - Features of Unix – UNIX Environment and UNIX Structure - Posix and Single Unix specification - The login prompt - UNIX commands – Basic commands - echo, printf, ls, who, date, passwd, cal - Combining commands - Internal and external commands – type, man, more and other commands - the user terminal, displaying its characteristics and setting characteristics - The root login - super user: su command - /etc/passwd and /etc/shadow files - Commands to add, modify and delete users.




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2.	UNIX file system
	<ul style="list-style-type: none"> UNIX File basics - File types and Categories – File Organization – Directories - home directory and the HOME variable - Reaching required files- the PATH variable - Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent parent directories - File related commands – cat, mv, rm, cp, wc - File inodes and the inode structure. File links – hard and soft links – Head and tail commands - Cut and paste commands - The sort command - Special files /dev/null and /dev/tty - File attributes and permissions - The umask and default file permissions - ls command - Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions
3.	UNIX Process Management
	<ul style="list-style-type: none"> The Structure of Processes: Process States and Transitions - Layout of system memory - Context of a process. Process Control: Process Creation – Signals – Process Termination – Invoking other programs – PID & PPID – Shell on a Shell.
4.	Vi Editor
	<ul style="list-style-type: none"> Introduction to Text Processing, Command & edit Mode, Invoking vi, deleting & inserting Line, Deleting & Replacing Character, Searching for Strings, Yanking, Running Shell Command Macros, Set Window, Set Auto Indent, Set No. Communicating with Other Users: who, mail, wall, send, mesg.
5.	Shell programming
	<ul style="list-style-type: none"> Introduction – Need for Scripts – Creating and Calling the Script – The Shebang – Different ways of running a script - Using variables in Script – Reading Input – Integer Variables – Arithmetic Expressions – Read-only variables – Exporting variables – Arrays - Control Statements: If, Then, Else, While and Until, Classic For, Break and Continue, Case – Handling Script Parameters: Shift, Getopts – Shell Functions – Handling Conditional expression patterns and Regular expressions in scripts.




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Sr. N	Reference Books	Author	Edition	Publication
1	UNIX Concepts and Applications	Sumitabha Das	Latest	Oxford University Press
2	UNIX and Shell Programming	Behrouz A. Forouzan, Richard F. Gilberg	Latest	Cengage Learning – India Edition
3	UNIX & Shell Programming	M.G. Venkatesh Murthy	Latest	Pearson Education
4	Linux Command Line and Shell Scripting Bible	Richard Blum, Christine Bresnahan	2 nd Edition	Wiley, 2014

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	2	—	—	—	3	—	—	—	2	1	1	—
CO2	3	—	—	—	2	—	—	—	2	1	1	—
CO3	3	—	—	—	2	—	—	—	2	2	—	—
CO4	2	3	—	—	3	—	—	—	2	1	1	—
CO5	3	—	3	—	2	—	—	—	3	2	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	—	3
CO-2	—	—	—
CO-3	2	—	2
CO-4	2	—	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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COURSE OVERVIEW AND OBJECTIVES:

- Object oriented programming is the most proven technique for developing reliable programs. It helps in increased productivity, reusability of code, decrease in the development time, and reduces cost of production to an extent.
- The cost of maintaining such systems have also considerably decreased. There are many languages which used the object oriented concepts and techniques. Some of them are C++, Java, Smalltalk, Objective-C, etc.
- Java is a purely object oriented language. Systems/applications created using java programming language reduces the need for developing and maintain complex and space consuming applications. Java has a lot of advantages of being simple, robust, platform independent, etc. Nowadays java is also found in the mobile phones.

COURSE OUTCOME: After completion of this course students should be able:-

- To read and understand Java-based software code of medium-to-high complexity.
- To use standard and third-party Java's API's when writing applications. Understand the basic principles of creating Java applications with graphical user interface (GUI).
- To understand the fundamental concepts of computer science: structure of the computational process, algorithms and complexity of computation.
- To understand the basic approaches to the design of software applications.
- To apply the above to design, implement, appropriately document and test a Java application of medium complexity, consisting of multiple classes.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	Classes	9
3.	Packages	7
4.	Multithreaded Programming	8
5.	JAVA Database Connectivity (JDBC)	8

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B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction
	<ul style="list-style-type: none"> History and Overview of Java, Object Oriented Programming, Control statements- if and for loop. Using Blocks of codes, Lexical issues - White space, identifiers, Literals, comments, separators, Java Key words, Data types - Integers, Floating point, characters, Boolean, A closer look at Literals, Variables, Type conversion and casting. Automatic type promotion in Expressions Arrays. Operators - Arithmetic operators, Bit wise operators, Relational Operators, Boolean Logical operators, Assignment Operator, Operator Precedence. Control Statements – Selection Statements - if, Switch, Iteration Statements - While, Do-while, for Nested loops, Jump statements.
2.	Classes
	<ul style="list-style-type: none"> Class Fundamentals, Declaring objects, Assigning object reference variables. Methods - constructors, "this" keyword, finalize () method A stack class, Over loading methods. Using objects as parameters, Argument passing, Returning objects. Recursion, Access control, Introducing final, understanding static. Introducing Nested and Inner classes. Using command line arguments. Inheritance – Basics, Using super, method overriding, and Dynamic method Dispatch, Using abstract classes and final with Inheritance.
3.	Packages
	<ul style="list-style-type: none"> Definition. Access protection importing packages. Interfaces: Definition and implementation. Exception Handling – Fundamentals, types, Using try and catch and Multiple catch clauses, Nested try Statements, throw, throws, finally. Java's built-in exception, using Exceptions.
4.	Multithreaded Programming
	<ul style="list-style-type: none"> Java thread model – main thread, creating single and multiple thread. Is alive () and join (). Thread – Priorities, Synchronization, Inter thread communication, suspending, resuming and stopping threads, using multi-threading. I / O basics – Reading control input, writing control output, Reading and Writing files. Applet Fundamentals – AWT package, AWT Event handling concepts, the transient and volatile modifiers. Using instance of using assert.
5.	JAVA Database Connectivity (JDBC)
	<ul style="list-style-type: none"> Database connectivity – JDBC architecture and Drivers. JDBC API - loading a driver, connecting to a database, creating and executing JDBC statements, handling SQL exceptions. Accessing result sets: types and methods. An example - JDBC application to query a database.

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Sr. N	Reference Books	Author	Edition	Publication
1	The complete reference Java –2	Herbert Schildt	5 th Edition	Pub. TMH
2	SAMS teach yourself Java – 2	Rogers Cedenhead and Leura Lemay	3rd Edition	Pearson Education

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

Code: BCAI204

Operating System

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- The operating system is the most important program that runs on a computer. Every general-purpose computer must have an operating system to run other programs.
- Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
- This course covers the concept of operating system and its applications.

COURSE OUTCOME: After completion of this course students should be able:-

- To acquire the knowledge about the evolution of OS over the years and different components of OS.
- To understand more significant functions of OS like Process management, storage and memory management etc.
- To extract maximum benefits out of the OS while developing programs, working with applications and etc.
- To understand file-system architecture in the OS, identify how operating system allocates and manages memory along with concepts and needs of virtual memory.
- To get knowledge about the protection and security provided by the OS.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Operating System	10
2.	Process Management	8
3.	Storage Management	7
4.	File-System Implementation	8
5.	Protection and Security	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Operating System
	<ul style="list-style-type: none"> • Introduction, Objectives and Functions of OS, Evolution of OS, OS Structures, OS Components, OS Services, System calls, System programs, Virtual Machines.



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2.	Process Management <ul style="list-style-type: none"> • Threads: Introduction to Threads, Single and Multi-threaded processes and its benefits, User and Kernel threads, Multithreading models, threading issues. • CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-time Scheduling, Algorithm Evaluation, Process Scheduling Models. • Process Synchronization: Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic Transactions • Deadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.
3.	Storage Management <ul style="list-style-type: none"> • Memory Management: Logical and physical Address Space, Swapping, Contiguous Memory Allocation, Paging, Segmentation with Paging. • Virtual Management: Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames, Thrashing, Operating System Examples, Page size and other considerations, Demand segmentation • File-System Interface: File concept, Access Methods, Directory structure, File-system Mounting, File sharing, Protection and consistency semantics.
4.	File-System Implementation <ul style="list-style-type: none"> • File-System structure, File-System Implementations, Directory Implementation, Allocation Methods, Free-space Management, Efficiency and Performance, Recovery • Disk Management: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation
5.	Protection and Security <ul style="list-style-type: none"> • Protection: Goals of Protection, Domain of Protection, Access Matrix, and Implementation of Access Matrix, Revocation of Access Rights, Capability- Based Systems, and Language – Based Protection. • Security: Security Problem, User Authentication, One – Time Password, Program Threats, System Threats, Cryptography, Computer – Security Classifications.



Sr. N	Reference Books	Author	Edition	Publication
1	Operating System Concepts and design	Milan Milonkovic	2 nd Edition	McGraw Hill
2	Operation System Concepts	Tanenbaum	2 nd Edition	Pearson Education
3	Operating System	Silberschatz / Galvin / Gagne	6 th Edition	WSE (WILEY Publication)
4	Operating System	William Stallings	4 th Edition	Pearson Education
5	Operating systems	H.M.Deitel	2 nd Edition	Pearson Education
6	Operating Systems	Nutt	3 rd Edition	Pearson Education

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	—	—	—	—	—	1	—	1	—	—	—
CO2	2	—	—	—	—	—	1	—	1	—	—	—
CO3	1	3	—	—	—	—	1	—	1	—	—	—
CO4	3	—	—	—	—	—	1	—	1	—	—	—
CO5	2	—	—	—	—	—	1	—	1	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	—	—
CO-2	2	—	—
CO-3	—	3	—
CO-4	2	—	—
CO-5	—	2	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

Surf



Code: BCAI205

Data Structure Using C

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- A data structure is a particular way of storing and organizing data in a computer so that it can be used efficiently.
- Different kinds of data structures are suited to different kinds of applications and some are highly specialized to specific tasks.
- This course covers the basic concepts of different data structures which are the basic building blocks of Programming and problem solving.

COURSE OUTCOME: After completion of this course students should be able:-

- To write programs that use arrays, records, linked structures, stacks, queues, trees, graphs and demonstrate different methods for traversing trees.
- To compare and contrast the benefits of dynamic and static data structures implementations.
- To describe the concept of recursion, give examples of its use, describe how it can be implemented using a stack.
- To design and implement an appropriate hashing function for an application.
- To get knowledge about the protection and security provided by the OS.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Data structures	10
2.	Searching and Sorting	7
3.	Stack and Queue	8
4.	Linked List	7
5.	Tree Graphs and their	10

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Data structures <ul style="list-style-type: none"> • Definition, Classification of data structures: primitive and non-primitive, Elementary data organization, Time and space complexity of an algorithm (Examples), String processing. Dynamic memory allocation and pointers: Definition of dynamic memory allocation, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Meaning of static and dynamic memory allocation, Memory allocation functions: malloc(), calloc(), free() and realloc(). Recursion: Definition, Recursion in C (advantages), Writing Recursive programs – Binomial coefficient, Fibonacci, GCD.



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2.	Searching and Sorting
	<ul style="list-style-type: none"> Basic Search Techniques: Sequential search: Iterative and Recursive methods, Binary search: Iterative and Recursive methods, Comparison between sequential and binary search. Sort: General background and definition, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort.
3.	Stack and Queue
	<ul style="list-style-type: none"> Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks. Queue: Definition, Array representation of queue, Types of queue: Simple queue, Circular queue, Double ended queue (deque), Priority queue, Operations on all types of Queues.
4.	Linked List
	<ul style="list-style-type: none"> Definition, Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list. Types of linked list: Singly linked list, doubly linked list, Circular linked list, Operations on singly linked list: creation, insertion, deletion, search and display.
5.	Tree Graphs and their Applications
	<ul style="list-style-type: none"> Definition : Tree, Binary tree, Complete binary tree, Binary search tree, Heap Tree terminology: Root, Node, Degree of a node and tree, Terminal nodes, Non-terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node. Binary tree: Array representation of tree, Creation of binary tree. Traversal of Binary Tree: Preorder, Inorder and postorder. Graphs, Application of Graphs, Depth First search, Breadth First search.



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Sr. N	Reference Books	Author	Edition	Publication
1	Data Structures and Algorithm Analysis in C	Weiss	2 nd Edition	Pearson Education
2	Schaum's outline series Data structures	Lipschutz	Latest Edition	Tata McGraw-Hill
3	Data Structures and program designing using 'C'	Robert Kruse	Latest	Pearson Education
4	Data Structures Using C	Tenenbaum	Latest	Pearson Education
5	Introduction to Data Structures in C	Kamthane	Latest	Pearson Education
6	Data Structures Using C	Bandyopadhyay	Latest	Pearson Education

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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Code: BCAI206

Environmental Studies

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- The course will provide an overview of natural resources, ecosystem, biodiversity environment pollution and social issues etc.

COURSE OUTCOME: After completion of this course students should be able:-

- To acquire the knowledge about natural resources, forest, water, mineral, food, energy etc.
- To acquire the knowledge of ecosystem, its types, food chains and food webs.
- To acquire the knowledge of biodiversity of India and its conservation methods.
- To acquire the knowledge about environmental pollutions, its types, firework safety, associated health effects.
- To acquire the knowledge of social issues, women and child welfare, corruption, ethics.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction and natural resources	10
2.	Ecosystem	7
3.	Biodiversity and Conservation	7
4.	Environmental pollution	8
5.	Social Issue and Environment	10

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction and natural resources <ul style="list-style-type: none"> Multidisciplinary nature and public awareness, renewable and non-renewable resources and associated problems, forest, water, mineral, food, energy and land resources. Introduction to natural resources, conservation of natural resources and human role.
2.	Ecosystem <ul style="list-style-type: none"> Ecological concepts, concept of ecosystems, types of ecosystems, ecosystem structure and functioning, energy flow, food chains and food webs, ecological pyramids.

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3.	Biodiversity and Conservation
	<ul style="list-style-type: none"> Definition, genetic species and ecosystem diversity biogeographically, classification of Indian value of biodiversity at national and local levels, India as a mega-diversity nation, treats to biodiversity and endangered and endemic species of India, need for conservation of biodiversity.
4.	Environmental pollution
	<ul style="list-style-type: none"> Definition , causes, effect and control of air pollution , water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, electromagnetic pollution, nuclear hazards , human role in prevention of pollution, solid waste management, disaster management, floods , earthquake, cyclone, and landslide Firework Safety: Combustion of firework and pollution (noise, smoke, fireworks fallout and residue pollution), heavy metal toxicity due to fireworks and associated health effects.
5.	Social Issue and Environment
	<ul style="list-style-type: none"> Unsuitable to suitable development, urban problem related to energy and water conservation, environment protection act, wild life protection act, forest conservation act, environmental issues, population explosion, and family welfare programme. Environmental and human health HIV, women and child welfare, role of information technology on environment and human health. Corruption: definition and reasons, details of organizations/agencies working against corruption, role of individual against corruption and mode of action. Ethics: Meaning, nature, determinants and objectives of ethics, ethics and its relation to values norms and morals, Indian ethos, Swami Vivekananda and ethics.

Sr. N	Reference Books	Author	Edition	Publication
1	Fundamentals of Environmental Biology	K. C. Agrawal	2 nd Edition	Nidhi Publishers (Bikaner)
2	Fundamentals of Ecology	E.P. Odum	Latest Edition	W.B. Saunders Co. (USA)
3	Fundamentals of Ecology	E. P. Odum	Latest	Natraj Publisher (Dehradun)
4	Ecology: Principles and Applications	J. L. Chapman & , M. J. Reiss	Latest	Cambridge University Press
5	Atmospheric pollution	W. Buch	Latest	Tata McGraw Hill
6	Professional Ethics and Human Values	M. Govindarajan	Latest	PHI Learning Private Limited
7	Corruption and Reform in India	Jennifer Bussell	Latest	Cambridge University Press

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	—	1	—	—	2	—	1
CO2	—	—	—	—	—	—	1	—	—	3	—	—
CO3	—	—	—	—	—	—	—	—	—	2	1	1
CO4	—	—	—	—	—	3	1	—	—	3	2	1
CO5	—	—	—	—	—	3	—	—	—	2	3	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Second Semester

Practical Subjects

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Code: BCAI207

Data Structure Using C Lab

2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- A data structure is a particular way of storing and organizing data in a computer so that it can be used efficiently.
- Different kinds of data structures are suited to different kinds of applications and some are highly specialized to specific tasks.
- This course covers the basic concepts and practical implementation of different data structures which are the basic building blocks of Programming and problem solving.

COURSE OUTCOME: After completion of this course students should be able to:-

- Write programs that use arrays, records, linked structures, stacks, queues, trees, graphs and demonstrate different methods for traversing trees.
- Compare and contrast the benefits of dynamic and static data structures implementations.
- To write program using the concept of recursion, give examples of its use, describe how it can be implemented using a stack.
- To design and implement an appropriate hashing function for an application.
- To write program to find the computational efficiency of the principal algorithms for sorting, searching, and hashing.

A. List of Experiments

Experiments

1. Use a recursive function to find GCD of two numbers.
2. Use a recursive function to find the Fibonacci series.
3. Use pointers to find the length of a string and to concatenate two strings.
4. Use pointers to copy a string and to extract a substring from a given a string.
5. Use a recursive function for the towers of Hanoi with three discs.
6. Insert an integer into a given position in an array.
7. Deleting an integer from an array.
8. Write a program to sort N numbers using insertion sort.
9. Write a program to sort N numbers using selection sort
10. Sort N numbers using merge sort.
11. Pointer implementation of stacks.
12. Pointer implementation of queues.
13. Write a program to create a linked list and to display it.
14. Inserting a node into a singly linked list.
15. Deleting a node from a singly linked list.
16. Creating a binary search tree and traversing it using in order, preorder and post order.

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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COURSE OVERVIEW AND OBJECTIVES:

- The course provides an overview and practical implementation of the Linux Operating System, geared toward new users as an exploration tour and getting started guide.

COURSE OUTCOME: After completion of this course students should be able to:-

- Get a practical overview of the Linux Operating System, geared toward new users as an exploration tour and getting started guide.
- Understand basic commands of Linux, the underlying management of the Linux operating system and its network configuration.
- Get practical knowledge of working with processes and system services of Linux along with the troubleshooting.
- Acquire practical knowledge to work on vi editor.
- Have a hand on practical exposure to the Linux Red Hat Enterprise and make them prepared for the RHCE Certification.

A. List of Experiments**Experiments**

- Use of Basic UNIX Shell Commands: ls, mkdir, rmdir, cd, cat, touch, file, wc, sort, cut, grep, dd, dfspace, du, ulimit.
- Commands related to inode, I/O redirection and piping, process control commands, mails.
- Shell Programming: Shell script exercises based on following: Interactive shell scripts (ii) Positional parameters (iii) Arithmetic (iv) if-then-fi, if-then- else-fi, nested if-else (v) Logical operators (vi) else + if equals elif, case structure (vii) while, until, for loops, use of break.
 - Write shell script for- Showing the count of users logged in, Printing Column list of files in your home directory, Listing your job with below normal priority, Continue running your job after logging out.
- Write a shell script to change data format. Show the time taken in execution of this script.
- Write a shell script to print files names in a directory showing date of creation & serial number of the file.
- Write a shell script to count lines, words and characters in its input.
- Write a shell script to print end of a Glossary file in reverse order using Array.
- Write a shell script to check whether Ram logged in, Continue checking further after every 30 seconds till success.
- Write a shell script to compute gcd lcm & of two numbers. Use the basic function to find gcd & LCM of N numbers.
- Write a shell script to find whether a given number is prime. Take a large number such as 15 digits or higher and use a proper algorithm.

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Experiments

19. Write a shell script to reverse a given integer.
20. Write a shell script to list the files arranged in descending order of their size.
21. Write a shell script to check whether the given string is palindrome or not.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAI209 Object Oriented Programming Using Java Lab 2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- Object oriented programming is the most proven technique for developing reliable programs. It helps in increased productivity, reusability of code, decrease in the development time, and reduces cost of production to an extent.
- The cost of maintaining such systems have also considerably decreased. There are many languages which used the object oriented concepts and techniques. Some of them are C++, Java, Smalltalk, Objective-C, etc.
- Java is a purely object oriented language. Systems/applications created using java programming language reduces the need for developing and maintain complex and space consuming applications. Java has a lot of advantages of being simple, robust, platform independent, etc. Nowadays java is also found in the mobile phones.

COURSE OUTCOME: After completion of this course students should be able:-

- To get practical knowledge of Java-based software code of medium-to-high complexity.
- To get practical knowledge of standard and third-party Java's API's when writing applications. Understand the basic principles of creating Java applications with graphical user interface (GUI).
- To get practical knowledge of structure of the computational process, algorithms and complexity of computation.
- To get practical knowledge of the basic approaches to the design of software applications.
- To apply the above to design, implement, appropriately document and test a Java application of medium complexity, consisting of multiple classes.

A. List of Experiments

Experiments
<ol style="list-style-type: none"> 1. Write a program to check whether two strings are equal or not. 2. Write a program to display reverse string. 3. Write a program to find the sum of digits of a given number. 4. Write a program to display a multiplication table. 5. Write a program to display all prime numbers between 1 to 1000. 6. Write a program to insert element in existing array. 7. Write a program to sort existing array. 8. Write a program to create object for Tree Set and Stack and use all methods. 9. Write a program to check all math class functions. 10. Write a program to copy a file to another file using Java to package classes. Get the file names at run time and if the target file is existed then ask confirmation to overwrite and take necessary actions. 11. Write a program to get file name at runtime and display number f lines and words in that file. 12. Write a program to list files in the current working directory depending upon a given pattern

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Experiments

13. Create a textfield that allows only numeric value and in specified length.
14. Create a Frame with 2 labels, at runtime display x and y command-ordinate of mouse pointer in the labels.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAI210

Personality Development 2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- To enhance and sharpen the various skills related to Personality Development and also make students aware of how to make use of these skills more effectively in team building and resolving conflicts both in personal and professional life.

COURSE OUTCOME: After completion of this course students should be able to:-

- Evaluate his inner self and improve his self esteem.
- Enhance and sharpen the various skills related to Personality Development.
- Use interpersonal skills more effectively in team building and resolving conflicts both in personal and professional life.
- Use effective techniques for problem solving and decision making.
- Effective ways for stress management and conflict resolution.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Personality & Self Esteem	6
2.	Interpersonal Skills & Working In team	5
3.	Time Management & Planning	6
4.	Problem Solving & Decision Making	5
5.	Conflict and stress Management	6

B. DETAILED SYLLABUS

Unit	Unit Name
1.	Personality and Stress Management
	<ul style="list-style-type: none"> Self-Management: discover yourself, skills and abilities, evaluate inner self, and expand your awareness, introspection, self- assessment, self-appraisal, self-development, self- interrogation, symptoms of negative attitude, anger management and positive attitude. Definition of personality, Components of Personality, common personality types, Definition of Self Esteem, Factors related to self-esteem, SWOT analysis, Building Self Esteem, Definition of Attitude



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2.	Interpersonal Skills & Working In team
	<ul style="list-style-type: none"> What are interpersonal skills? Importance of Interpersonal Skills in the Business world, How to build relationships, approaches to team building, difference between a team and a group, kinds of teams, What is a team, Significance of working in team, Qualities required to be an effective Team Member, Skills required to build an effective TEAM, practice activities for team building Leadership Skills: Leadership traits and trends, leadership in business , dynamics between Leadership and management, Leadership styles in India, analysing leadership theories in the context of globalisation and leadership abroad, leaders for new organizations, different styles of Leadership
3.	Time Management & Planning
	<ul style="list-style-type: none"> Time as a resource, individual understanding of time, Effective time management Techniques, identifying time waster, achieving goals through effective time management, Time management Matrix – practice, multitasking, delegating, saying no assertively, relationship between time and stress management Goal setting: concept of setting SMART goals, steps to achieve goals, career goals/ anticipating career challenges, utilizing opportunities, mapping skills sets
4.	Problem Solving & Decision Making
	<ul style="list-style-type: none"> What is a problem? Different stages of resolving a problem, Different factors that influence decision making, Different stages of decision making.
5.	Conflict and stress Management
	<ul style="list-style-type: none"> What is a conflict?, Consequences of Conflict – Good & Bad, main sources of Conflict, Techniques to handle conflicts – Lose – win, Lose- Lose, Win – Lose, WIN-WIN; Role plays to practice conflict management, maintaining a positive attitude Stress Management: stress and its causes, handling stress, types of stress, managing stress through motivation, relaxation techniques.



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	—	3	—	—	—	2	—
CO2	—	—	—	—	—	—	2	—	—	—	3	—
CO3	—	—	—	—	—	—	3	—	3	—	3	—
CO4	—	—	—	—	—	—	3	—	—	—	2	—
CO5	—	—	—	—	—	—	2	—	—	—	2	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Cloud Technology and Information Security)****Semester III**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI301	PC	DBMS	3	0	0	3	3
2	BCAI302	PC	Computer Networks	3	0	0	3	3
3	BCAICT301	PC	Information Security	3	0	0	3	3
4	BCAICT302	PC	Principles of Virtualization	2	0	0	2	2
5	BCAICT303	PC	Cloud Computing	3	0	0	3	3
6		PE	Elective-I	3	0	0	3	3
7	BCAI303	PC	DBMS Lab	0	0	4	4	2
8	BCAICT306	PC	Principles of Virtualization Lab	0	0	2	2	1
9	BCAI304	HSM	Business communication and Presentation Skills	0	0	4	4	2
10	BCAI305	ST	Summer Project Seminar I	0	0	2	2	1



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Core Theory Subjects**Code:** BCAI301**DBMS****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- A database management system (DBMS) is collection of software meant to manage a Database. Many popular databases currently in use are based on the relational database model.
- RDBMSs have become a predominant choice for the storage of information in new databases used for financial records, manufacturing and logistical information, personnel data and much more.
- The course covers the basic concepts of databases in general with an emphasis on relational databases, modeling techniques and writing queries. Normalization techniques, Transaction processing, Concurrency Control techniques and Recovery of databases against crashes are also covered.

COURSE OUTCOME: After completion of this course students should be able:-

- To describe the fundamental elements of database management systems.
- To explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- To understand Query Language.
- To database anomalies and normalization.
- To understand transaction concepts, Concurrency and Recovery techniques.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	Relational Model	8
3.	SQL	8
4.	Database Design	8
5.	Transactions	8




B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction
	<ul style="list-style-type: none"> Purpose of Database System — Views of data – Data Models – Database Languages — Database System Architecture – Database users and Administrator – Entity–Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases.
2.	Relational Model
	<ul style="list-style-type: none"> The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals, Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables, Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL.
3.	SQL
	<ul style="list-style-type: none"> Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause, Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User, Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL- Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases
4.	Database Design
	<ul style="list-style-type: none"> Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.
5.	Transactions
	<ul style="list-style-type: none"> Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery –Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.



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Code: BCAI302

Computer Networks

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the basics of networking and its underlying principles. This course enables learners to understand computer networking concepts, how they work, operate, communicate with ports and Protocols. Standards and models associated with networking technology and their troubleshooting mechanisms.

COURSE OUTCOME: After completion of this course students should be able to:-

- Explain the types of Network and its architecture. Identify the function of each layer in OSI and TCP/IP Models.
- Describe the Ethernet and wireless standards. Discuss the functionality of Networking devices.
- Demonstrate the IPv4 and IPv6 addressing types.
- List the WAN Technologies.
- To understand transaction concepts, Concurrency and Recovery techniques.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Networking Fundamentals	10
2.	Basics of Network Devices	8
3.	Basics of Network, Transport and Application Layers	8
4.	WAN Technology	8
5.	Troubleshooting Network	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Networking Fundamentals <ul style="list-style-type: none"> Trouble Shooting Networks: Command-Line Interface Tools, Network and Internet Troubleshooting, Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.



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Sr. N	Reference Books	Author	Edition	Publication
1	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudharshan	5th Edition	Tata McGraw Hill
2	Fundamentals of Database Systems	RamezElmasri, Shamkant B. Navathe	4th Edition	Pearson/Addision Wesley
3	Database Management Systems	Raghu Ramakrishnan	3rd	McGraw Hill

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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2.	Basics of Network Devices
	<ul style="list-style-type: none"> Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, Modem, Ethernet standards, Ethernet Components, Point-to-Point Protocol, Address Resolution Protocol, Message format, transactions, Benefits of Wireless Technology, Types of Wireless Networks, Wireless network Components, wireless LAN standards, wireless security Protocols.
3.	Basics of Network, Transport and Application Layers
	<ul style="list-style-type: none"> Network Layer: Internet Protocol (IP), IP standards, versions, functions, The IPv4 and IPv6 Datagram Format, IPv4 addressing, IPv4 Subnetting, CIDR and VLSM, IPv6 Addressing, , Internet Control Message Protocol , Internet Group Management Protocol ,Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer Protocols
4.	WAN Technology
	<ul style="list-style-type: none"> Introduction to WAN, WAN Switching techniques, connecting to the Internet, Satellite-Based Services, Cellular Technologies, Technologies used for Connecting LANs, Remote Access Connections and technologies, Authentication and Authorization, Tunnelling and Encryption Protocols, Security Appliances and Security Threats.
5.	Troubleshooting Network
	<ul style="list-style-type: none"> Trouble Shooting Networks: Command-Line Interface Tools, Network and Internet Troubleshooting, Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring

Sr. N	Reference Books	Author	Edition	Publication
1	CCNA Cisco Certified Network Associate: Study Guide (With CD)	CISCO	7th Edition	Wiley India
2	CCENT/CCNA ICND1 640-822 Official Cert Guide	CISCO	3rd Edition	Pearson
3	Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD)	CCNA	Latest	Pearson
4	CCNA Exploration Course Booklet: Routing Protocols and Concepts	CCNA	Latest	Pearson



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Sub

Code: BCAICT-301

Information Security

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To help students understand foundational concepts of information security
- To make it possible for students to appreciate the need for securing information from threats and risks
- To facilitate students to gain knowledge on how network infrastructure and connectivity can be secured.

COURSE OUTCOME: After completion of this course students should be able to:-

- Describe Security Attacks, Security Services, and Security Mechanisms. Understand various cryptographic techniques. Implement Chinese Remainder Theorem etc for Security mechanisms.
- Describe DES. Describe IDEA algorithm.
- Describe RSA algorithms, Diffie hellman key exchange algorithm.
- Describe SHA Algorithm, MACs.
- Explain X.509 Authentication Service and PGP and S/MIME email security techniques.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	User Identity and Access	8
3.	System and Server Security	8
4.	Internet Security	8
5.	Risk Assessment and Cyber Laws	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction <ul style="list-style-type: none"> • Security Definition, Why Security, Security and its need, Current Trends and Statistics, Basic Terminology, The C I A of Security the Relation: Security functionality and Ease of Use Triangle.
2.	User Identity and Access Management <ul style="list-style-type: none"> • User identity and Access Management: Authentication, Account Authorization, Validation, Access Control and Privilege management. Hashing and Cryptography-Encryption and Decryption.




3.	System and Server Security
	<ul style="list-style-type: none"> System Security, Desktop & Server Security, Firewalls, Password cracking Techniques, Key-logger, viruses and worms, Malwares & Spy wares, Windows Registry
4.	Internet Security
	<ul style="list-style-type: none"> Internet Security: LAN Security, Email Security, Hacking attacks, preventive measures
5.	Risk Assessment and Cyber Laws
	<ul style="list-style-type: none"> Vulnerability Assessment, Penetration Testing, Risk Assessment, Threat, Vulnerability, Cyber Laws – Indian Context

Sr. N	Reference Books	Author	Edition	Publication
1	Information Systems Security: Security Management, Metrics, Frameworks And Best Practices	Nina Godbole	Latest Edition	ISC2 Press
2	Mark Stamp's Information Security: Principles and Practice (WIND)	Deven N. Shah	Latest Edition	Wiley
3	Information Security Risk Analysis	Thomas R. Peltier	3rd	Auerbach
4	Information Security: The Complete Reference	Mark Rhodes-Ousley	2 nd	McGraw Hill Education
5	Cyber Security	Nina Godbole, SunitBelapure	Latest	Wiley
6	Principles of Information Security	Michael E. Whitman	5 th Edition	Cengage Learning India Pvt Ltd

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—



CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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COURSE OVERVIEW AND OBJECTIVES:

- To understand the virtualization and Cloud Technology
- Implementing Virtualization using Hypervisors
- To understand the vSphere components and its features.
- Understanding and implementing the Storage Virtualization
- Implementing Network virtualization using VMware NSX
- How to Secure the ESXi and vCenter Servers
- Monitoring the performance of resources used in SDDC

COURSE OUTCOME: After completion of this course students should be able to:-

- Understand basic concepts of Virtualization.
- Understand Virtualization technologies: Hypervisor, emulation, and application VM; Platform virtualization, storage virtualization, and network virtualization etc.
- Create, manage, migrate and troubleshoot virtual machines, templates, clones, alarms, configure virtual switches, configure virtual storages, examine the features and functions of different storage protocols, such as FC, FCoE, iSCSI, NFS.
- Understand the VMware vSphere features such as load balancing, migration, high availability, fault tolerance etc.
- Understand CPU scheduling, CPU Optimization, network optimization, storage optimization, configuration of distributed switch in virtualized Environment.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	9
2.	Components of vSphere	9
3.	Features of vSphere and NSX	8
4.	VSphere Solutions to Data Center Challenges and vSphere Security	8
5.	Resource optimization and resource management	8



B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction
	<ul style="list-style-type: none"> Introduction to Virtualization - Types of virtualization - Difference between cloud and virtualization - Physical infrastructure and virtual infrastructure - Virtualization approaches - Partitioning - Hosting - Isolation - Hardware independence - Virtual machine - Hypervisor - Types of hypervisor - Virtual machine manager - Types of hypervisor - Introduction to datacenter virtualization Esxi - Difference between Esxi and Esx - Versions of Esxi - Installation and configuration of Esxi 6.0 - vSphere 6.0
2.	Components of vSphere 6.0
	<ul style="list-style-type: none"> Components of VMware vSphere - vSphere 6.0: Overview and Architecture - Topology of vSphere 6.0 Data Center - vSphere 6.0 Configuration MaximumsvCenter Server - vCenter Server Features - Certificate Management - Alarms and Alerts - Monitoring Features - Template Management - Linked Mode Deployment - Storage Features in vSphere - Shared Storage - Storage Protocols - Datastores - Virtual SAN - Virtual Volumes - Networking Features in vSphere - Virtual Networking - Virtual Switches and its types
3.	Features of vSphere and NSX
	<ul style="list-style-type: none"> vSphere Resource Management Features - vMotion - Distributed Resource Scheduler (DRS) - Distributed Power Management (DPM) - Storage vMotion - Storage DRS - Storage I/O Control - Network I/O Control - vSphere Availability Features - vSphere Data Protection - High Availability - Fault Tolerance - vSphere Replication - Introduction to NSX
4.	vSphere Solutions to Data Center Challenges and vSphere Security
	<ul style="list-style-type: none"> Challenges - Availability Challenges - Scalability Challenges - Management Challenges - Optimization Challenges - Application Upgrade Challenges - Cloud Challenges - Security - Describe the features and benefits of VMware Platform Services Controller - Configure ESXi host access and authorization - Secure ESXi - vCenter Server - and virtual machines - Upgrade ESXi and vCenter Server instances
5.	Resource optimization and resource management
	<ul style="list-style-type: none"> Network Optimization - Configure and manage vSphere distributed switches - Migrate virtual machines from standard switches to distributed switches - Explain distributed switch features such as port mirroring - LACP - QoS tagging - and NetFlow - CPU Optimization - Explain the CPU scheduler operation - NUMA support - and other features that affect CPU performance - Monitor key CPU performance metrics - Memory Optimization - Explain ballooning - memory compression - and host swapping techniques for memory reclamation when memory is overcommitted - Monitor key memory performance metrics - Storage Optimization - Diagnose storage access problems - Configure VMware vSphere Flash Read Cache - Monitor key storage performance metrics



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Sr. N	Reference Books	Author	Edition	Publication
1.	Virtualization Essentials Paperback	Matthew Portnoy	Latest Edition	Wiley
2.	VMware Cookbook	Troy - Shroff/O'Reilly	Latest Edition	Wiley
3.	Mastering VMware vSphere 5.5 (SYBEX)	Scott Lowe, Nick Marshall, Forbes Guthrie, Matt Liebowitz, Josh Atwell	2014	Wiley

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAICT-303

Cloud Computing

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud computing so that they are able to identify the vendors and assess the risk involved in cloud migration.
- To enable students be aware of the various governance issues in cloud and how to manage the same.

COURSE OUTCOME: After completion of this course students should be able to:-

- Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures..
- Analyze the risks involved in migrating the existing infrastructure to cloud.
- Assess various cloud service providers and generate effective cloud infrastructure by optimizing the cost involved.
- Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.
- Design and develop backup strategies for cloud data based on features.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Fundamentals of Cloud Computing	9
2.	Cloud Delivery Models 6.0 Management	8
3.	Cloud Platforms	9
4.	Cloud Computing - Challenges, Risk and Mitigation	8
5.	Managing the Cloud	8



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B. DETAILED SYLLABUS

Unit	Unit Details
1.	Fundamentals of Cloud Computing
	<ul style="list-style-type: none"> Cloud Computing Basics – History of Cloud Computing, Characteristics of Cloud Computing, Need for Cloud computing, Advantages and Possible Disadvantages of cloud computing, Cloud Deployment Models – Public, Private, Hybrid, Community, Other deployment Models. Evolving Data Center into Private Cloud, Datacenter Components, Extracting Business value in Cloud Computing – Cloud Security, Cloud Scalability, Time to Market, Distribution over the Internet, Cloud Computing Case Studies.
2.	Cloud Delivery Models
	<ul style="list-style-type: none"> Introduction to Cloud Services, Infrastructure as a Service (IaaS) – Overview, Virtualization, Container, Pricing Models, Service Level Agreements, Migrating to the Cloud, IaaS Networking options, Virtual Private Cloud(VPC), IaaS Storage – File and Object storage, Data Protection, IaaS security, Benefits, Risks and Examples of IaaS. Platform as a Service (PaaS) – Overview, IaaSvsPaaS, PaaS Examples, benefits and risks. Software as a Service (SaaS) – Introducing SaaS, SaaS Examples – Office 365, Google G Suite, Salesforce.com , Evaluating SaaS – user and vendor perspective, Impact of SaaS, Benefits and risks of SaaS. Other Services on Cloud, Cloud Delivery Models Considerations
3.	Cloud Platforms
	<ul style="list-style-type: none"> Introducing Cloud Platforms, Evaluating cloud platforms, Cloud Platform technologies – Amazon Web Services, Microsoft Azure, Google Cloud Platform, Salesforce.com, and Impact of Cloud platforms. Private Cloud Platforms – Introducing Private clouds – Microsoft Azure stack, Open stack, AWS Greengrass, Impact of Private clouds Cloud Migration : Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies
4.	Cloud Computing - Challenges, Risk and Mitigation
	<ul style="list-style-type: none"> Cloud Storage, Application performance, Data Integration, Security. Ensuring Successful Cloud Adoption: Designing a Cloud Proof of Concept, Vendor roles and capabilities, moving to the Cloud. Impact of Cloud on IT Service Management. Risks and Consequences of Cloud Computing – Legal Issues, Compliance Issues, Privacy and Security.
5.	Managing the Cloud
	<ul style="list-style-type: none"> Managing and Securing Cloud Services, Virtualization and the Cloud, Managing Desktops and devices on the cloud, SOA and Cloud computing, Managing the Cloud environment, Planning for the Cloud – Economic Cost Model and Leveraging the Cloud, Cloud computing resources, Cloud Dos and Don'ts.

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Sr. N	Reference Books	Author	Edition	Publication
1	CLOUD ESSENTIALS CompTIA® Authorized Courseware for Exam CLO-001	Kirk Hausman, Susan L. Cook, Telmo Sampaio	Latest Edition	Wiley & Sons
2	Cloud Computing for Dummies	Judith Hurwitz , Robin Bloor , Marcia Kaufman , Fern Halper	Latest Edition	Wiley
3	Cloud Computing: Concepts, Technology & Architecture	Erl	2014	Pearson Education
4	Cloud Computing: A Practical Approach for Learning and Implementation	Srinivasan	2014	Pearson Education

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	—	—	—	—	—	1	—	1	—	—	—
CO2	2	—	—	—	—	—	1	—	1	—	—	—
CO3	1	3	—	—	—	—	1	—	1	—	—	—
CO4	3	—	—	—	—	—	1	—	1	—	—	—
CO5	2	—	—	—	—	—	1	—	1	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	—	—
CO-2	2	—	—
CO-3	—	3	—
CO-4	2	—	—
CO-5	—	2	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Elective-I**Code: BCAICT-304****Server Administration****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To recognize and explore various services provided the windows server 2012
- To analyze and apply centralized services with client nodes of the network
- To recognize the importance of active directory and dynamic access control services while applying the same in the server network infrastructure
- To justify the minimal management and attain improved performance with Hyper v client.

COURSE OUTCOME: After completion of this course students should be able to:-

- Recognize the various services of Server 2012
- Configuration of Active directory and manage the domains
- Administrate and manage the AD domains in server 2012
- Maintain and manage the group policies.
- Configure File and share access permissions

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Installing and Configuring Windows Server 2012	9
2.	Securing Files and Disks	9
3.	Configuring File and Share Access Permissions	9
4.	Configuring DNS Zones and Records	8
5.	Implementing Patch Management and Monitoring Server	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Installing and Configuring Windows Server 2012
	<ul style="list-style-type: none"> • Introduction, Selecting a Windows Server 2012 Edition, Supporting Server Roles and Features, Server Licensing, Installing Windows Server 2012: System Requirement, Performing a Clean Installation, Working with Installation Partitions, Server Core Defaults, Server Core Capabilities, Completing Post-Installation Tasks, Converting Between GUI and Server Core, Upgrade paths, Installing Windows Server Migration Tools, Configuring NIC Teaming, Configuring local storage, Configuring WDS to install OS through networking.

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2.	Securing Files and Disks
	<ul style="list-style-type: none"> How to Securing Files, Encryption files with EFS, Configuring EFS, Using the Cipher Command, Sharing Files Protected with EFS with others, Configuring EFS with Group Policies, Configuring EFS Recovery Agent, Managing EFS Certificates, Encrypting Files with BitLocker, Configuring BitLocker Encryption, configuring BitLocker to Go, Configuring BitLocker Policies, Managing BitLocker Certificates.
3.	Configuring File and Share Access Permissions
	<ul style="list-style-type: none"> Designing a File-Sharing Strategy, Arranging Shares, Controlling Access, Mapping Drives, Creating Folder Shares, Assigning Permissions, Understanding the windows Permission Architecture and Basic, Advanced Permissions, Allowing and Denying Permissions, Inheriting Permissions, Understanding Effective Access, Setting Share Permissions, Understanding NTFS Authorization, Assigning Basic NTFS Permissions, Understanding Resource Ownership, Combining Share and NTFS Permissions, Installing File Server Resource Manager, Using, creating, changing Quotas, Managing Files with File Screening, Creating File Groups, Creating a File Screen, Creating a File Screen Exception, Creating a File screen Template. Storage Reports
4.	Configuring DNS Zones and Records
	<ul style="list-style-type: none"> Understanding DNS, Understanding DNS Names and Zones, Understanding the Address Resolution Mechanism, configuring and Managing DNS Zones, Installing DNS, Configuring Primary and Secondary Zones, Configuring Active Directory-Integrated Zones, configuring Zone Delegation, configuring Stub Zones, configuring Caching-Only Servers, Configuring Forwarding and Conditional Forwarding, Configuring DNS Record types, creating and Configuring DNS Resource Records, Start of Authority(SOA) Records, Name Server(NS) Records, Host(A and AAAA) Records, Canonical Name(CNAME) Records, Pointer(PTR) Records.
5.	Implementing Patch Management and Monitoring Server Performance
	<ul style="list-style-type: none"> Understanding windows Updates and Automatic Updates, Deploying Windows Server Update Services(WSUS), How to Install and Configure WSUS, Configuring WSUS Synchronization, Configuring WSUS Computer Groups, Configuring Group Policies for Updates, Configuring Client-Side Targeting, Approving Updates, Viewing Reports, Administrating WSUS with Commands, Troubleshooting Problems with Installing Updates. Introducing the Microsoft Management Console(MMC), Server Manager, Event Viewer, Understanding Logs and Events, Adding and Filtering Events, Managing Performance, Task Manager, Resource Monitor,



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Sr. N	Reference Books	Author	Edition	Publication
1	Windows Server 2012: A Handbook for Professionals	Aditya Raj	Latest	McGraw-Hill Education
2	Administering Windows Server 2012 (Certification Guide)	Orin Thomas	Latest	McGraw-Hill Education
3	Administering Windows Server 2012	Patrick Regan	Latest	McGraw-Hill Education
4	Mastering Windows Server 2012 R2	Mark Minasi, Kevin Greene, Christian Booth	Latest	McGraw-Hill

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1



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COURSE OVERVIEW AND OBJECTIVES:

- RHEL is a high performing operating system that. RHEL 6 is the sixth generation of the long term and predictable operating platform.
- With the flexibility to deploy on physical hardware, as a virtual host, as a virtual guest or in the cloud, Red hat Enterprise Linux 6 is the ideal foundation for next-generation datacenters.
- The fresh system administrators need to have a strong functional knowledge of RHEL 6 in any current IT work environment. The unit explores the security and network access controls in Linux, organizing network system and Mail Services, Securing Data and Account Management.

COURSE OUTCOME: After completion of this course students should be able to:-

- Attain skills required to manage and administer systems and servers using Linux Operating System.
- Gain knowledge about Red hat Enterprise Linux 6(RHEL 6).
- Learn basic commands in Linux and get knowledge about File system.
- Learn basic server configuration in Linux servers for example, HTTP server, mail server, samba server, ntp server etc.
- Appear for RED HAT Certification exam in Linux Administration after the completion of this course.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Linux	10
2.	Package, User and group	9
3.	Configuring local storage and filesystem	7
4.	Managing system and infrastructure services	9
5.	OpenSSH and Linux security	7

B. DETAILED SYLLABUS

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Unit	Unit Details
1.	Introduction to Linux
	<ul style="list-style-type: none"> Introduction to Operating system - Types of Operating system - Multi user operating system - Open source licensing - History of Linux - Unix Vs Linux - Flavors of Linux - Benefits and characteristics of Linux - Installation of Linux - Linux booting process - Log in and switch users in multiuser run levels - Shell and bash features - Linux kernel - sudo vs su - Date and time configuration - Linux run levels. Directories and files: Directory structure - System directory - Absolute path and relative path - Creating and removing directory - Changing directory path - Creating - removing - copying and moving files - File Permissions - Links - hard link and soft link - Input and output redirection - Filters and pipes - Locate - read - and use system documentation including man pages
2.	Package, User and group Management
	<ul style="list-style-type: none"> RPM - YUM - Archive - Compress - unpack and uncompress files using tar - star - gzip - and bzip2 - Create - delete - and modify local user accounts - Change passwords for local user accounts - Create - delete - and modify local groups and group memberships - Changing owner and modes.
3.	Configuring local storage and filesystem
	<ul style="list-style-type: none"> List - create - delete - and partition type for primary - extended - and logical partitions - Create and remove physical volumes - assign physical volumes to volume groups - Create and delete logical Volumes. - Create - mount - unmount - ext2 - ext3 - and ext4 file systems. - Mount - unmount - and LUKS-encrypted file systems. Access control list
4.	Managing system and infrastructure services
	<ul style="list-style-type: none"> Managing system services - Shutting down - suspending and hibernating the system - Controlling systemd on remote machine - Creating and modifying systemd unit files - DHCP Configuration - HTTP server Configuration - FTP server Configuration - Mail server Configuration - Samba server Configuration - NTP server Configuration - NFS server Configuration
5.	OpenSSH and Linux security
	<ul style="list-style-type: none"> OPENSSH - The SSH Protocol - Configuring OpenSSH and Starting an OpenSSH Server Key-Based Authentication in OpenSSH - OpenSSH Clients - Using the ssh Utility - scp Utility and sftp Utility - Configure firewall settings using system-config-firewall or iptables - Set enforcing and permissive modes for SELinux - List and identify SELinux file and process context



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Sr. N	Reference Books	Author	Edition	Publication
1	RHCSA/RHCE Red Hat Linux Certification Study Guide Exams EX200 & EX300	Jang Orsaria	July 2017	McGraw-Hill
2	Red Hat RHCSA/RHCE 7 Cert Guide: Red Hat Enterprise Linux 7 (EX200 and EX300)	Sander Van Vugt	2009	Phi Learning Pvt Ltd

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




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Practical Subjects

Code: BCAI303

DBMS Lab

2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- A database management system (DBMS) is collection of software meant to manage a Database. Many popular databases currently in use are based on the relational database model.
- RDBMSs have become a predominant choice for the storage of information in new databases used for financial records, manufacturing and logistical information, personnel data and much more.
- The course covers the basic concepts of databases in general with an emphasis on relational databases, modeling techniques and writing queries. Normalization techniques, Transaction processing, Concurrency Control techniques and Recovery of databases against crashes are also covered

COURSE OUTCOME: After completion of this course students should be able:-

- Understand the concept of Database Management
- Able to perform Database creation/ deletion, table creation/ deletion.
- Understanding Query Execution
- Able to check Validity of Query
- Designing of a database management system

A. List of Experiments

Experiments
<ol style="list-style-type: none"> 1. Perform following actions using SQL statements <ol style="list-style-type: none"> (i) Create a new user with name "shiva" and password "kumar@1" (ii) Assign the following privileges (iii) Create and drop tables, Create and drop users, Allow to assign above privileges to new users, List all tables in the database, (iv) List all users in the database, Logout from current user and log in as "shiva" 2. Create following tables and insert minimum 10 rows in to each table <ol style="list-style-type: none"> (i) Department table with following columns with appropriate data types: DeptId, DeptName, DeptLoc (ii) Employee table with following columns with appropriate data types: EmpId, EmpName, DOB, DOJ, Job, Salary (iii) Product table with following columns with appropriate data types: ProdId, ProdName, Price (iv) Sales table with following columns with appropriate data types: SalesId, Date, Quantity



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Experiments

3. Update above tables with following features using SQL statements
 - (i) Make DeptId in Department table as Primary Key
 - (ii) Make EmpId in Employee table as Primary Key
 - (iii) Add DeptId column to the Employee table and make it foreign key from Department table and update the values
 - (iv) Add EmpId and ProdId to the Sales table and make them foreign key from Employee and Product table and update the values
4. Update all columns in all tables with appropriate constraint such as not null, check and so on
5. Perform the following SQL statements
 - (i) Create a view "EmpDeptView" from Employee and Department table which contains following columns (EmpName, DOB, Salary, DeptId, DeptName, Loc)
 - (ii) Retrieve all employees whose salary between 25,000 to 30,000
 - (iii) Retrieve all employees who is working in Accounts department (If it is not there add this row to Department table)
 - (iv) Retrieve all employees who is working other than Accounts department
 - (v) Retrieve all employees who is working in Accounts department (If it is not there add this row to Department table)
 - (vi) Retrieve all employee who is working in Sales department and Bangalore location
 - (vii) Retrieve all employees who completed minimum 5 years Retrieve all employees who completed minimum 5 years and salary less than 30,000
6. Perform the following SQL statements
 - (i) Retrieve all employees whose salary more than 30,000
 - (ii) Retrieve employee details who is getting maximum salary
 - (iii) Retrieve employee details who is getting minimum salary
 - (iv) Retrieve employee details who is getting 3rd maximum salary
 - (v) Retrieve employee details who is getting 5th minimum salary
 - (vi) Retrieve total number of employees in each department in Bangalore location
 - (vii) Retrieve total number of employees in each location
 - (viii) Retrieve total number of employees in each location in Accounts department
 - (ix) Retrieve total number of employees who complete more than 10 years in each department
7. Write a PL/SQL Procedure to find prime number from 1 to n, n is a user input or parameter
8. Write a PL/SQL Functions to return number of days an employee working using EmpId
9. Write a PL/SQL Procedure to find sum of salaries of all employee working in a particular location
10. Write a PL/SQL Function to return sum of sales by ProdId
11. Write a PL/SQL Function to return sum of sales by EmpId
12. Write a PL/SQL Procedure to generate Employee Report department wise as follows:
 - (i) DeptName; EmpName; Job; Location; Salary; Cumulative_Salary



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Experiments

13. Write a PL/SQL Trigger to insert row into OldEmployee table when a employee deleted from Employee table (Create OldEmployee table)
14. Write a PL/SQL Trigger not to delete more than 2 employees at a time
15. Write a PL/SQL Trigger not to update employee salary if it cross 67000
16. Write a PL/SQL Package with following procedures and functions Procedures:
 - (i) Print Total Quantity Sales Summary Report(SalesId, Date, Quantity and Total Quantity)
 - (ii) Print Total Quantity Sales Summary Report by Date wise
 - (iii) Functions:
 - (iv) Return employee name who made maximum sales till date
 - (v) Return product name soled maximum quantity till date

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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COURSE OVERVIEW AND OBJECTIVES:

- To understand the virtualization and Cloud Technology
- Implementing Virtualization using Hypervisors
- To understand the vSphere components and its features.
- Understanding and implementing the Storage Virtualization
- Implementing Network virtualization using VMware NSX
- How to Secure the ESXi and vCenter Servers
- Monitoring the performance of resources used in SDDC

COURSE OUTCOME: After completion of this course students should be able:-

- To understand various components like Compute, Memory and Storage, Network and software application, operating system, database etc. and the multiple parameters affecting performance.
- In depth knowledge of the various performance measurement techniques for performance monitoring, reporting, comparison and analysis and tools.
- To understand Virtual machines and Implementation of virtual machines
- To understand tools and techniques for creating virtual machines and environment.
- To understand network virtualization and NSX.

A. List of Experiments

Experiments
1. Installing and configuring ESXi 5.5/6.0 Server [On Premise]
2. HOL-2010-01-SDC:
(i) Introduction to Management with vCenter Server, Networking And Security
3. HOL-2010-01-SDC:
(i) Introduction to vSphere Storage
4. HOL-1808-01-HCI - vSAN v6.6 - Getting Started
(i) vSAN 6.6 Setup and Enablement
(ii) vSAN Scale Out with Configuration Assist
(iii) vSAN All Flash Capabilities, vSANiSCSI Target, vSAN Encryption
(iv) vSAN PowerCLI and ESXCLI, vSAN Stretched Cluster
5. HOL-1808-01- NET - VMware NSX - Getting Started
(i) NSX Manager Installation and Configuration, Logical Switching
(ii) Logical Routing, Edge Services Gateway
6. HOL-1811-04-SDC - vSphere Security - Getting Started
(i) Automating Password Complexity for ESXi Users
(ii) Forensic Security with vRealize Log Insight
(iii) VM Encryption and Encrypted vMotion
(iv) Secure Boot for Hosts and VMs
(v) No-Cryptography Administrator Roles and Permissions




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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Sup

Code: BCAI304 Business Communication & Presentation Skills 2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- To train students in how to be effective communicators by practicing various skills and also help those in becoming well-groomed individuals in terms of both verbal and non-verbal communication.

COURSE OUTCOME: After completion of this course students should be able:-

- Trained to be effective communicators by practicing various skills.
- Well-groomed individuals in terms of both verbal and non-verbal communication.
- To overcome nervousness and stage fear at the end of the course.
- Trained for effective email writing, Resume preparation, report writing etc.
- Develop effective presentation skills.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Principles of Effective written communication	12
2.	Letter writing	11
3.	Email & Memo writing	11
4.	Precise Writing & Report Writing	11
5.	Resume writing	11

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Principles of Effective written communication
	<ul style="list-style-type: none"> 7 C's of Business communication: Clarity, Completeness, Conciseness, Consideration, Courtesy, Correctness, and Concreteness. Practice sessions for business writing.
2.	Letter writing
	<ul style="list-style-type: none"> Structure & Planning, Types of Letter: Leave letter, Cover Letter, Application Letter. Persuasive Writing: AIDA; practice sessions on letter writing.
3.	Email & Memo writing
	<ul style="list-style-type: none"> Importance of Email & Memo writing in the business world, Format of Email & Memo, Structure of Email & Memo, practice sessions on email and memo writing

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4.	Precise Writing & Report Writing
	<ul style="list-style-type: none"> Techniques of Precise writing, qualities of a good precise. Different types of Report – sales report, Annual report, Technical report, Components of a good report focusing on how to write short reports, practice sessions on report writing
5.	Resume writing
	<ul style="list-style-type: none"> Components of a good resume, different formats of resume, resume writing practice Conducting Effective Meetings Different Types of meetings: Business meetings, Review meetings, Preparation for the meeting – Writing Agenda, MOM. Presentation Skills Planning & developing effective Presentation, Do's & don'ts of a good presentation, use of Effective visual aids in a presentation

Sr. N	Reference Books	Author	Edition	Publication
1	Business Communication Strategies	Matthukutty Monippally M	Latest Edition	Tata McGraw-Hill
2	Business Communication; Concepts, Cases, & Applications	Chaturvedi P.D. et al	Latest Edition	Pearson Education
3	Communication for Business	Shirley Taylor	Latest Edition	Pearson Education
4	Basic Business Communication	Lesiicar and Flatley	Latest Edition	TMC
5	Business Communication Today	Courtan L. Bovee et al.,	Latest Edition	Pearson Education
6	Business communication	Meenakshi Raman & Prakash Singh	Latest Edition	Oxford University Press

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	3	3	1	3	2	2	2
CO2	—	—	—	—	—	2	3	1	3	1	1	—
CO3	—	—	—	—	—	—	—	—	3	—	—	—
CO4	—	—	—	3	—	—	—	—	—	—	—	—
CO5	2	2	2	2	—	—	—	—	—	—	—	—

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CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAI305

Summer Project Seminar I

1 Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- The objective of Summer Project is to enable the student to take up investigative study in field of Computer application with emphasis on their specialization. This is expected to provide a good initiation for the student(s) in Industry practices. The students are expected to investigate, model and present their work either individually or in groups (to be decided by the department) to the departmental committee.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development.

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TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Cloud Technology and Information Security)****Semester IV**

S.No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P		
1	BCAICT401	PC	Storage and Datacenter	3	0	0	3	3
2	BCAI401	PC	Python Programming	3	0	0	3	3
3	BCAICT402	PC	Cloud Web services	3	0	0	3	3
4	BCAICT403	PC	Ethical Hacking	3	0	0	3	3
5		PE	Elective-II	3	0	0	3	3
6	BCAICT406	PC	Ethical Hacking Lab	0	0	4	4	2
7	BCAI402	PC	Python Programming Lab	0	0	2	2	1
8	BCAICT407	PC	Cloud Web Services Lab	0	0	2	2	1
9	BCAI403	HSM	Logical Reasoning and Thinking	0	0	4	4	2
TOTAL				15	0	12	27	21

Course Code	Program Elective-II
BCAICT404	Network Security
BCAICT405	Database security fundamentals



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Core Theory Subjects**Code:** BCAICT-401**Storage and Datacenter****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To impart the basic concepts of Storage systems and Datacenter environment.
- To understand concepts about RAID techniques.
- To understand basic concepts about NAS and SAN.
- To understanding about taking backup and restoring the data with the help of Business Continuity and Disaster Recovery concepts and tools.
- To understand about Data Center Consolidation and Clustering.

COURSE OUTCOME: After completion of this course students should be able to:-

- Analyze storage devices and technologies.
- Summarize the advantages and functionality of NAS and SAN
- Appreciate knowledge on Backups and Disaster Recovery.
- Describe Data Center Consolidation and its phases.
- Appreciate knowledge on design and analysis of Cluster Architecture.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Storage System	8
2.	Storage Networking Technologies	9
3.	Backup and Disaster Recovery	9
4.	Data Center Consolidation	7
5.	Data Center Clusters	9



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B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Storage System
	<ul style="list-style-type: none"> • Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing • Data Center Environment: Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application • Data Protection (RAID): RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison.
2.	Storage Networking Technologies
	<ul style="list-style-type: none"> • Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization. • Fibre Channel Storage Area Networks: Fibre Channel Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN. • IP SAN and FCoE: iSCSI, FCIP, FcoE • RAID and Storage Networking Technologies : Implementation of RAID - Software RAID - Hardware RAID -RAID Array Component -RAID Levels - Striping - Mirroring - RAID Impact on Disk-Performance - Introduction to Direct Attached Storage – Types of DAS – Introduction to SAN – Components of SAN – FC connectivity – FC topologies – Introduction to NAS – NAS components – NAS Implementation – NAS File sharing.
3.	Backup and Disaster Recovery
	<ul style="list-style-type: none"> • Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. • Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture.

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Unit	Unit Details
4.	Data Center Consolidation
	<ul style="list-style-type: none"> • Reasons for Data Center Consolidation: Reasons for Data Center Consolidation, Consolidation Opportunities. • Data Center Consolidation Phases: Phase 1: Study and Document the Current Environment, Phase 2: Architect the Target Consolidated Environment, Phase 3: Implement the New Architecture, Phase 4: Control and Administer the Consolidated. • Best Practices in IT: Defining Best Practices, Deploying Best Practices, Benefits of Best Practices, Systems Management Best Practices, Server Cluster Best Practices, Data Storage Best Practices, Network Management Best Practices, Documentation Best Practices, Network Diagram Documentation, Documentation Formats.
5.	Data Center Clusters
	<ul style="list-style-type: none"> • Cluster Architecture: Asymmetric Two-Node Clusters, Symmetric Two-Node Clusters, Complex Cluster Configurations, Failover Policies, Best Practices. • Cluster Requirements: Required Hardware Cluster Components, Cluster Software Requirements, What Happens During Service Failover, Cluster Installation Checklist. • Designing Cluster-Friendly Applications: Automating Operations, Controlling Application Failover Time, Reducing Data Loss During Failover, Minimizing Application Failures, Designing Node-Independent Applications, Minimizing Planned Downtime, Restoring Client Connections.

Sr. N	Reference Books	Author	Edition	Publication
1	Information Storage and Management (Storing Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments)	Somasundaram Gnanasundaram Alok Shrivastava	2 nd Edition	McGraw-Hill Education
2	Administering Data Centers: Servers, Storage, and Voice over IP	KailashJayaswal	Latest	ISBN-13: 978-0471771838
3	Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, ISCSI, INFINIB and FOCE	Ulf Troppens	Latest	Wiley



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Code: BCAI-401

Python Programming

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To setup the environment to run the python programs
- To understand concepts about Data Types and Looping techniques
- To understand and implement the OOP concepts, Decorators, and Iterators
- To understand and build the Web Applications
- Debugging and Troubleshooting Python Programs.

COURSE OUTCOME: After completion of this course students should be able to:-

- Install and Run Python Program. Write functions and Loops in the python program.
- Implementing OOPs concepts while writing Python Program.
- Develop web applications using Django.
- Build microservices in Python.
- Test, Debug and Troubleshoot Python Programs.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Python	8
2.	Advanced Concepts Management	9
3.	Web Development	9
4.	Cloud Native Python	8
5.	Exception Handling	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Python
	<ul style="list-style-type: none"> • Introduction: Introduction to Python, Setting up the environment, Installing Python, Running python program, Python's execution model, Guidelines on how to write good, The Python culture, A note on the IDEs. • Built-in Data Types: Numbers, Immutable sequences, Mutable sequences, Set types, Mapping types – dictionaries, The collections module, Final considerations • Iterating and Making Decisions: Conditional programming, Looping, Putting this all together.



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Unit	Unit Details
2.	Advanced Concepts
	<ul style="list-style-type: none"> • Functions, the Building Blocks of Code: Use of functions, Scopes and name resolution, Input parameters, Return values, Recursive functions, Anonymous functions, Function attributes, Built-in functions, importing objects. • Saving Time and Memory: map, zip, and filter, Comprehensions, Generators, Some performance considerations, Name localization, and Generation behavior in built-ins. • Advanced Concepts – OOP, Decorators, and Iterators: Decorators, Class and object namespaces, Attribute shadowing, Initializing an instance, Accessing a base class, Multiple inheritance, Static and class methods, Private methods and name mangling, The property decorator, Operator overloading, Polymorphism
3.	Web Development
	<ul style="list-style-type: none"> • The Edges – GUIs and Scripts: Scripting-The imports, Parsing Arguments, The business logic, GUI application- The import, The layout logic, The business logic, The tkinter module, The turtle module, wxPython, PyQt, and PyGTK, The principle of least astonishment, Threading considerations. • Web Development Done Right: Django design philosophy, The Django URL dispatcher, Setting up Django, Adding the Entry model, Customizing the admin panel, Creating the form, Writing the views, Tying up URLs and views, Writing the templates, Writing a Flask view, Building a JSON quote server in Falcon.
4.	Cloud Native Python
	<ul style="list-style-type: none"> • Building Microservices in Python: Modeling microservices, Building microservices, Testing the RESTful API. • Building a Web Application in Python: Getting started with applications, Working with Observables and AJAX, Binding data for the adduser template, Working on Observables with AJAX for the addtweet template, Data binding for the addtweet template, CORS - Cross-Origin Resource Sharing, Session management, Cookies. • Interacting Data Services: MongoDB terminology, Initializing the MongoDB database, Integrating microservices with MongoDB, Working with user resources, Working with the tweets resources.
5.	Exception Handling
	<ul style="list-style-type: none"> • Testing, Profiling, and Dealing with Exceptions: The anatomy of a test, Testing guidelines, Unit testing, Test-driven development, Exceptions, Profiling Python. • Debugging and Troubleshooting: Debugging with print, Debugging with a custom function, Inspecting the traceback, Using the Python debugger, Inspecting log files, Other techniques, Troubleshooting guidelines.



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Sr. N	Reference Books	Author	Edition	Publication
1	Learn Python Programming	Fabrizio Romano	2 nd Edition	McGraw-Hill Education
2	Python Cookbook	David Beazley Brian K. Jones	3rd Edition	Oreilly
3	Python Programming: A Step-by-Step Guide For Absolute Beginners	Brian Jenkins and ATS Coding Academy	Latest	Wiley
4	Python and AWS Cookbook: Managing Your Cloud with Python and Boto	Mitch Garnaat	Latest	McGraw-Hill Education
5	Advanced Python Programming: Build high performance, concurrent, and multi-threaded apps with Python using proven design patterns	Dr. Gabriele Lanaro	Latest	McGraw-Hill Education

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAICT-402

Cloud Web Services

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- Introducing cloud computing and Amazon web services.
- Understanding and using EC2 instances.
- Deploying and managing applications on AWS cloud.
- Using AWS security services.
- Implementing the networking concepts on AWS cloud.

COURSE OUTCOME: After completion of this course students should be able to:-

- Gain fundamental understanding of AWS cloud technologies
- Start a Windows or Linux server in the cloud with its own private address.
- Start up a CRM / Word Press / etc. website hosted in cloud.
- Start a highly scalable MySQL or Oracle database in the cloud with multiple read-replica databases (for scalability of database).
- Setup a load-balancer in the cloud.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Cloud Computing and Amazon Web Services	9
2.	Introduction to EC2	8
3.	Web Applications and Security	9
4.	AWS Storage	8
5.	AWS Networking	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Cloud Computing and Amazon Web Services
	<ul style="list-style-type: none"> • Introduction to Cloud Computing, Cloud Service Delivery Models (IAAS, PAAS, SAAS), Cloud Deployment Models (Private, Public, Hybrid and Community), Cloud Computing Security, Case Study • Introduction to Amazon Web Services, Why Amazon? Use Cases, AWS Storage Options, AWS Compute Options, AWS Database Options, AWS Workflow Automation and Orchestration Options, AWS Systems Management and Monitoring Options, AWS Virtual Private Cloud Introduction, Pricing Concepts



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Unit	Unit Details
2.	Introduction to EC2
	<ul style="list-style-type: none"> Introduction To EC2, Instance Types And Uses, Auto scaling Instances, Amazon Machine Images (AMIS), Modifying Existing Images, Creating New Images of Running Instances, Converting An Instance Store AMI To An EBS AMI, Instances Backed By Storage Types, Elastic IPS, Elastic Load Balancing
3.	Web Applications and Security
	<ul style="list-style-type: none"> Introduction to Elastic Beanstalk, Deploying Scalable Application On AWS, Selecting And Launching An Application Environment, Provisioning Application Resources with Cloud formation, Introduction to CloudWatch, Describe Amazon Cloud Watch metrics and alarms, AWS Messaging Services(SNS,SQS,SES). Introduction to AWS Security, Describe Amazon Identity and Access Management (IAM), AWS Directory Service, AWS Key Management Service, Securing Data at Rest and In Motion,
4.	AWS Storage
	<ul style="list-style-type: none"> Amazon Storage, S3 Storage Basics, Buckets and Objects, Creating A Web Server Using S3 Endpoints, Managing Voluminous Information with EBS, Glacier Storage Service , Describe Amazon Dynamo, Understand key aspects of Amazon RDS, Launch an Amazon RDS instance
5.	AWS Networking
	<ul style="list-style-type: none"> Introduction to AWS Networking , Access Control Lists (ACLs), Setting Up a Security Group, Setting Up VPC And Internet Gateway, Setting Up A VPN, Setting Up A Customer Gateway For VPN, Setting Up Dedicated Hardware For VPC, Scenario 1:VPC With A Public Subnet Only (Standalone Web), Scenario 2: VPC with Public And Private Subnets (3 Tier App), Scenario 3:VPC With Public And Private Subnets And Hardware VPN Access (Web On The Cloud, Database and App On Prem) Scenario 4: VPC With A Private Subnet Only And Hardware VPN Access. (Extension Of Your Corporate Network), Route53 for DNS System, Cloud front, Case Study.



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Sr. N	Reference Books	Author	Edition	Publication
1	AWS Certified Solutions Architect Official Study Guide: Associate Exam	Joe Baron, Hisham Baz , Tim Bixler , Biff Gaut , Kevin E. Kelly , Sean Senior , John Stamper	2017	Wiley and Sons
2	AWS Certified Solutions Architect Official Study Guide: Associate Exam	Yohan Wadia	2016	John Packt Publishing
3	Amazon Web Services for Dummies	Bernald Golden	2013	Wiley & Sons

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

Code: BCAICT-403

Ethical Hacking

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To help students understand how ethical hacking is used as a method to prevent hacking.
- To make it possible for students to learn the process of identifying vulnerabilities and exploits of the technological ecosystem comprising of various hardware, software, network, OS and applications and identify suitable countermeasures.
- To facilitate students, appreciate the need for understanding non-technology aspects of ethical hacking such as legal frameworks, documentation and report writing.

COURSE OUTCOME: After completion of this course students should be able to:-

- Explain the importance of ethical hacking in achieving the goals of information security.
- Differentiate the processes of vulnerability assessment and ethical hacking from penetration testing.
- Comprehend the importance of appropriate countermeasures for managing vulnerabilities.
- Justify the need for meticulous documentation in writing reports for consumption of both technical and management audiences.
- Articulate the rationale for having an adequate legal framework for dealing with hacking and ethical hacking.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Ethical Hacking	9
2.	Hacking Methodology	8
3.	Web and Network Hacking	9
4.	Report writing & Mitigation	8
5.	Ethical Hacking and Legal System	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Ethical Hacking
	<ul style="list-style-type: none"> • Hacking Methodology, Process of Malicious Hacking, and Foot printing and scanning: Foot printing, scanning. Enumeration: Enumeration. System Hacking and Trojans: System Hacking, Trojans and Black Box Vs. White Box Techniques.




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2.	Hacking Methodology
	<ul style="list-style-type: none"> Denial of Service, Sniffers, Session Hijacking and Hacking Web Servers: Session Hijacking, Hacking Web Servers. Web Application Vulnerabilities and Web Techniques Based Password Cracking: Web Application Vulnerabilities, Web Based Password Cracking Techniques
3.	Web and Network Hacking
	<ul style="list-style-type: none"> SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking. Evading IDS and Firewalls: Evading IDS and Firewalls.
4.	Report writing & Mitigation
	<ul style="list-style-type: none"> Introduction to Report Writing & Mitigation, requirements for low level reporting & high level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues identified including tracking
5.	Ethical Hacking and Legal System
	<ul style="list-style-type: none"> Overview of India's Information Technology Amendment Act 2008 (IT Act 2008), hacker vs cracker, liabilities – civil and penal, cyber theft and IPC sec 378, IT Act 2008 – sections 43, 65 and 66, how to file a complaint of suspected hacking, Case Studies, understanding how hacking is legally dealt with among BRICS countries

Sr. N	Reference Books	Author	Edition	Publication
1	Gray Hat Hacking The Ethical Hackers Handbook	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle	3rd Edition	McGraw Hill Education
2	CEH v9: Certified Ethical Hacker Version 9 Study Guide	Sean-Philip Oriyano	Stg edition	Sybex
3	Hacking for Beginners: Ultimate 7 Hour Hacking Course for Beginners. Learn Wireless Hacking, Basic Security, Penetration Testing	Anthony Reynolds	2017	CreateSpace Independent Publishing Platform
4	The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy	Patrick Engebretson	2nd Edition	Syngress



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	2	1	3	—	2	3	3	—	—
CO2	2	1	2	2	1	3	—	3	2	3	—	—
CO3	3	1	2	2	1	1	—	3	3	3	—	—
CO4	—	—	—	—	—	—	—	3	3	3	—	—
CO5	—	—	—	—	—	—	—	—	—	2	2	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	—	—
CO-2	3	—	—
CO-3	3	—	—
CO-4	—	2	2
CO-5	—	2	2

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Elective-II**Code: BCAICT-404****Network Security****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To help students understand various characteristics of network security, threats and risks to securing network
- To make it possible for students to learn important network security protocols and means of achieving an effective network security
- To facilitate students, gain hands-on experience of identifying and providing solutions for common network security challenges using various security tools and techniques.

COURSE OUTCOME: After completion of this course students should be able to:-

- Relate fundamental concepts of information security with network and connectivity.
- Understand various characteristics of network security, threats and risks to securing network.
- Learn important network security protocols and means of achieving an effective network security
- Apply their understanding of network security in identifying common issues and propose suitable solutions.
- Articulate the importance of managing the network using policies, processes and framework for effective and efficient security.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Network Security	10
2.	Threats, Vulnerabilities and Attacks	9
3.	Network Security Management	7
4.	Network Security Controls	9
5.	Network Management	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Network Security
	<ul style="list-style-type: none"> • Perimeter Security – Overview of Network Security, Access Control, Device Security, Security features on Switches, Firewall, Types of firewall, Access Management, Multifactor Authentication, Wireless LAN (WLAN) Security and Network Admission Control (NAC).




Unit	Unit Details
2.	Threats, Vulnerabilities and Attacks
	<ul style="list-style-type: none"> Threat; Vulnerabilities; Attacks – Application Attack, Network Attack and Mitigating & Detering Attacks; Network Security – Security through network devices, Security through Network Technologies and Security through Network Design Elements, Administering a Secure Network
3.	Network Security Management
	<ul style="list-style-type: none"> Secure Socket Layer (SSL) – Introduction to SSL, Open SSL basics, Problems with SSL, Cryptography, Message Digests Algorithms, Digital Signature and Public Key Infrastructure (PKI); Data Privacy – IPsec VPN, Dynamic Multipoint VPN (DMVPN), Group Encrypted Transport VPN (GET VPN), Secure Sockets Layer VPN (SSL VPN) and Multiprotocol Label Switching VPN (MPLS VPN)
4.	Network Security Controls
	<ul style="list-style-type: none"> Network Intrusion Prevention – Overview of Intrusion Prevention System (IPS), Intrusion Detection System (IDS), Deploying IPS and IPS high Availability; host Intrusion Prevention; Anomaly Detection and Mitigation.
5.	Network Management
	<ul style="list-style-type: none"> Security Monitoring and correlation; Security Management - Security and Policy Management and Security Framework and Regulatory Compliance; Best Practices Framework, Case Studies

Sr. N	Reference Books	Author	Edition	Publication
1	Network Security Bible	Eric Cole	2nd Edition	Wiley
2	Network Security: Private Communication in a Public World	Charlie Kaufman, Radia Perlman, Mike Speciner	2nd Edition	Pearson Education
3	Network Security and Administration	Adesh K. Pandey, S.K. Kataria	2013	Kataria & Sons
4	Network Security: A Beginners Guide	Eric Maiwald	3rd Edition	McGraw Hill
5	Information Security: The Complete Reference	Mark Rhodes-Ousley	2nd Edition	McGraw Hill
6	Information Systems Security: Security Management, Metrics, Frameworks and Best Practices	Nina Godbole	1 st Edition	Wiley
7	Hacking Exposed 7: Network Security Secrets and Solutions	Stuart McClure, Joel Scambray, George Kurtz	7 th Edition	McGraw Hill

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	2	3	2	2	3	—	—	—	—	—	—	—
CO2	2	3	3	2	2	—	—	—	—	—	—	—
CO3	3	3	2	3	3	—	—	—	—	—	—	—
CO4	2	2	3	2	2	—	—	—	—	—	—	—
CO5	—	—	—	—	—	—	—	—	3	2	3	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	2	—
CO-2	2	3	—
CO-3	3	3	—
CO-4	3	2	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Elective-II**Code: BCAICT-405 Database Security Fundamentals 3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To help students relate concepts of information security with databases
- To make it possible for students to learn how important principles of Security are implemented in securing the database

COURSE OUTCOME: After completion of this course students should be able to:-

- Relate concepts of information security with databases.
- Justify the need for securing database in mitigating important vulnerabilities.
- Get the basic knowledge of NoSQL database
- Acquire the knowledge about the encryption and permission used in SQL server 2012.
- Acquire the knowledge about the security and auditing in SQL server 2012.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Concepts of Database Security Management System	8
2.	Concepts of NoSQL	9
3.	Encryption and Permissions in SQL Server 2012	8
4.	Security of SQL Server 2012	9
5.	SQL Server Auditing	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Concepts of Database Security Management System
	<ul style="list-style-type: none"> • Database security concept, Importance of data, Levels of data security, Authorization in databases, Issues in database security, Concept of Least Privilege in User ID for databases. Perimeter security, firewalls, intrusion detection, and intrusion prevention.
2.	Concepts of NoSQL
	<ul style="list-style-type: none"> • No SQL databases introduction, Differences from classical DBMS concepts with NoSQL, Advantages of NoSQL like Elastic Scaling, Big Data, Goodbye DBAs', Economics/Cost, Flexible Data models. Non/ partial applicability of ACID (Atomicity, Consistency, Isolation, Durability), BASE Properties, CAP theorem, comparison to traditional RDBMS databases. Horizontal scalability, Benefits of NoSQL Databases compared to traditional Databases.

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Unit	Unit Details
	<ul style="list-style-type: none"> Concept of UnSQL or Unstructured Query Language, Concept of Key Value & Tuple Store Databases, Concept of Graph Databases, Concept of Multimodel Databases
3.	Encryption and Permissions in SQL Server 2012
	<ul style="list-style-type: none"> Understanding permissions, Creating and using database roles, using schemas for security, configuring cross-database security. Code and Data Encryption- Using service and database master keys, creating and using symmetric and asymmetric keys, creating and storing hash values, Authenticating stored procedure by signature
4.	Security of SQL Server 2012
	<ul style="list-style-type: none"> User authorization, authentication and security, protecting data using permissions, roles, schemas, SQL firewall, web application firewall, securing dynamic SQL from injections, protecting SQL server from DoS and injection attacks.
5.	SQL Server Auditing
	<ul style="list-style-type: none"> Auditing – Using the profiler to audit SQL server access, using DML trigger for auditing data modification, Using DDL triggers for auditing structure modification, configuring SQL server auditing, auditing and tracing user configurable events, policy based management, system centre advisor to analyze instances

Sr. N	Reference Books	Author	Edition	Publication
1	Database security	SilvanaCastano	2nd Edition	Addison-Wesley Professional
2	Microsoft SQL server 2012 Security Cookbook	Rudi Bruchez	1st Edition	PACKT publishing
3	Handbook of database security: Applications and Trends	Michael Gertz, SushilJajodia	1st Edition	Springer
4	Network Security: A Beginners Guide	Eric Maiwald	3rd Edition	McGraw Hill
5	Implementing database security and auditing	Ron Ben-Natan	1 st Edition	Digital Press
6	Information Systems Security: Security Management, Metrics, Frameworks and Best Practices	Nina Godbole	1 st Edition	Wiley



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Sub

Practical Subjects

Code: BCAICT-406

Ethical Hacking Lab

2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- To help students understand how ethical hacking is used as a method to prevent hacking.
- To make it possible for students to learn the process of identifying vulnerabilities and exploits of the technological ecosystem comprising of various hardware, software, network, OS and applications and identify suitable countermeasures.
- To facilitate students, appreciate the need for understanding non-technology aspects of ethical hacking such as legal frameworks, documentation and report writing.

COURSE OUTCOME: After completion of this course students should be able to:-

- Get the practical knowledge to scan the network to find out how many active hosts, open ports and current running services.
- Get the practical knowledge to perform user system surveillance and write a mitigation report on the same.
- Get the practical knowledge to exploit NetBIOS vulnerability and password revelation from browsers and social networking application using Key Logger and Trojan
- Get the practical knowledge to perform denial service attack on a server operating system and write a report on the same with mitigation strategy.
- Get the practical knowledge to perform man-in-the-middle attack and hijack an established session of a user. Write a report on the same with mitigation strategy.

A. List of Experiments

Experiments
<ol style="list-style-type: none"> 1. Perform network scan to revile active hosts, open ports and services running. 2. Perform user system surveillance and write a mitigation report on the same. 3. Perform privilege escalation attack on Client operating system and gain control of a Client operating system and write a short note on its mitigation strategy. 4. Demonstrate ARP Poisoning and detect ARP Poisoning in switch-based network. 5. Perform man-in-the-middle attack and hijack an established session of a user. Write a report on the same with mitigation strategy. 6. Crack FTP credentials using dictionary attack and write a report of possible suggestion on hardening the login services. 7. Perform user system surveillance and write a mitigation report on the same. 8. Exploiting NetBIOS vulnerability and password revelation from browsers and social networking application using Key Logger and Trojan.

CO-PO Mapping




COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	2	1	3	—	2	3	3	—	—
CO2	2	1	2	2	1	3	—	3	2	3	—	—
CO3	3	1	2	2	1	1	—	3	3	3	—	—
CO4	—	—	—	—	—	—	—	3	3	3	—	—
CO5	—	—	—	—	—	—	—	—	—	2	2	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	—	—
CO-2	3	—	—
CO-3	3	—	—
CO-4	—	2	2
CO-5	—	2	2

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Sup

Code: BCAI-402

Python Programming Lab

1Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- To setup the environment to run the python programs
- To understand concepts about Data Types and Looping techniques
- To understand and implement the OOP concepts, Decorators, and Iterators
- To understand and build the Web Applications
- Debugging and Troubleshooting Python Programs.

COURSE OUTCOME: After completion of this course students should be able to:-

- Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
- Express different Decision Making statements and Functions, Interpret Object oriented programming in Python
- Understand and summarize different File handling operations
- Explain how to design GUI Applications in Python and evaluate different database operations
- Design and develop Client Server network applications using Python

A. List of Experiments

Experiment
1. Write a python code to find given number is prime or not
2. Write a python code to find LCM and GCM of a given list
3. Write a python code to find mean and standard deviation of a given list of numbers
4. Write a python code to add and delete element from a dictionary using functions
5. Write a python code to print 10 student details using class and lists
6. Write a python code to find student from a given list using class
7. Write a python code to inherit employee class to student class
8. Write a python code to build simple GUI calculator
9. Write a python code to build web page with student registration form
10. Write a python code to build web pages with sign-in and sing-up forms
11. Write a python code to build Rest API for product
12. Write a python code to build Ajax enabled web application for product



CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

Sub



Code: BCAICT-407

Cloud Web Services Lab

1Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- Introducing cloud computing and Amazon web services.
- Understanding and using EC2 instances.
- Deploying and managing applications on AWS cloud.
- Using AWS security services.
- Implementing the networking concepts on AWS cloud.

COURSE OUTCOME: After completion of this course students should be able to:-

- Get practical knowledge of Amazon Simple storage services.
- Get practical knowledge of Amazon Internet-of-Things.
- Get practical knowledge of Amazon API Gateway.
- Get practical knowledge of Amazon Lambda
- Get practical knowledge of Amazon Elastic File System

A. List of Experiments**Experiments**

1. Introduction to Amazon Simple Storage Service (S3)
2. Introduction to Amazon Cloud Front
3. Introduction to AWS Key Management Service
4. Introduction to Amazon Elastic search Service
5. Introduction to Amazon Dynamo DB
6. Introduction to Amazon API Gateway
7. Introduction to Amazon Redshift
8. Introduction to Amazon Aurora
9. Introduction to Amazon Machine Learning
10. Introduction to AWS Database Migration Service
11. Introduction to AWS Lambda
12. Introduction to AWS Internet-of-Things (IoT)
13. Introduction to AWS Device Farm
14. Introduction to Amazon Kinesis Firehose
15. Introduction to Amazon Route 53
16. Introduction to Amazon Elastic File System (EFS)

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CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




Code: BCAI-403

Logical Reasoning and Thinking**2 Credits [LTP: 0-0-4]****COURSE OVERVIEW AND OBJECTIVES:**

- To help students learn the techniques of enhancing and sharpening their aptitude skills related to verbal ability, quantitative aptitude, logical reasoning and data presentation.

COURSE OUTCOME: After completion of this course students should be able to:-

- Learn the techniques of enhancing and sharpening their aptitude skills.
- To improve verbal ability
- To improve logical reasoning.
- The skills for data interpretation.
- To improve is quantitative aptitude, which makes them them ready to clear written aptitude tests in industries and get placed easil y.

A. OUTLINE OF THE COURSE

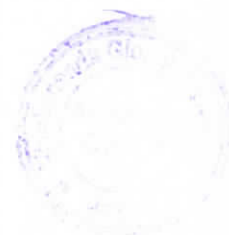
Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Verbal ability	6
2.	Basic quantitative aptitude	5
3.	Logical Reasoning - I	6
4.	Measures of Central Tendency	5
5.	Presentation of Data	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Verbal ability
	<ul style="list-style-type: none"> Synonyms, Antonyms and One word substitutes
2.	Basic quantitative aptitude
	<ul style="list-style-type: none"> Speed, Time and Distance, Time and Work, Linear Equations, Progressions (Sequences & Series), Permutation and Combination, Probability, Functions, Set Theory, Number Systems, LCM and HCF, Percentages, Collection and Scrutiny of data: Primary data, questionnaire and schedule; secondary data, their major sources including some government publications.

Unit	Unit Details
3.	Logical Reasoning – I
	<ul style="list-style-type: none"> Number and Letter Series, Calendars, Clocks, Cubes, Venn Diagrams, Binary Logic, Seating Arrangement, Logical Sequence, Logical Matching, Logical Connectives, Syllogism, Blood Relations; concept of a statistical population and sample from a population; qualitative and quantitative data
4.	Measures of Central Tendency
	<ul style="list-style-type: none"> Objective of averaging, characteristics of good average, types of average, arithmetic mean of grouped and ungrouped data, correcting incorrect values, weighted arithmetic mean Median - median of grouped and ungrouped data merit and limitation of median, computation of quartile, decile and percentile Mode - calculation of mode of grouped and ungrouped data, merits and limitation of mode, relationship between mean, median and mode. Geometric mean and Harmonic mean.
5.	Presentation of Data
	<ul style="list-style-type: none"> Construction of tables with one or more factors of classification; Diagrammatic and Graphical representation of non-frequency data; Frequency distribution, cumulative frequency distribution and their graphical representation - histogram, Column Graphs, Bar Graphs, Line Charts, Pie Chart, Data Interpretation – Introduction and approaches

Sr. N	Reference Books	Author	Edition	Publication
1	Statistics for Management	Richard I Levin, David S. Rubin	5th Edition	Pearson Prentice
2	Business Statistics	Bajpai, N	Latest Edition	Pearson
3	Business Statistics	Sharma J.K.	Latest Edition	Pearson Education
4	Quantitative Methods for Business	Anderson; David R, Dennis J. Sweeney and Thomas A. Williams	Latest Edition	Prentice-Hall, West Publishing
5	CAT Complete course	Mittal	Latest Edition	UPKAR publications

TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Cloud Technology and Information Security)****Semester V**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAICT501	PC	Digital Forensics and Investigation	3	0	0	3	3
2	BCAICT502	PC	Cloud Migration	3	0	0	3	3
3		PE	Elective -III	3	0	0	3	3
4		PE	Elective - IV	3	0	0	3	3
5		PE	Elective -V	3	0	0	3	3
6		GE	Generic Elective – I	3	0	0	3	3
7	BCAICT511	PC	Digital Forensics and Investigation Lab	0	0	2	2	1
8		PE	Elective – III Lab	0	0	2	2	1
9	BCAI501	PR	Mini Project	0	0	8	8	4
10	BCAI502	HSM	Working Towards Placements	0	0	4	4	2
11	BCAI503	ST	Summer Project Seminar II	0	0	2	2	1
TOTAL				18	0	18	36	27

COURSE CODE	Program Elective-III
BCAICT503	PowerShell Scripting
BCAICT504	Infrastructure Automation

COURSE CODE	Program Elective-IV
BCAICT505	Cloud Security
BCAICT506	Application and Web Security

COURSE CODE	Generic-Elective-I
BCAICT509	Introduction to IoT
BCAICT510	Business Intelligence

COURSE CODE	Program Elective-III Lab
BCAICT512	PowerShell Scripting Lab
BCAICT513	Infrastructure Automation Lab

COURSE CODE	Program Elective-V
BCAICT507	IT Governance, Risk, & Information Security Management
BCAICT508	Infrastructure Solutions on ¹²⁸ Cloud



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CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	—	3	3	3	—	—	—
CO2	—	—	—	—	—	—	3	3	3	—	—	—
CO3	—	—	—	—	—	—	3	3	—	3	—	—
CO4	—	—	—	—	—	—	3	3	—	—	—	—
CO5	—	—	—	—	—	—	3	3	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Core Theory Subjects**Code: BCAICT-501 Digital Forensics and Investigation****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- The objective of this class is to emphasize the fundamentals and importance of digital forensics. Students will learn different techniques and procedures that enable them to perform a digital investigation. This course focuses mainly on the analysis of physical storage media and volume analysis.

COURSE OUTCOME: After completion of this course students should be able to:-

- Explain and properly document the process of digital forensics analysis.
- Gain an understanding of the tradeoffs and differences between various forensic tools.
- Describe the representation and organization of data and metadata within modern computer systems.
- understand the inner workings of file systems, create disk images, recover deleted files and extract hidden information
- be introduced to the current research in computer forensics. This will encourage them to define research problems and develop effective solutions

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Digital forensic	10
2.	Windows Systems and artifacts	9
3.	Linux Systems and artifacts	8
4.	Current Computer Forensics Tools	8
5.	Identification of data	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Digital forensic
	<ul style="list-style-type: none"> Computer forensics and investigations as a profession, Understanding computer forensics, computer forensics versus other related disciplines, A brief History of computer Forensics, Understanding case laws, Developing computer forensics resources, Preparing for computer investigations, Understanding law enforcement agency investigations, Following the legal process, Understanding corporate investigations, Establishing company policies, Displaying warning Banners.



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Unit	Unit Details
2.	Windows Systems and artifacts
	<ul style="list-style-type: none"> Windows Systems and Artifacts: Introduction, Windows File Systems, File Allocation Table, New Technology File System, File System Summary, Registry, Event Logs, Prefetch Files, Shortcut Files, Windows Executables.
3.	Linux Systems and artifacts
	<ul style="list-style-type: none"> Linux Systems and Artifacts: Introduction, Linux File Systems, File System Layer, File Name Layer, Metadata Layer, Data Unit Layer, Journal Tools, Deleted Data, Linux Logical Volume Manager, Linux Boot Process and Services, System V, BSD, Linux System Organization and Artifacts, Partitioning, File system Hierarchy, Ownership and Permissions, File Attributes, Hidden Files, User Accounts, Home Directories, Shell History GNOME Windows Manager Artifacts, Logs, User Activity Logs, Syslog, Command Line Log Processing, Scheduling Tasks.
4.	Current Computer Forensics Tools
	<ul style="list-style-type: none"> Evaluating Computer Forensics Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Other Considerations for Tools, Computer Forensics Software Tools, Command-Line Forensics Tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations, Using a Write-Blocker.
5.	Identification of data
	<ul style="list-style-type: none"> Identification of Data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events: How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files, Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, Investigating network Traffic, Investigating Web attacks, Router Forensics. Cyber forensics tools and case studies.

Sr. N	Reference Books	Author	Edition	Publication
1	Digital Forensics with Open Source Tools	Cory Altheide, Harlan Carvey	Latest Edition	Syngress
2	Guide to Computer Forensics and Investigations	Bill Nelson, Amelia Phillips, Christopher Steuart,	4th Edition	Course Technology
3	Digital forensics: Digital evidence in criminal investigation	Angus M.Marshall	2008 Edition	Wiley and Sons



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	3	2	—	—	3	3	—	2	2	3	—
CO2	—	—	—	—	3	—	—	—	—	—	2	—
CO3	—	3	—	—	—	—	—	—	—	—	—	—
CO4	—	2	3	—	3	—	—	—	—	—	—	—
CO5	—	—	—	3	—	—	—	—	—	—	2	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	1	—
CO-2	2	3	—
CO-3	3	1	—
CO-4	2	2	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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Code: BCAICT-502

Cloud Migration

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud computing so that they are able to identify the vendors and assess the risk involved in cloud migration.
- To enable students be aware of the various governance issues in cloud and how to manage the same.

COURSE OUTCOME: After completion of this course students should be able to:-

- Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures..
- Analyze the risks involved in migrating the existing infrastructure to cloud.
- Assess various cloud service providers and generate effective cloud infrastructure by optimizing the cost involved.
- Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.
- Design and develop backup strategies for cloud data based on features.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to cloud and their Challenges	9
2.	Assessing applications for a cloud Migration	8
3.	Cloud Migration Business Strategy	8
4.	Total Cost of Ownership (TCO)	8
5.	Migration Process	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to cloud and their Challenges
	<ul style="list-style-type: none"> • Cloud Migration Terminology, Digital Transformation, Cloud Migration Benefits, Cloud Migration Concerns, Time Table (Gantt chart), AWS CLOUD, Amazon EC2, Amazon S3, Amazon RDS, Amazon Elastic Cache, Amazon Elastic Map Reduce.

Unit	Unit Details
2.	Assessing applications for a cloud Migration
	<ul style="list-style-type: none"> Application Design Complexity, Integration Complexity, The Host OS, The Application Database SWOT analysis: The Usage of SWOT Analysis, Strengths, Weaknesses, Opportunities, Threats
3.	Cloud Migration Business Strategy
	<ul style="list-style-type: none"> Establishing the Migration-Architect Role, Cloud Integration Level, Single Cloud or Multi-Cloud, Setting the Cloud KPIs, Establishing Performance Baselines, Prioritizing Migration Components, Performing any Necessary Refactoring, Creating a Data-Migration Plan, Switching Over Production, Reviewing the Application Resource Allocation, Cloud Migration Technical Strategy, Service Levels, Period of Performance, Invoices, Other Findings of the Study
4.	Total Cost of Ownership (TCO)
	<ul style="list-style-type: none"> Ensuring Costs Optimization on AWS Cloud Performance: Supervising tuning and capacity delivery, Root cause analysis, Restoring service and SLA, Tune, Increasing Resource Allocation, Producing and maintaining the capacity plan
5.	Migration Process
	<ul style="list-style-type: none"> Migrate ERP VM to AWS, VM Import/Export – VoIP Solution, Migrate Survey Solution to AWS

Sr. N	Reference Books	Author	Edition	Publication
1	CLOUD ESSENTIALS CompTIA® Authorized Courseware for Exam CLO-001	Kirk Hausman, Susan L. Cook, Telmo Sampaio	2013 Edition	Wiley & Sons
2	Cloud Computing for Dummies	Judith Hurwitz , Robin Bloor , Marcia Kaufman , Fern Halper	2010 Edition	Wiley Publishing
3	Cloud Computing: Concepts, Technology & Architecture	Erl	2014 Edition	Pearson Education
4	Cloud Computing: A Practical Approach for Learning and Implementation	Srinivasan	2014	Pearson Education




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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




Program Elective-III

Code: BCAICT-503

PowerShell Scripting**3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- Build higher functions
- Use cmdlets plus Microsoft .NET Framework in windows PowerShell
- Write Controller script
- Handle Script error
- Use XML Data records
- Manage Server Configurations by using the desired state configuration
- Examine and debug script
- Understand window PowerShell Workflow

COURSE OUTCOME: After completion of this course students should be able to:-

- Configure and manage networks and computers from the command line.
- Perform and automate common systems administration tasks using Linux shell scripts and Windows PowerShell scripts.
- Access and manipulate different types of data using scripts, write, run, test, and troubleshoot scripts.
- Monitor activities on networks and systems using logging techniques.
- Measure system performance and produce reports using scripts and examine various system commands and interfaces in the Linux and Windows environments.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to PowerShell	10
2.	The PowerShell Pipeline, Scripts and Syntax	9
3.	Security	8
4.	Script Flow Control Statements	7
5.	Error Handling	8




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B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to PowerShell
	<ul style="list-style-type: none"> the Basics: What is PowerShell, PowerShell Cmdlets, PowerShell Snapins, PowerShell Modules, PowerShell Remoting, Navigating in PowerShell
2.	The PowerShell Pipeline, Scripts and Syntax
	<ul style="list-style-type: none"> Pipelines, Scripts, Syntax, Output and Script Blocks, Variables and Data Types, Variable Scopes, and Collections: Variables and Data Types: Variable Scopes, Collections
3.	Security
	<ul style="list-style-type: none"> Script Execution, Signing Scripts, Requesting Credentials and Using Secure Strings, Securing Remote Sessions
4.	Script Flow Control Statements
	<ul style="list-style-type: none"> Foreach and For, While / Do While / Do Until, If / Switch, Break /Continue, Functions, Filters and Modules: Functions and Filters, Scripting with Functions and Parameters, Modules
5.	Error Handling
	<ul style="list-style-type: none"> Error Handling, Script Debugging, Administrative Uses: Manipulating files and folders, Modifying Registry Data, Working with Events, Working with Active Directory Objects, Advanced Scripting

Sr. N	Reference Books	Author	Edition	Publication
1	Learn PowerShell Toolmaking in a Month of Lunches	Jeffery Hicks, Don Jones	Latest Edition	Manning Publications
2	Windows PowerShell Cookbook: The Complete Guide to Scripting Microsoft's Command Shell	Lee Holmes	2010 Edition	O'Reilly
3	Learn Windows PowerShell in a Month of Lunches	Jeffery Hicks, Don Jones	3 rd Edition	Manning Publications

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CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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Program Elective-III

Code: BCAICT-504

Infrastructure Automation

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- Introducing cloud computing and Amazon web services with Ansible.
- Understanding and using EC2 instances with Ansible.
- Deploying and managing applications on AWS cloud.
- Using AWS security services with Ansible.
- Implementing the networking concepts on AWS cloud with Ansible.

COURSE OUTCOME: After completion of this course students should be able to:-

- Get practical knowledge of Amazon Simple storage services with Ansible.
- Get practical knowledge of Amazon Internet-of-Things with Ansible.
- Get practical knowledge of Amazon API Gateway with Ansible.
- Get practical knowledge of Amazon Lambda with Ansible.
- Get practical knowledge of Amazon Elastic File System with Ansible.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Provisioning	11
2.	Provisioning on cloud	11
3.	System Provisioning and Configuration Management	10
4.	Topics from terraform	10

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Provisioning
	<ul style="list-style-type: none"> • Understanding provisioning • Significance of Provisioning • Test machines • Provisioning for deployments
2.	Provisioning on cloud
	<ul style="list-style-type: none"> • Provisioning machines • Automated provisioning

Unit	Unit Details
3.	System Provisioning and Configuration Management
	<ul style="list-style-type: none"> State of various tools in Provisioning and Configuration Reasons for using provisioning and configuration tools Examples: Automation, preventing errors, tracking of changes Examples of tools and their capabilities"
4.	Topics from terraform
	<ul style="list-style-type: none"> Fundamentals Variables, Conditions, Loops
5.	TCL
	<ul style="list-style-type: none"> State Management Workspaces, Modules

Sr. N	Reference Books	Author	Edition	Publication
1	Get started with Ansible	Lorin Hochstein	Latest	Wiley and Sons
2	Ansible Configuration Management	Daniel Hall	Latest	John Packt Publishing

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—




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CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Program Elective-IV**Code: BCAICT-505****Cloud Security****3 Credits [LTP: 3-0-0]**

COURSE OVERVIEW AND OBJECTIVES: Students will learn and develop understanding of the following:

1. Fundamentals of cloud computing architectures based on current standards, protocols, and best practices intended for delivering Cloud based enterprise IT services and business applications.
2. Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.
3. Approaches to designing cloud services that meets essential Cloud infrastructure characteristics – on-demand computing, shared resources, elasticity and measuring usage.
4. Design security architectures that assures secure isolation of physical and logical infrastructures including compute, network and storage, comprehensive data protection at all layers, end-to-end identity and access management, monitoring and auditing processes and compliance with industry and regulatory mandates.

COURSE OUTCOME: Upon successful completion of this course, students will be able to:

- Articulate the differences between deployment models (public, private, hybrid, and community) versus service models (infrastructure-, platform-, and software-as-a-service) of cloud computing.
- Describe cloud security architectures from the perspectives of: providers, brokers, carriers, and auditors. Describe a methodology for orchestrating a cloud ecosystem.
- Understand how cloud computing changes the traditional enterprise security considerations compared to on-premise.
- Understand how identity management considerations are different in the cloud, compared to on-premise.
- How shared security responsibilities change in each service model.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Security Concepts	8
2.	Multi-Tenancy Issues	9
3.	Virtualization System-Specific Attacks	8
4.	Technologies For Virtualization-Based Security Enhancement	8
5.	Legal and Compliance Issues	9




B. DETAILED SYLLABUS

Unit	Unit Details
1.	Security Concepts
	<ul style="list-style-type: none"> Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; Cryptographic Systems- Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.
2.	Multi-Tenancy Issues
	<ul style="list-style-type: none"> Isolation of users/VMs from each other. How the cloud provider can provide this; Virtualization System Security Issues- e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).
3.	Virtualization System-Specific Attacks
	<ul style="list-style-type: none"> Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.
4.	Technologies For Virtualization-Based Security Enhancement
	<ul style="list-style-type: none"> IBM security virtual server protection, virtualization-based sandboxing; Storage Security- HIDPS, log management, Data Loss Prevention. Location of the Perimeter.
5.	Legal and Compliance Issues
	<ul style="list-style-type: none"> Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

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Sr. N	Reference Books	Author	Edition	Publication
1	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance	Tim Mather, Subra Kumaraswamy, ShahedLatif	Ist Edition	O'Reilly
2	Cloud Security	Ronald L. Krutz, Russell Dean Vines	2010 Edition	O'Reilly
3	Cloud Computing	John Rittinghouse, James Ransome	Ist Edition	CRC Press
4	Securing the Cloud	J.R. ("Vic") Winkler	2011	Syngress
5	Security Guidance for Critical Areas of Focus in Cloud Computing	Cloud Security Alliance	2009 Edition	Syngress
6	VMware Security Hardening Guide	Vmware	2011 June	WhitePaper
7	Top Threats to Cloud Computing	Cloud Security Alliance 2010	2013 Edition	Microsoft

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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Program Elective-IV

Code: BCAICT-506

Application and Web Security

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- The primary objective of this course is to study and practice fundamental techniques in developing secure web based applications, including vulnerability of web based applications and how to protect those applications from attacks.
- In addition, advanced topics related to Web, such as E-commerce security, Web 2.0, collaborative Web-based applications, etc., will also be studied.

COURSE OUTCOME: After completion of this course students should be able to:-

- Understand security-related issues in Web-based systems and applications; understand the fundamental security components of a computer system.
- Be able to evaluate a Web-based system with respect to its security requirements and understand the process of developing secure networked systems.
- Understand the fundamental mechanisms of securing a Web-based system.
- Be able to implement security mechanisms to secure a Web-based application.
- Understand security issues and common controls in electronic commerce systems.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Web Fundamentals and Security Configurations	10
2.	Web Application Authentication and Authorization	9
3.	Web Services and Front-End Security	7
4.	Cutting-Edge Web Security	8
5.	Capture-and-Defend-the-Flag Exercise	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Web Fundamentals and Security Configurations <ul style="list-style-type: none"> Introduction to HTTP protocol, Overview of web authentication technologies, Web application architecture, Recent attack trends, Web infrastructure security/Web application firewalls, Managing configurations for web apps. Defense Against Input Related Threats Input-related vulnerabilities in web applications SQL injection, Cross-site request forgery, Cross-site scripting vulnerability and defenses Unicode handling strategy, File upload handling, Business logic and concurrency.



Unit	Unit Details
2.	Web Application Authentication and Authorization
	<ul style="list-style-type: none"> Authentication vulnerabilities and defense, Multifactor authentication, Session vulnerabilities and testing, Authorization vulnerabilities and defense, SSL vulnerabilities and testing, Proper encryption use in web application
3.	Web Services and Front-End Security
	<ul style="list-style-type: none"> Honeytoken, Web services overview Security in parsing of XML, XML security, AJAX technologies overview, AJAX attack trends and common attacks, REST security, Browser-based defense such as Content Security Policy
4.	Cutting-Edge Web Security
	<ul style="list-style-type: none"> Serialization security, Clickjacking, DNS rebinding, HTML5 security, Logging collection and analysis for web apps, Security testing, IPv6 impact on web security.
5.	Capture-and-Defend-the-Flag Exercise
	<ul style="list-style-type: none"> Mitigating server configuration errors, Discovering and mitigating coding problems, Testing business logic issues and fixing problems, Testing web services and mitigating security problems, Reinforcing key topics discussed throughout the course through comprehensive exercises

Sr. N	Reference Books	Author	Edition	Publication
1	Security Technologies for the World Wide Web	Oppliger, Rolf	2nd Edition	Artech House Publishers
2	Web Application Security: Exploitation and Countermeasures for Modern Web Applications	Andrew Hoffman	Latest Edition	Wiley Publishing
3	Alice and Bob Learn Application Security	Tanya Janca	Latest Edition	Pearson Education




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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Program Elective-V

Code: BCAICT-507 IT Governance, Risk, & Information Security Management 3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES: The primary objective of this course is to:

- Understand the concepts of governance, risk management and compliance (GRC)
- Understand the regulatory environment
- The reason for being governance is essential for effective regulatory compliance risk management

COURSE OUTCOME: After completion of this course students should be able to:-

- Identify high-risk areas and compliance in your organization and Apply Risk-based Approach
- The role of the compliance officer and his team
- Develop and implement a governance, risk management and compliance strategic plan
- Understand, define, and enhance organizational culture as it relates to performance, risk, and compliance
- Implement governance, risk management and compliance processes that are effective and efficient using a risk-based audit approach

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Governance, Risk & Compliance GRC-Definitions	8
2.	Information Security Governance	9
3.	Information Security Management Practices	10
4.	Case Study Analysis	8
5.	Compliance-Introduction-Information Technology and	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Governance, Risk & Compliance GRC-Definitions
	<ul style="list-style-type: none"> • Governance, Risk, Compliance, Risk Threshold, Risk Modeling, Risk Appetite, Governance Standards. Best Practices for IT Governance-ITIL - ISO/IEC 27001 - Control Objectives of Information and Related Technology (COBIT) - The Information Security Management Maturity Model - Capability Maturity Model - latest standards and compliance technologies.

Unit	Unit Details
2.	Information Security Governance
	<ul style="list-style-type: none"> Effective Information Security Governance - Importance of Information Security Governance - Outcomes of Information Security Governance - Strategic alignment - Risk Management - Performance Measurement - Information System Strategy - Strategic Planning - Steering Committee- Policies and Procedures.
3.	Information Security Management Practices
	<ul style="list-style-type: none"> Personnel Management - Financial Management - Quality Management - Information Security Management - Performance Optimization - Roles and Responsibilities - Auditing IT Governance Structure - Evaluation Criteria & Benchmark - Assessment Tools.
4.	Case Study Analysis
	<ul style="list-style-type: none"> Risk Management framework - COSO - The Internal environment - Objective Setting - Event Identification - Risk assessment - Risk Response - Control activities - Information & communication - Monitoring - NIST - Risk Assessment - Risk Mitigation - Evaluation & Assessment - Case Study Analysis
5.	Compliance-Introduction-Information Technology and security
	<ul style="list-style-type: none"> Evolution of Information systems - Roles and responsibilities - Audit, Assessment and review - The Role of the Compliance Officer - The duties and responsibilities of the compliance officer and the function of compliance - Compliance officer activities - The requirements of a Compliance Officer - Drafting compliance reports - Designing an Internal Compliance System - Regulatory principles - Issues - Developing high-level compliance policies - Defining responsibility for compliance - The compliance function - Specific internal compliance control issues - Information System Audit - Scope of System Audit - Audit Planning - Audit Manual - Audit check lists - Audit Reports - Best Practices for IT compliance and Regulatory Requirements

Sr. N	Reference Books	Author	Edition	Publication
1	Cyber Security Management: A Governance, Risk and Compliance Framework	Peter Trim, Yang-Im Lee	2nd Edition	Kindle Edition
2	Introduction to Information Security: A Strategic-Based Approach	Timothy Shimeall and Jonathan Spring	Latest Edition	Syngress



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Sub

Program Elective-V

Code: BCAICT-508

Infrastructure Solutions on Cloud

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- The primary objective of this course is to evaluate information storage management design in a cloud environment and how it relates to the business objectives of an organization and analyze the role technology plays in the design of a storage solution in a cloud architecture.

COURSE OUTCOME: After completion of this course students should be able to:-

- Critically appraise the opportunities and challenges of information management in complex business environments
- Evaluate information storage management design in a cloud environment and how it relates to the business objectives of an organization
- Analyze the role technology plays in the design of a storage solution in a cloud architecture
- Investigate how a global storage solution can be optimized so that it can be delivered successfully from the cloud
- Analyze how best to provide reliable access to information both locally and remotely using storage technologies

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Virtualized Data Center Architecture	8
2.	Information Storage Security & Design	9
3.	Storage Network Design	8
4.	Optimization of Cloud Storage	9
5.	Information Availability Design security	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Virtualized Data Center Architecture
	<ul style="list-style-type: none"> Cloud infrastructures; public, private, hybrid. Service provider interfaces; SaaS, PaaS, IaaS. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures. SRM-M.Tech Cloud Computing 2015 – 16




Unit	Unit Details
2.	Information Security Governance
	<ul style="list-style-type: none"> Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloud environments. Monitoring and management; security auditing and SIEM.
3.	Storage Network Design
	<ul style="list-style-type: none"> Architecture of storage, analysis and planning. Storage network design considerations; NAS and FC SANs, hybrid storage networking technologies (iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, host system design considerations.
4.	Optimization of Cloud Storage
	<ul style="list-style-type: none"> Global storage management locations, scalability, operational efficiency. Global storage distribution; terabytes to petabytes and greater. Policy based information management; metadata attitudes; file systems or object storage.
5.	Information Availability Design
	<ul style="list-style-type: none"> Designing backup/recovery solutions to guarantee data availability in a virtualized environment. Design a replication solution, local remote and advanced. Investigate Replication in NAS and SAN environments. Data archiving solutions; analyzing compliance and archiving design considerations.

Sr. N	Reference Books	Author	Edition	Publication
1	Cloud and Virtual Data Storage Networking	Greg Schulz	Latest Edition	Auerbach Publications
2	Foundations of Green IT	Marty Poniatowski	1st Edition	Prentice Hall
3	Information Storage and Management	EMC	2 nd Edition	Wiley
4	Storage Management in Data Centers	Volker Herminghaus, Albrecht Scriba	Latest Edition	Springer
5	High Availability and Disaster Recovery	Klaus Schmidt	Latest Edition	Springer

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Generic Elective-I

Code: BCAICT509

Introduction to IoT

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the concepts of Internet of Things and can able to build IoT applications.

COURSE OUTCOME: After completion of the course the student will be able to:

- Understand general concepts of Internet of Things (IoT) (Understand)
- Recognize various devices, sensors and applications (Knowledge)
- Apply design concept to IoT solutions (Apply)
- Analyze various M2M and IoT architectures (Analyze)
- Evaluate design issues in IoT applications (Evaluate)
- Create IoT solutions using sensors, actuators and Devices (Create)

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to IoT	8
2.	M2M to IoT	8
3.	M2M vs IoT An Architectural Overview	8
4.	Constraints affecting design in IoT world	9
5.	Developing IoT solutions	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to IoT
	<ul style="list-style-type: none"> • Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

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2.	M2M to IoT
	<ul style="list-style-type: none"> Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT
3.	M2M vs IoT An Architectural Overview
	<ul style="list-style-type: none"> Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT. IoT Reference Architecture- Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment.
4.	Constraints affecting design in IoT world
	<ul style="list-style-type: none"> Introduction, Technical design Constraints, Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.
5.	Developing IoT solutions
	<ul style="list-style-type: none"> Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

Sr. N	Reference Books	Author	Edition	Publication
1	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle	Latest Edition	Academic Press, 2014
2	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	1st Edition	VPT, 2014
3	Rethinking the Internet of Things: A Scalable Approach to Connecting Everything	Francis daCosta	2 nd Edition	Apress Publications, 2013
4	Getting Started with the Internet of Things	Cuno Pfister	Latest Edition	O'Reilly Media, 2011




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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	2	1	—	—	—	—	—	—	—
CO2	3	3	2	—	—	—	—	—	—	—	—	—
CO3	2	2	—	3	—	—	—	—	—	—	—	—
CO4	3	1	3	—	3	—	—	—	—	—	—	—
CO5	2	2	—	2	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	2	—
CO-2	1	3	—
CO-3	2	1	—
CO-4	3	2	—
CO-5	2	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development.



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Generic Elective-I**Code: BCAICT-510****Business Intelligence****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To understand the basic concepts of Business Intelligence and its architecture.
- To understand the procedure for Business Performance management and business intelligence.
- To understand the importance of OLAP and Business Intelligence Data stages.
- To understand the different types of business intelligence, reporting and dash board design.
- To understand how the Business Intelligence system is implemented.

COURSE OUTCOME: After completion of this course students should be able to:-

- Understand the important terminologies and architecture of Business Intelligence system.
- Understand the important difference between business performance management and business intelligence.
- Understand the different OLAP systems used in Business Intelligence Report creations and analytics.
- Learn the different business intelligence types, and importance of report creation and dashboard design.
- Understand implementation procedure for business intelligence systems.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Business Intelligence	10
2.	Business Performance Management	9
3.	Business Intelligence: Stages	7
4.	Types of Business Intelligence	9
5.	Business Intelligence Implementation	7



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B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Business Intelligence
	<ul style="list-style-type: none"> Introduction to Business Intelligence, A Framework for Business Intelligence (BI), Definitions of BI, A Brief History of BI The Architecture of BI, Styles of BI, The Benefits of BI, Event-Driven Alerts, Intelligence Creation and Use and BI Governance, A Cyclical Process of Intelligence Creation and Use, Intelligence and Espionage, Transaction Processing versus Analytic Processing, Successful BI Implementation, The Typical BI user Community, Appropriate Planning and Alignment with the Business Strategy, Real-Time, On-Demand BI Is Attainable, Developing or Acquiring BI Systems, Justification and Cost-Benefit Analysis, Security and Protection of Privacy, Integration of Systems and Applications , Major Tools and Techniques of Business Intelligence.
2.	Business Performance Management
	<ul style="list-style-type: none"> Business Performance Management (BPM) Overview, BPM Defined, Comparison of BPM and BI, Operational Planning, Financial Planning and Budgeting, Pitfalls of Variance Analysis, Act and Adjust: What Do We Need to Do Differently?, Performance Measurement, Key Performance Indicators (KPI) and Operational Metrics, Problems with Existing Performance Measurement Systems, Effective Performance Measurement, BPM Methodologies, Balanced Scorecard (BSC) , Six Sigma, BPM Technologies and Applications, BPM Architecture, Commercial BPM Suites, BPM Market versus the BI Platform Market, Performance Dashboards and Scorecards, Dashboards versus Scorecards, Dashboard Design, important properties of design of dash board.
3.	Business Intelligence: Stages
	<ul style="list-style-type: none"> Introduction, Extract, Transform, and Load (ETL), Data Warehouse, Data Warehouse Architecture, Design of Data Warehouses, Dimensions and Measures, Data Warehouse Implementation Methods: Top-Down Approach, The Bottom-Up Approach, The Federated Approach, The Need for Staged Data, Integrating Data from Multiple Operating Systems, OLAP, Types of OLAP, Multidimensional OLAP (MOLAP), Relational OLAP (ROLAP), Hybrid OLAP (HOLAP), Data Mining, Data Mining and Statistical Analysis, Data-Mining Operations, Data Mining—Data Sources, Data Dredging, Data Management, Data Usage, Enterprise Portal (EP).



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4	Types of Business Intelligence
	<ul style="list-style-type: none"> Multiplicity of BI Tools, The Problem with Multiple BI Tools, Types of BI, Enterprise Reporting, Cube Analysis, Ad Hoc Query and Analysis, Statistical Analysis and Data Mining, Alerting and Report Delivery, Modern BI, Enterprise Reporting, Support for Different Forms and Types, Support for Personalization and Customization, Support for Wide Reach, High Throughput and Access across All Touch Points, The Enterprise BI, Single Unified User Interface, Single Unified Backplane, Vision of a Critical BI System, Centralized Business Logic, Flexible Data Structures, Advanced Analytics, Reporting, Rich Report Design, Flexible Information Delivery, Self-Service Reporting, Critical BI for the Enterprise.
5	Business Intelligence Implementation
	<ul style="list-style-type: none"> OPENSSE - The Introduction, Implementation of BI System: An Overview, BI Implementations Factors, Managerial Issues Related to BI Implementation, BI and Integration Implementation, Types of Integration, Levels of BI Integration, Embedded Intelligent Systems, Connecting BI Systems to Databases and Other Enterprise Systems, Connecting to Databases, Integrating BI Applications and Back-End Systems, Middleware, On-Demand BI, The Limitations of Traditional BI, The On-demand Alternative, Key Characteristics and Benefits, Issues of Legality, Privacy, and Ethics, Legal Issues, Privacy, Ethics in Decision Making and Support.

Sr. N	Reference Books	Author	Edition	Publication
1	Business Intelligence: A Managerial Approach	Turban, Sharda Efraim; Ramesh, Dursun Delen and King, David	2nd Edition	Prentice Hall
2	Business Intelligence for Telecommunications	Deepak Pareek	Latest	Auerbach Publications
3	Applied Data Mining Statistical Methods for Business and Industry	PAOLO GIUDICI,	Latest	Wiley & Sons
4	Data Mining: Concepts and Techniques	Han, Jiawei and Kamber, Micheline.	Latest	Morgan Kaufmann Publishers
5	Business Analysis for Business Intelligence	Bert Brijs	Latest	CRC Press

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Fifth Semester

Practical Subjects

Code: BCAICT-511 Digital Forensics and Investigation Lab 1 Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- The **objective** of this class is to emphasize the fundamentals and importance of **digital forensics**. Students will learn different techniques and procedures that enable them to perform a **digital** investigation. This **course** focuses mainly on the analysis of physical storage media and volume analysis.

COURSE OUTCOME: After completion of this course students will be enriched with the practical application of the subject. They should be able to:-

- Explain and properly document the process of digital forensics analysis.
- Gain an understanding of the tradeoffs and differences between various forensic tools.
- Describe the representation and organization of data and metadata within modern computer systems.
- Understand the inner workings of file systems, create disk images, recover deleted files and extract hidden information
- be introduced to the current research in computer forensics. This will encourage them to define research problems and develop effective solutions

A. List of Experiments

Experiments
1. Use of E-Mail, Instant Messaging, & Chat
2. Computer Hacking & Network Intrusion
3. Copyright Infringement
4. Software Piracy
5. Intellectual Property Theft
6. Identity Theft
7. Online Auction Fraud
8. Credit Card Fraud
9. Other Financial Frauds & Schemes
10. Telecommunications Fraud
11. Threats, Harassment

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	3	2	—	—	3	3	—	2	2	3	—
CO2	—	—	—	—	3	—	—	—	—	—	2	—
CO3	—	3	—	—	—	—	—	—	—	—	—	—
CO4	—	2	3	—	3	—	—	—	—	—	—	—
CO5	—	—	—	3	—	—	—	—	—	—	2	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	1	—
CO-2	2	3	—
CO-3	3	1	—
CO-4	2	2	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

Program Elective-III Lab

Code: BCAICT-512

PowerShell Scripting Lab

1 Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- Build higher functions
- Use cmdlets plus Microsoft .NET Framework in windows PowerShell
- Write Controller script
- Handle Script error
- Use XML Data records
- Manage Server Configurations by using the desired state configuration
- Examine and debug script
- Understand window PowerShell Workflow

COURSE OUTCOME: After completion of this course students should be able to:-

- Configure and manage networks and computers from the command line.
- Perform and automate common systems administration tasks using Linux shell scripts and Windows PowerShell scripts.
- Access and manipulate different types of data using scripts, write, run, test, and troubleshoot scripts.
- Monitor activities on networks and systems using logging techniques.
- Measure system performance and produce reports using scripts and examine various system commands and interfaces in the Linux and Windows environments.

A. List of Experiments

Experiments
<ol style="list-style-type: none"> 1. Task 1: Run a command that will display the newest 100 entries from the Application event log. Do not use Get-WinEvent. 2. Task 2: Write a command line that displays only the five top processes based on virtual memory (VM) usage. 3. Task 3: Create a CSV file that contains all services, including only the service name and status. Have running services listed before stopped services. 4. Task 4: Write a command line that changes the startup type of the BITS service to Manual. 5. Task 5: Get a directory listing for C:\Program Files. Include all subfolders and files. Direct the directory listing to a text file named C:\Dir.txt (remember to use the > redirector, or the Out-File cmdlet).

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Experiements

6. Task 6: Get a list of the 20 most recent entries from the Security event log, and convert the information to XML. Do not create a file on disk: Have the XML display in the console window. Note that the XML may display as a single top-level object, rather than as raw XML data—that's fine. That's just how PowerShell displays XML. You can pipe the XML object to Format-Custom to see it expanded out into an object hierarchy, if you like.
7. Task 7: Get a list of all event logs on the computer, selecting the log name, its maximum size, and overflow action, and then convert to CSV, but without writing to a log file. You may need to discover another CSV related cmdlet.
8. Task 8: Get a list of services. Keep only the services' names, display names, and statuses, and send that information to an HTML file with a title of "Service Report". Have the phrase "Installed Services" displayed in the HTML file before the table of service information. If you can, display Installed Services with an <H1> html tag. Verify the file in a web browser.
9. Task 9: Create a new alias, named D, which runs Get-ChildItem. Export just that alias to a file. Now, close the shell and open a new console window. Import that alias into the shell. Make sure you can run D and get a directory listing.

Sr. N	Reference Books	Author	Edition	Publication
1	Learn PowerShell Toolmaking in a Month of Lunches	Jeffery Hicks, Don Jones	Latest Edition	Manning Publications
2	Windows PowerShell Cookbook: The Complete Guide to Scripting Microsoft's Command Shell	Lee Holmes	2010 Edition	O'Reilly
3	Learn Windows PowerShell in a Month of Lunches	Jeffery Hicks, Don Jones	3 rd Edition	Manning Publications

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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Program Elective-III Lab**Code: BCAICT-513****Infrastructure Automation Lab****1 Credits [LTP: 0-0-2]****COURSE OVERVIEW AND OBJECTIVES:**

- Introducing cloud computing and Amazon web services with Ansible.
- Understanding and using EC2 instances with Ansible.
- Deploying and managing applications on AWS cloud.
- Using AWS security services with Ansible.
- Implementing the networking concepts on AWS cloud with Ansible.

COURSE OUTCOME: After completion of this course students should be able to:-

- Get practical knowledge of Amazon Simple storage services with Ansible.
- Get practical knowledge of Amazon Internet-of-Things with Ansible.
- Get practical knowledge of Amazon API Gateway with Ansible.
- Get practical knowledge of Amazon Lambda with Ansible.
- Get practical knowledge of Amazon Elastic File System with Ansible.

A. List of Experiments

Experiment
<ol style="list-style-type: none"> 1. Setting up Ansible 2. Writing playbooks using YAML 3. Deploy a non-trivial application using Ansible 4. Working with roles to simplify and reuse playbooks 5. Making playbooks run faster with ssh multiplexing, pipelining, and parallelism 6. Using Ansible to create Docker images and deploying Docker containers 7. E2, Security Group, IAM Policy 8. VPC 1.13. S3 Bucket 9. TCL, Variables 10. State Management 11. Workspaces 12. Modules




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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAI501

Mini Project

4 Credits [LTP: 0-0-8]

COURSE OVERVIEW AND OBJECTIVES:

- The objective of Mini Project is to enable the student to take up investigative study in field of Computer application with emphasis on their specialization.
- This is expected to provide a good initiation for the student(s) in Industry practices.
- The students are expected to investigate, model and present their work either individually or in groups (to be decided by the department) to the departmental committee.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




Code: BCAI502

Working Towards Placements

2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- The objective of this course is to enable the student to learn the techniques of enhancing and sharpening their aptitude skills related to verbal ability, quantitative aptitude, logical reasoning.
- This course also aims to enhance students presentation and interview skills with resume writing.

COURSE OUTCOME: After completion of this course students should be able:-

- To solve questions related to verbal and non-verbal abilities.
- To solve questions related to quantitative and logical reasoning.
- To enhance their professional presentation skills.
- To enhance their interview skills.
- To write professional and impressive resumes..

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Verbal non-verbal ability	6
2.	Quantitative and Logical Reasoning	5
3.	Presentation Skills	6
4.	Interview Skills	5
5.	Resume Writing	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Verbal non-verbal ability
	<ul style="list-style-type: none"> • Synonyms, antonyms, one-word substitute
2.	Quantitative and Logical Reasoning
	<ul style="list-style-type: none"> • Speed, Time and Distance, Time and Work, Linear Equations, Progressions (Sequences & Series), Permutation and Combination, Probability, Functions, Set Theory, Number Systems, LCM and HCF, Percentages, Collection and Scrutiny of data: Primary data, questionnaire and schedule; secondary data, their major sources including some government publications. • Number and Letter Series, Calendars, Clocks, Cubes, Venn Diagrams, Binary Logic, Seating Arrangement, Logical Sequence, Logical Matching, Logical Connectives, Syllogism, Blood Relations;




Unit	Unit Details
3.	Presentation Skills
	<ul style="list-style-type: none"> Effective communication skills, better presentation skills.
4.	Interview Skills
	<ul style="list-style-type: none"> Mock interviews
5.	Resume Writing
	<ul style="list-style-type: none"> Resume Writing for various jobs.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



TEACHING AND EXAMINATION SCHEME FOR
Bachelor of Computer Application
(Specialization in Cloud Technology and Information Security)

Semester VI

S.No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI601	ST	Major Project / Internship	-	-	40	40	20
TOTAL				-	-	40	40	20



COURSE OVERVIEW AND OBJECTIVES:

- The objective of Summer Project is to enable the student to take up investigative study in field of Computer application with emphasis on their specialization. This is expected to provide a good initiation for the student(s) in Industry practices. The students are expected to investigate, model and present their work either individually or in groups (to be decided by the department) to the departmental committee.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAI601

Major Project

20 Credits [LTP: 0-0-40]

COURSE OVERVIEW AND OBJECTIVES:

- To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The practical training aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.
- The purpose of practical training is not only to get acquainted with the culture of companies, but also to realize something of importance for the company visited. By working in a group within the company, it is expected that the trainee gets a better insight in the practical aspects of the industry. This is intended to facilitate the transition from the thorough theoretical education, dispensed at our University, into an industrial professional career.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3




CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Artificial Intelligence)****Semester III**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINT
				L*	T*	P*		
1	BCAI301	PC	DBMS	3	0	0	3	3
2	BCAI302	PC	Computer Networks	3	0	0	3	3
3	BCAI401	PC	Python Programming	3	0	0	3	3
4	BCAIIPA301	PC	Statistics and Probability	3	1	0	4	4
5	BCAIIPA302	PC	Digital Electronics	3	0	0	3	3
6		PE	Elective-I	3	0	0	3	3
7	BCAI303	PC	DBMS Lab	0	0	4	4	2
8	BCAI402	PC	Python Programming Lab	0	0	2	2	1
9	BCAI304	HSM	Business communication and Presentation Skills	0	0	4	4	2
10	BCAI305	ST	Summer Project Seminar I	0	0	2	2	1
TOTAL				18	1	12	31	25

Course Code	Program Elective-I
BCAIIPA303	Data Visualization
BCAIIPA304	Business Intelligence



TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Artificial Intelligence)****Semester IV**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAIIPA401	PC	Introduction to RPA Tools	3	0	0	3	3
2	BCAIIPA402	PC	Introduction to Intelligent Process Automation	3	0	0	3	3
3	BCAIIPA403	PC	Sensor Technology	3	0	0	3	3
4	BCAIIPA404	HSM	Business Process Management	3	0	0	3	3
5		PE	Elective-II	3	0	0	3	3
6	BCAIIPA407	PC	Introduction to Intelligent Process Automation Lab	0	0	4	4	2
7	BCAIIPA408	PC	Introduction to RPA Tools Lab	0	0	4	4	2
8	BCAI403	PC	Logical Reasoning and Thinking	0	0	4	4	2
TOTAL				15	0	12	27	21

Course Code	Program Elective – II
BCAIIPA405	Introduction to Data Science
BCAIIPA406	Pattern Recognition

TEACHING AND EXAMINATION SCHEME FOR Bachelor of Computer Application

(Specialization in Artificial Intelligence)

Semester V

S. No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAIIPA501	HSM	Six Sigma and Lean Methods	3	0	0	3	3
2	BCAIIPA502	PC	Digital Image Processing	2	0	0	2	2
3		PE	Elective-III	2	0	0	2	2
4		PE	Elective-IV	3	0	0	3	3
5		PE	Elective-V	3	0	0	3	3
6		GE	Generic Elective-I	3	0	0	3	3
7	BCAIIPA511	PC	Digital Image Processing Lab	0	0	2	2	1
8		PE	Elective-III Lab	0	0	2	2	1
9	BCAI501	PR	Mini Project	0	0	8	8	4
10	BCAI502	HSM	Working Towards Placements	0	0	4	4	2
11	BCAI503	ST	Summer Project Seminar II	0	0	2	2	1
TOTAL				16	0	18	34	25

Course Code	Program Elective-III
BCAIIPA503	Test Automation using Selenium
BCAIIPA504	Software Testing

Course Code	Program Elective-V
BCAIIPA507	Embedded Systems
BCAIIPA508	Design Thinking

Course Code	Generic Elective-I
BCAIIPA509	Introduction to IoT
BCAIIPA510	Cloud Computing

Course Code	Program Elective-IV
BCAIIPA505	Introduction to web Services
BCAIIPA506	Digital Signal Processing


Course Code	Program Elective-III Lab
BCAIIPA512	Test Automation using Selenium Lab
BCAIIPA513	Software Testing Lab



TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Artificial Intelligence)****Semester III**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINT
				L*	T*	P*		
1	BCAI301	PC	DBMS	3	0	0	3	3
2	BCAI302	PC	Computer Networks	3	0	0	3	3
3	BCAI401	PC	Python Programming	3	0	0	3	3
4	BCAIIPA301	PC	Statistics and Probability	3	1	0	4	4
5	BCAIIPA302	PC	Digital Electronics	3	0	0	3	3
6		PE	Elective-I	3	0	0	3	3
7	BCAI303	PC	DBMS Lab	0	0	4	4	2
8	BCAI402	PC	Python Programming Lab	0	0	2	2	1
9	BCAI304	HSM	Business communication and Presentation Skills	0	0	4	4	2
10	BCAI305	ST	Summer Project Seminar I	0	0	2	2	1
TOTAL				18	1	12	31	25

Course Code	Program Elective-I
BCAIIPA303	Data Visualization
BCAIIPA304	Business Intelligence




Core Theory Subjects

APPROVED

Code: BCAI301

DBMS

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- A database management system (DBMS) is collection of software meant to manage a Database. Many popular databases currently in use are based on the relational database model.
- RDBMSs have become a predominant choice for the storage of information in new databases used for financial records, manufacturing and logistical information, personnel data and much more.
- The course covers the basic concepts of databases in general with an emphasis on relational databases, modeling techniques and writing queries. Normalization techniques, Transaction processing, Concurrency Control techniques and Recovery of databases against crashes are also covered.

COURSE OUTCOME: After completion of this course students should be able:-

- To describe the fundamental elements of database management systems.
- To explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- To understand Query Language.
- To database anomalies and normalization.
- To understand transaction concepts, Concurrency and Recovery techniques.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	Relational Model	8
3.	SQL	8
4.	Database Design	8
5.	Transactions	8

B. DETAILED SYLLABUS

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Unit	Unit Details
1.	Introduction
	<ul style="list-style-type: none"> Purpose of Database System – Views of data – Data Models – Database Languages – Database System Architecture – Database users and Administrator – Entity-Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases.
2.	Relational Model
	<ul style="list-style-type: none"> The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals, Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables, Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL.
3.	SQL
	<ul style="list-style-type: none"> Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause, Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User, Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL- Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases
4.	Database Design
	<ul style="list-style-type: none"> Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.
5.	Transactions
	<ul style="list-style-type: none"> Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery – Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.

Sr. N	Reference Books	Author	Edition	Publication
1	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudharshan	5th Edition	Tata McGraw Hill
2	Fundamentals of Database Systems	RamezElmasri, Shamkant B. Navathe	4th Edition	Pearson/Addision Wesley
3	Database Management Systems	Raghu Ramakrishnan	3rd	McGraw Hill

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




APPROVED

COURSE OVERVIEW AND OBJECTIVES:

To understand the basics of networking and its underlying principles. This course enables learners to understand computer networking concepts, how they work, operate, communicate with ports and Protocols. Standards and models associated with networking technology and their troubleshooting mechanisms.

COURSE OUTCOME: After completion of this course students should be able to:-

- Explain the types of Network and its architecture. Identify the function of each layer in OSI and TCP/IP Models.
- Describe the Ethernet and wireless standards. Discuss the functionality of Networking devices.
- Demonstrate the IPv4 and IPv6 addressing types.
- List the WAN Technologies.
- To understand transaction concepts, Concurrency and Recovery techniques.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Networking Fundamentals	10
2.	Basics of Network Devices	8
3.	Basics of Network, Transport and Application Layers	8
4.	WAN Technology	8
5.	Troubleshooting Network	8

B. DETAILED SYLLABUS



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Unit	Unit Details
1.	Networking Fundamentals
	<ul style="list-style-type: none"> Basics of Network & Networking, Advantages of Networking, Types of Networks, Types of Network Architecture, Workgroup vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling, media connectors, Introduction of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, Comparison between OSI model & TCP/IP model.
2.	Basics of Network Devices
	<ul style="list-style-type: none"> Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, Modem, Ethernet standards, Ethernet Components, Point-to-Point Protocol, Address Resolution Protocol, Message format, transactions, Benefits of Wireless Technology, Types of Wireless Networks, Wireless network Components, wireless LAN standards, wireless security Protocols.
3.	Basics of Network, Transport and Application Layers
	<ul style="list-style-type: none"> Network Layer: Internet Protocol (IP), IP standards, versions, functions, The IPv4 and IPv6 Datagram Format, IPv4 addressing, IPv4 Subnetting, CIDR and VLSM, IPv6 Addressing, , Internet Control Message Protocol , Internet Group Management Protocol ,Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer Protocols
4.	WAN Technology
	<ul style="list-style-type: none"> Introduction to WAN, WAN Switching techniques, connecting to the Internet, Satellite-Based Services, Cellular Technologies, Technologies used for Connecting LANs, Remote Access Connections and technologies, Authentication and Authorization, Tunnelling and Encryption Protocols, Security Appliances and Security Threats.
5.	Troubleshooting Network
	<ul style="list-style-type: none"> Trouble Shooting Networks: Command-Line Interface Tools, Network and Internet Troubleshooting, Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.

Sr. N	Reference Books	Author	Edition	Publication
1	CCNA Cisco Certified Network Associate: Study Guide (With CD)	CISCO	7th Edition	Wiley India
2	CCENT/CCNA ICND1 640-822 Official Cert Guide	CISCO	3rd Edition	Pearson
3	Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD)	CCNA	Latest	Pearson
4	CCNA Exploration Course Booklet: Routing Protocols and Concepts	CCNA	Latest	Pearson

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

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APPROVED

COURSE OVERVIEW AND OBJECTIVES:

- To setup the environment to run the python programs
- To understand concepts about Data Types and Looping techniques
- To understand and implement the OOP concepts, Decorators, and Iterators
- To understand and build the Web Applications
- Debugging and Troubleshooting Python Programs.

COURSE OUTCOME: After completion of this course students should be able to:-

- Install and Run Python Program. Write functions and Loops in the python program.
- Implementing OOPs concepts while writing Python Program.
- Develop web applications using Django.
- Build microservices in Python.
- Test, Debug and Troubleshoot Python Programs.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Python	8
2.	Advanced Concepts Management	9
3.	Web Development	9
4.	Cloud Native Python	8
5.	Exception Handling	8

B. DETAILED SYLLABUS



Self

Unit	Unit Details
1.	Introduction to Python
	<ul style="list-style-type: none"> • Introduction: Introduction to Python, Setting up the environment, Installing Python, Running python program, Python's execution model, Guidelines on how to write good, The Python culture, A note on the IDEs. • Built-in Data Types: Numbers, Immutable sequences, Mutable sequences, Set types, Mapping types – dictionaries, The collections module, Final considerations • Iterating and Making Decisions: Conditional programming, Looping, Putting this all together.
2.	Advanced Concepts
	<ul style="list-style-type: none"> • Functions, the Building Blocks of Code: Use of functions, Scopes and name resolution, Input parameters, Return values, Recursive functions, Anonymous functions, Function attributes, Built-in functions, importing objects. • Saving Time and Memory: map, zip, and filter, Comprehensions, Generators, Some performance considerations, Name localization, and Generation behavior in built-ins. • Advanced Concepts – OOP, Decorators, and Iterators: Decorators, Class and object namespaces, Attribute shadowing, Initializing an instance, Accessing a base class, Multiple inheritance, Static and class methods, Private methods and name mangling, The property decorator, Operator overloading, Polymorphism
3.	Web Development
	<ul style="list-style-type: none"> • The Edges – GUIs and Scripts: Scripting-The imports, Parsing Arguments, The business logic, GUI application- The import, The layout logic, The business logic, The tkinter.tixmodule, The turtle module, wxPython, PyQt, and PyGTK, The principle of least astonishment, Threading considerations. • Web Development Done Right: Django design philosophy, The Django URL dispatcher, Setting up Django, Adding the Entry model, Customizing the admin panel, Creating the form, Writing the views, Tying up URLs and views, Writing the templates, Writing a Flask view, Building a JSON quote server in Falcon.



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Unit	Unit Details
4.	Cloud Native Python
	<ul style="list-style-type: none"> Building Microservices in Python: Modeling microservices, Building microservices, Testing the RESTful API. Building a Web Application in Python: Getting started with applications, Working with Observables and AJAX, Binding data for the adduser template, Working on Observables with AJAX for the addtweet template, Data binding for the addtweet template, CORS - Cross-Origin Resource Sharing, Session management, Cookies. Interacting Data Services: MongoDB terminology, Initializing the MongoDB database, Integrating microservices with MongoDB, Working with user resources, Working with the tweets resources.
5.	Exception Handling
	<ul style="list-style-type: none"> Testing, Profiling, and Dealing with Exceptions: The anatomy of a test, Testing guidelines, Unit testing, Test-driven development, Exceptions, Profiling Python. Debugging and Troubleshooting: Debugging with print, Debugging with a custom function, Inspecting the traceback, Using the Python debugger, Inspecting log files, Other techniques, Troubleshooting guidelines.

Sr. N	Reference Books	Author	Edition	Publication
1	Learn Python Programming	Fabrizio Romano	2 nd Edition	McGraw-Hill Education
2	Python Cookbook	David Beazley Brian K. Jones	3rd Edition	Oreilly
3	Python Programming: A Step-by-Step Guide For Absolute Beginners	Brian Jenkins and ATS Coding Academy	Latest	Wiley
4	Python and AWS Cookbook: Managing Your Cloud with Python and Boto	Mitch Garnaat	Latest	McGraw-Hill Education
5	Advanced Python Programming: Build high performance, concurrent, and multi-threaded apps with Python using proven design patterns	Dr. Gabriele Lanaro	Latest	McGraw-Hill Education
6	Programming Google App Engine with Python: Build and Run Scalable Python Apps on Google's Infrastructure	Dan Sanderson	Latest	McGraw-Hill Education




CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Sup

Code: BCAIIPA-301

Statistics and Probability

4 Credits [LTP: 3-1-0]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the basic concepts of statistics and probability.
- To understand the description of data using statistical techniques
- To understand the summary of data using statistical measures
- To understand the statistical methods involved in hypothesis testing
- To understand the ANOVA and its importance in business performance.

COURSE OUTCOME: After completion of this course students should be able to:-

- Understand the importance of statistics in different research areas.
- Understand the suitable statistical measures to describe and summarize the data.
- Understand the application of statistical test to appropriate research environment.
- Understand the basic concepts of probability and its applications.
- Understand the application of regression analysis in finding the expected values.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Descriptive Statistics	10
2.	Elements of Probability and Sampling Distributions Management	8
3.	Hypothesis Testing	8
4.	Correlation and Regression Analysis	8
5.	Linear Model	8



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B. DETAILED SYLLABUS

Unit	Unit Details
1.	Descriptive Statistics
	<ul style="list-style-type: none"> Data and Data Sources, Types of Data, Measures of Central Tendency – Mean, median mode for raw and grouped data, measures of dispersion – Range, standard deviation, variance, coefficient of variation, mean deviation, mean absolute deviation, measures of symmetry: Skewness and Kurtosis.
2.	Elements of Probability and Sampling Distributions
	<ul style="list-style-type: none"> Experiments and events, Basic Relations of Probability, Conditional Probability, Joint Probability, conditional probability on discrete case and continuous case, computing expectations by conditioning, introduction to Bayes theorem, problems related to Bayes Theorem, Discrete Probability Distribution (Binomial and Poisson), Continuous Probability Distribution (Normal). Various types of Probability and Non-probability Sampling, Sampling distribution of important statistic.
3.	Hypothesis Testing
	<ul style="list-style-type: none"> Introduction, Statistical assumptions for parametric test, Level of significance, confidence level, Type I Error, Type II error, Critical value, power of the test, sampling distribution, small sample test – t test, F test, Large Sample test – Z test for equality of single mean with population mean, equality of two sample mean, equality of single proportion with population proportion and equality of two sample proportions.
4.	Correlation and Regression Analysis
	<ul style="list-style-type: none"> Correlation analysis, properties, significance of single and multiple correlation coefficients, multiple and partial correlation, linear model, factor, effect, residuals, dependency, independency, assumptions of linear model, estimation of parameters of regression coefficients, properties, significance, diagnostic testing: auto correlation, multi collinearity, heteroscedasticity, normality, significance of estimated parameters in multiple linear regression,.



Unit	Unit Details
5.	Linear Model
	<ul style="list-style-type: none"> Introduction, assumptions, factors and levels in ANOVA, layout of one way ANOVA, multiple comparison of sample means, one way analysis of variance with unequal sample sizes, two factor analysis of variance – introduction and parameter estimation, two way analysis of variance with interaction, Post ANOVA: testing of hypothesis for significance of mean using Fishers Least Significance Difference test (lsd), Tukeys test, Dunnet test, Duncan Multiple Range test.

Sr. N	Reference Books	Author	Edition	Publication
1	Fundamentals of mathematical statistics	SC Gupta and VK Kapoor	Latest Edition	Sultan Chand & Sons Publication
2	Introduction to probability Models	Sheldon M. Ross	9th Edition	Elsevier Publication
3	Introduction to Probability and Statistics for Engineers and Scientists	Sheldon M. Ross	3rd	Elsevier Publication

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	3	—	3	3	—	2	—	—	—	—	—
CO2	—	2	—	2	1	—	2	—	—	—	—	—
CO3	—	3	—	1	3	—	1	—	—	—	—	—
CO4	—	—	—	1	2	—	1	—	—	—	—	—
CO5	—	—	—	3	2	—	2	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




Code: BCAIIPA-302

Digital Electronics 3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- Understand concepts of combinational and sequential circuits.
- Analyze the synchronous and asynchronous logic circuits.
- Understand concepts of memory, programmable logic and digital integrated circuits.
- Design Combinational and sequential systems.

COURSE OUTCOME: After completion of this course students should be able to:-

- Understand different number systems and its inter-conversions.
- Understand the concept of Boolean algebra and its different theorems, properties etc. and understand simplification of Boolean functions.
- Understand the construction and working of different combinational circuits etc. and understand different flip-flops and its applications.
- Understand different sequential logic circuits and basic design of sequential circuits and counters.
- Understand different types of memories and its applications.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Basic Concepts, Boolean algebra, Theorems and Functions	9
2.	Components of vSphere	9
3.	Features of vSphere and NSX	8
4.	VSphere Solutions to Data Center Challenges and vSphere Security	8
5.	Resource optimization and resource management	8



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B. DETAILED SYLLABUS

APPROVED

Unit	Unit Details
1.	Basic Concepts, Boolean algebra, Theorems and Functions
	<ul style="list-style-type: none"> Number Systems: Decimal number system, binary number system, octal number system, hexadecimal number system, BCD number system, Excess-3 code, Gray code, Alpha numeric code, error detecting and error correcting codes. Arithmetic: Arithmetic number representation, Binary arithmetic, Hexadecimal arithmetic, BCD arithmetic. Boolean algebra and Theorems: Logic gates and logic operations, Boolean theorems and postulates, SOP's & POS's, Minterms and Maxterms. Minimization of Boolean Functions: Algebraic simplification, Karnaugh map simplification, Quine-McCluskey or Tabulation method.
2.	Logic Gates
	<ul style="list-style-type: none"> Logic Families: Metal Oxide Semiconductor logic families- switching properties of NMOS and PMOS transistors, static NMOS, dynamic NMOS, Static CMOS and dynamic CMOS logic families, CMOS Transmission gate circuits, Bipolar logic families- switching properties of NPN and PNP transistors, TTL, Schottkey TTL, Comparison of MOS logic circuits(CMOS) with that of a TTL digital circuit, Tristate gates. Electrical characteristics: Meanings of speed, propagation delay, operating frequency, and power dissipated per gate, supply voltage levels, operational voltage levels of various logic families.
3.	Combinational Systems
	<ul style="list-style-type: none"> Binary arithmetic units (Adder, Subtractor, n-bit parallel adder & Subtractor, look ahead carry generator), decoder, encoder, multiplexer, Demultiplexer, code converters, Magnitude comparators, parity generators. Implementation of combinational logic by standard IC's.
4.	Sequential Systems
	<ul style="list-style-type: none"> Flip-flop and Latch: SR latch, JK flip-flop, T flip-flop, D flip-flop and latch, Master-slave RS flip-flop, Master-slave JK flip-flop, asynchronous inputs. Registers & Counters: Shift registers (SISO, SIPO, PISO, PIPO), universal shift register. Counters Asynchronous/Ripple counters, Synchronous counters, Modulus-n Counter, Ring counter, Johnson counter, Up-Down counter, asynchronous clear, preset and load in a counter, synchronous clear, preset and load in a counter, typical IC's for counters. Synchronous (Clocked) sequential circuits:



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COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

CO-PSO Mapping

COs and PSOs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	1	—	—	—	—	1	—
CO2	—	—	—	—	—	—	2	—	2	3	—	—
CO3	—	—	—	—	—	—	—	3	—	—	2	—
CO4	—	—	—	—	—	—	2	—	3	2	—	—
CO5	—	—	—	—	—	—	—	1	—	—	1	—

CO-PO Mapping

Sr. N	Reference Books	Author	Edition	Publication
1	Digital Design	Morris Mano M, Michael D. Ciletti,	4th Edition	Pearson Education
2	Fundamentals of Logic Design	Charles H Roth (Jr), Larry L. Kinney	5th Edition	Cengage Learning
3	Digital Fundamentals	Floyd and Jain	8th Edition	Pearson Education
4	Digital Systems: Principles and Applications	Ronald J. Tocci	10th Edition	Pearson Education
5	Digital Principles and Applications	Donald P Leach, Albert Paul Malvino, Goutam Saha	6th Edition	Tata McGraw Hill

Unit	Unit Details
5.	Memory and Programmable Logic
	<ul style="list-style-type: none"> RAM, memory decoding, ROM, PROMs, PAL & PLA, Sequential Programmable Devices (discuss three major devices without going into their detailed construction).

APPROVED

Elective-I**Code: BCAIIPA-303****Data Visualization****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To understand the importance of data visualization in the business and engineering
- To understand the application and role of visualization tools in creating the advanced techniques.
- To understand the importance of vector visualization in multivariate data analysis
- To understand the impact of visualization techniques in ease the analytics decision making process.

COURSE OUTCOME: After completion of this course students should be able to:-

- Design effective data visualizations in order to provide new insights into a research question or communicate information to the viewer.
- Know the basics of data visualization
- Understand the importance of data visualization and the design and use of many visual
- Components
- Learn to wisely use various visualization structures such as tables, spatial data, time-varying data, tree and network, etc.
- Learn the basics of colors, views, and other popular and important visualization-based issues.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Data Visualization	9
2.	Static Graphical Techniques – 1	9
3.	Configuring File and Share Access Permissions	9
4.	Configuring DNS Zones and Records	8
5.	Implementing Patch Management and Monitoring Server Performance	9



B. DETAILED SYLLABUS

APPROVED

Unit	Unit Details
1.	Introduction to Data Visualization
	<ul style="list-style-type: none"> Brief history of data visualization, scientific design choices in data visualization- choice of graphical form, grammar of graphical techniques of large amount of data, crucial need of visualization techniques, challenges in visualization techniques, classification of visualization techniques for qualitative and quantitative data, power of visualization techniques, introduction to different visualization techniques..
2.	Static Graphical Techniques – 1
	<ul style="list-style-type: none"> Introduction to bar graph, basic understanding of making basic bar graph, grouping bars together, bar graphs on counts, customization of bar graphs by changing colour, size, title, axis units, changing width and spacing of the bar chart, adding labels to bar graph, application of bar graph in business.
3.	Multivariate Graphical Techniques
	<ul style="list-style-type: none"> Introduction to correlation matrix, application of correlation matrix in the multivariate analysis, network graph, basics of heat map, difference between heat map and tree map, introduction to higher dimensional scatter plot, axis adjustment in the higher dimensional scatter plot, addition of prediction surface of higher dimensional scatter plot.
4.	Graphical Validation
	<ul style="list-style-type: none"> Basics of multivariate statistical visual representations and its results, dendrogram, importance of dendrogram in grouping (cluster analysis), Scree Plot, importance of Scree Plot, application of Scree Plot in determining number of clusters and factors, QQ plot, importance of QQ plot in distribution of data for the further quantitative analysis, PP plot, applications and usage of PP Plot for distribution detection.



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5	Customization
	<ul style="list-style-type: none"> Introduction to annotations – adding : text, mathematical expression , lines, arrows, shaded shapes, highlighting the texts and items, adding error bars, introduction to axis, swapping x and y axis, changing the scaling ration in the axis, positioning of axis and arranging tick marks and labels, changing the appearance of axis labels, circular graphs, using themes, changing the appearance of theme elements, creating the own themes, legends : removing the legends, position of legends, legend title, labels in legends.

Sr. N	Reference Books	Author	Edition	Publication
1	DATA VISUALIZATION PRINCIPLES AND PRACTICE	Alexandru Telea	Latest	CRC Press
2	Hand book of Data Visualization	Chun-houh Chen, Wolfgang Härdle, Antony Unwin	Latest	Springer Publication
3	R Graphics Cook Book	Winston Chang	Latest	O'Reilly
4	Elegant Graphics for Data Analysis	Hadley Wickham	Latest	Springer Publication

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—



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CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Elective-I

Code: BCAIIPA-304

Business Intelligence

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the basic concepts of Business Intelligence and its architecture.
- To understand the procedure for Business Performance management and business intelligence.
- To understand the importance of OLAP and Business Intelligence Data stages.
- To understand the different types of business intelligence, reporting and dash board design.
- To understand how the Business Intelligence system is implemented.

COURSE OUTCOME: After completion of this course students should be able to:-

- Understand the important terminologies and architecture of Business Intelligence system.
- Understand the important difference between business performance management and business intelligence.
- Understand the different OLAP systems used in Business Intelligence Report creations and analytics.
- Learn the different business intelligence types, and importance of report creation and dashboard design.
- Understand implementation procedure for business intelligence systems.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Business Intelligence	10
2.	Business Performance Management	9
3.	Business Intelligence: Stages	7
4.	Types of Business Intelligence	9
5.	Business Intelligence Implementation	7



B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Business Intelligence
	<ul style="list-style-type: none"> Introduction to Business Intelligence, A Framework for Business Intelligence (BI), Definitions of BI, A Brief History of BI The Architecture of BI, Styles of BI, The Benefits of BI, Event-Driven Alerts, Intelligence Creation and Use and BI Governance, A Cyclical Process of Intelligence Creation and Use, Intelligence and Espionage, Transaction Processing versus Analytic Processing, Successful BI Implementation, The Typical BI user Community, Appropriate Planning and Alignment with the Business Strategy, Real-Time, On-Demand BI Is Attainable, Developing or Acquiring BI Systems, Justification and Cost-Benefit Analysis, Security and Protection of Privacy, Integration of Systems and Applications , Major Tools and Techniques of Business Intelligence.
2.	Business Performance Management
	<ul style="list-style-type: none"> Business Performance Management (BPM) Overview, BPM Defined, Comparison of BPM and BI, Operational Planning, Financial Planning and Budgeting, Pitfalls of Variance Analysis, Act and Adjust: What Do We Need to Do Differently?, Performance Measurement, Key Performance Indicators (KPI) and Operational Metrics, Problems with Existing Performance Measurement Systems, Effective Performance Measurement, BPM Methodologies, Balanced Scorecard (BSC) , Six Sigma, BPM Technologies and Applications, BPM Architecture, Commercial BPM Suites, BPM Market versus the BI Platform Market, Performance Dashboards and Scorecards, Dashboards versus Scorecards, Dashboard Design, important properties of design of dash board.
3.	Business Intelligence: Stages
	<ul style="list-style-type: none"> Introduction, Extract, Transform, and Load (ETL), Data Warehouse, Data Warehouse Architecture, Design of Data Warehouses, Dimensions and Measures, Data Warehouse Implementation Methods: Top-Down Approach, The Bottom-Up Approach, The Federated Approach, The Need for Staged Data, Integrating Data from Multiple Operating Systems, OLAP, Types of OLAP, Multidimensional OLAP (MOLAP), Relational OLAP (ROLAP), Hybrid OLAP (HOLAP), Data Mining, Data Mining and Statistical Analysis, Data-Mining Operations, Data Mining—Data Sources, Data Dredging, Data Management, Data Usage, Enterprise Portal (EP).



4	Types of Business Intelligence
	<ul style="list-style-type: none"> Multiplicity of BI Tools, The Problem with Multiple BI Tools, Types of BI, Enterprise Reporting, Cube Analysis, Ad Hoc Query and Analysis, Statistical Analysis and Data Mining, Alerting and Report Delivery, Modern BI, Enterprise Reporting, Support for Different Forms and Types, Support for Personalization and Customization, Support for Wide Reach, High Throughput and Access across All Touch Points, The Enterprise BI, Single Unified User Interface, Single Unified Backplane, Vision of a Critical BI System, Centralized Business Logic, Flexible Data Structures, Advanced Analytics, Reporting, Rich Report Design, Flexible Information Delivery, Self-Service Reporting, Critical BI for the Enterprise.
5	Business Intelligence Implementation
	<ul style="list-style-type: none"> OPENSSEH - The Introduction, Implementation of BI System: An Overview, BI Implementations Factors, Managerial Issues Related to BI Implementation, BI and Integration Implementation, Types of Integration, Levels of BI Integration, Embedded Intelligent Systems, Connecting BI Systems to Databases and Other Enterprise Systems, Connecting to Databases, Integrating BI Applications and Back-End Systems, Middleware, On-Demand BI, The Limitations of Traditional BI, The On-demand Alternative, Key Characteristics and Benefits, Issues of Legality, Privacy, and Ethics, Legal Issues, Privacy, Ethics in Decision Making and Support.

Sr. N	Reference Books	Author	Edition	Publication
1	Business Intelligence: A Managerial Approach	Turban, Sharda Efraim; Ramesh, Dursun Delen and King, David	2nd Edition	Prentice Hall
2	Business Intelligence for Telecommunications	Deepak Pareek	Latest	Auerbach Publications
3	Applied Data Mining Statistical Methods for Business and Industry	PAOLO GIUDICI,	Latest	Wiley & Sons
4	Data Mining: Concepts and Techniques	Han, Jiawei and Kamber, Micheline.	Latest	Morgan Kaufmann Publishers
5	Business Analysis for Business Intelligence	Bert Brijs	Latest	CRC Press

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Third Semester

APPROVED

Practical Subjects

Code: BCAI303

DBMS Lab

2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- A database management system (DBMS) is collection of software meant to manage a Database. Many popular databases currently in use are based on the relational database model.
- RDBMSs have become a predominant choice for the storage of information in new databases used for financial records, manufacturing and logistical information, personnel data and much more.
- The course covers the basic concepts of databases in general with an emphasis on relational databases, modeling techniques and writing queries. Normalization techniques, Transaction processing, Concurrency Control techniques and Recovery of databases against crashes are also covered

COURSE OUTCOME: After completion of this course students should be able:-

- Understand the concept of Database Management
- Able to perform Database creation/ deletion, table creation/ deletion.
- Understanding Query Execution
- Able to check Validity of Query
- Designing of a database management system

A. List of Experiments

Experiments
<ol style="list-style-type: none">1. Perform following actions using SQL statements<ol style="list-style-type: none">(i) Create a new user with name "shiva" and password "kumar@1"(ii) Assign the following privileges(iii) Create and drop tables, Create and drop users, Allow to assign above privileges to new users, List all tables in the database,(iv) List all users in the database, Logout from current user and log in as "shiva"2. Create following tables and insert minimum 10 rows in to each table<ol style="list-style-type: none">(i) Department table with following columns with appropriate data types: DeptId, DeptName, DeptLoc(ii) Employee table with following columns with appropriate data types: EmpId, EmpName, DOB, DOJ, Job, Salary(iii) Product table with following columns with appropriate data types: ProdId, ProdName, Price(iv) Sales table with following columns with appropriate data types: SalesId, Date, Quantity

Surf



Experiments

3. Update above tables with following features using SQL statements
 - (i) Make DeptId in Department table as Primary Key
 - (ii) Make EmpId in Employee table as Primary Key
 - (iii) Add DeptId column to the Employee table and make it foreign key from Department table and update the values
 - (iv) Add EmpId and ProdId to the Sales table and make them foreign key from Employee and Product table and update the values
4. Update all columns in all tables with appropriate constraint such as not null, check and so on
5. Perform the following SQL statements
 - (i) Create a view "EmpDeptView" from Employee and Department table which contains following columns (EmpName, DOB, Salary, DeptId, DeptName, Loc)
 - (ii) Retrieve all employees whose salary between 25,000 to 30,000
 - (iii) Retrieve all employees who is working in Accounts department (If it is not there add this row to Department table)
 - (iv) Retrieve all employees who is working other than Accounts department
 - (v) Retrieve all employees who is working in Accounts department (If it is not there add this row to Department table)
 - (vi) Retrieve all employee who is working in Sales department and Bangalore location
 - (vii) Retrieve all employees who completed minimum 5 years Retrieve all employees who completed minimum 5 years and salary less than 30,000
6. Perform the following SQL statements
 - (i) Retrieve all employees whose salary more than 30,000
 - (ii) Retrieve employee details who is getting maximum salary
 - (iii) Retrieve employee details who is getting minimum salary
 - (iv) Retrieve employee details who is getting 3rd maximum salary
 - (v) Retrieve employee details who is getting 5th minimum salary
 - (vi) Retrieve total number of employees in each department in Bangalore location
 - (vii) Retrieve total number of employees in each location
 - (viii) Retrieve total number of employees in each location in Accounts department
 - (ix) Retrieve total number of employees who complete more than 10 years in each department
7. Write a PL/SQL Procedure to find prime number from 1 to n, n is a user input or parameter
8. Write a PL/SQL Functions to return number of days an employee working using EmpId
9. Write a PL/SQL Procedure to find sum of salaries of all employee working in a particular location
10. Write a PL/SQL Function to return sum of sales by ProdId
11. Write a PL/SQL Function to return sum of sales by EmpId
12. Write a PL/SQL Procedure to generate Employee Report department wise as follows:
 - (i) DeptName; EmpName; Job; Location; Salary; Cumulative_Salary



Experiments

13. Write a PL/SQL Trigger to insert row into OldEmployee table when a employee deleted from Employee table (Create OldEmployee table)
14. Write a PL/SQL Trigger not to delete more than 2 employees at a time
15. Write a PL/SQL Trigger not to update employee salary if it cross 67000
16. Write a PL/SQL Package with following procedures and functions Procedures:
 - (i) Print Total Quantity Sales Summary Report(SalesId, Date, Quantity and Total Quantity)
 - (ii) Print Total Quantity Sales Summary Report by Date wise
 - (iii) Functions:
 - (iv) Return employee name who made maximum sales till date
 - (v) Return product name soled maximum quantity till date

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

COURSE OVERVIEW AND OBJECTIVES:

- To setup the environment to run the python programs
- To understand concepts about Data Types and Looping techniques
- To understand and implement the OOP concepts, Decorators, and Iterators
- To understand and build the Web Applications
- Debugging and Troubleshooting Python Programs.

COURSE OUTCOME: After completion of this course students should be able to:-

- Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
- Express different Decision Making statements and Functions, Interpret Object oriented programming in Python
- Understand and summarize different File handling operations
- Explain how to design GUI Applications in Python and evaluate different database operations
- Design and develop Client Server network applications using Python

A. List of Experiments

Experiments
<ol style="list-style-type: none"> 1. Write a python code to find given number is prime or not 2. Write a python code to find LCM and GCM of a given list 3. Write a python code to find mean and standard deviation of a given list of numbers 4. Write a python code to add and delete element from a dictionary using functions 5. Write a python code to print 10 student details using class and lists 6. Write a python code to find student from a given list using class 7. Write a python code to inherit employee class to student class 8. Write a python code to build simple GUI calculator 9. Write a python code to build web page with student registration form 10. Write a python code to build web pages with sign-in and sing-up forms 11. Write a python code to build Rest API for product 12. Write a python code to build Ajax enabled web application for product



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	1	—	—	1	1
CO2	3	3	2	2	3	—	—	1	—	—	—	1
CO3	2	3	3	2	2	—	—	—	—	—	1	—
CO4	2	2	3	3	3	—	—	1	—	—	—	1
CO5	2	3	2	2	2	—	—	—	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to employability and Skill Development



Signature

APPROVED

Code: BCAI304 Business Communication & Presentation Skills 2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

- To train students in how to be effective communicators by practicing various skills and also help those in becoming well-groomed individuals in terms of both verbal and non-verbal communication.

COURSE OUTCOME: After completion of this course students should be able:-

- Trained to be effective communicators by practicing various skills.
- Well-groomed individuals in terms of both verbal and non-verbal communication.
- To overcome nervousness and stage fear at the end of the course.
- Trained for effective email writing, Resume preparation, report writing etc.
- Develop effective presentation skills.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Principles of Effective written communication	12
2.	Letter writing	11
3.	Email & Memo writing	11
4.	Precise Writing & Report Writing	11
5.	Resume writing	11



A handwritten signature in blue ink, appearing to be 'Smt.' followed by a stylized name.

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Principles of Effective written communication
	<ul style="list-style-type: none"> 7 C's of Business communication: Clarity, Completeness, Conciseness, Consideration, Courtesy, Correctness, and Concreteness. Practice sessions for business writing.
2.	Letter writing
	<ul style="list-style-type: none"> Structure & Planning, Types of Letter: Leave letter, Cover Letter, Application Letter. Persuasive Writing: AIDA; practice sessions on letter writing.
3.	Email & Memo writing
	<ul style="list-style-type: none"> Importance of Email & Memo writing in the business world, Format of Email & Memo, Structure of Email & Memo, practice sessions on email and memo writing
4.	Precise Writing & Report Writing
	<ul style="list-style-type: none"> Techniques of Precise writing, qualities of a good precise. Different types of Report – sales report, Annual report, Technical report, Components of a good report focusing on how to write short reports, practice sessions on report writing
5.	Resume writing
	<ul style="list-style-type: none"> Components of a good resume, different formats of resume, resume writing practice Conducting Effective Meetings Different Types of meetings: Business meetings, Review meetings, Preparation for the meeting – Writing Agenda, MOM. Presentation Skills Planning & developing effective Presentation, Do's & don'ts of a good presentation, use of Effective visual aids in a presentation



Sr. N	Reference Books	Author	Edition	Publication
1	Business Communication Strategies	Matthukutty M Monippally	Latest Edition	Tata McGraw-Hill
2	Business Communication; Concepts, Cases, & Applications	Chaturvedi P.D. et al	Latest Edition	Pearson Education
3	Communication for Business	Shirley Taylor	Latest Edition	Pearson Education
4	Basic Business Communication	Lesiicar and Flatley	Latest Edition	TMC
5	Business Communication Today	Courtan L. Bovee et al.,	Latest Edition	Pearson Education
6	Business communication	Meenakshi Raman & Prakash Singh	Latest Edition	Oxford University Press

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	3	3	1	3	2	2	2
CO2	—	—	—	—	—	2	3	1	3	1	1	—
CO3	—	—	—	—	—	—	—	—	3	—	—	—
CO4	—	—	—	3	—	—	—	—	—	—	—	—
CO5	2	2	2	2	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAI305

Summer Project Seminar I

1 Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- The objective of Summer Project is to enable the student to take up investigative study in field of Computer application with emphasis on their specialization. This is expected to provide a good initiation for the student(s) in Industry practices. The students are expected to investigate, model and present their work either individually or in groups (to be decided by the department) to the departmental committee.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development




TEACHING AND EXAMINATION SCHEME FOR**Bachelor of Computer Application****(Specialization in Artificial Intelligence)****Semester IV**

S.No.	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAIIPA401	PC	Introduction to RPA Tools	3	0	0	3	3
2	BCAIIPA402	PC	Introduction to Intelligent Process Automation	3	0	0	3	3
3	BCAIIPA403	PC	Sensor Technology	3	0	0	3	3
4	BCAIIPA404	HSM	Business Process Management	3	0	0	3	3
5		PE	Elective-II	3	0	0	3	3
6	BCAIIPA407	PC	Introduction to Intelligent Process Automation Lab	0	0	4	4	2
7	BCAIIPA408	PC	Introduction to RPA Tools Lab	0	0	4	4	2
8	BCAI403	PC	Logical Reasoning and Thinking	0	0	4	4	2
TOTAL				15	0	12	27	21

Course Code	Program Elective – II
BCAIIPA405	Introduction to Data Science
BCAIIPA406	Pattern Recognition



Core Theory Subjects

APPROVED

Code: BCAIPA-401

Introduction to RPA Tools

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the fundamentals of Robotic process automation and to relate these to various RPA tools. Understanding the performance of RPA tools.

COURSE OUTCOME: After completion of the course the student will be able to:

- To understand the basics of RPA tools used in the industry.
- To understand what RPA process.
- To understand UI and tool windows.
- To understand the packages installed for automatic specific targets.
- To have practical knowledge on designing RPA solutions

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Robotic Process Automation concepts	10
2.	Sequence and Data Manipulation	9
3.	Overview of RPA Tools	8
4.	Control Flow Activities and Selectors	7
5.	Automation	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Robotic Process Automation concepts
	<ol style="list-style-type: none"> 1. Introduction to RPA: Scopes and techniques of RPA, About UiPath, The future of automation 2. Record and Play: Record and Play, UiPath stack, Installing and Learning UiPath studio, Task recorder

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Vivekananda Global University, Jaipur

2.	Sequence and Data Manipulation
	<ul style="list-style-type: none"> • Sequence: Sequence, Flowchart and Control Flow, sequencing the workflow, control flow, various types of loops and decision making, step by step example using sequence, Flowchart and Control Flow. • Data Manipulation: Variables and scope, Collections, Arguments, Collections, Clipboard management, File operation, CSV/Excel to data table and vice versa
3.	Overview of RPA Tools
	<ul style="list-style-type: none"> • User Interface Components: Ribbon, Toolbars Access, Library panel, project panel, Outline panel, locals panel, Debugging, Recording, Workflow execution, context menu, properties panel, Designer panel, Universal search bar. • Workflow Design and UiPath Studio: Layout diagrams, Type of Decisions, switch activity, Flow Decision, Flow switch, naming conventions, managing variables in studio, types of variables, Managing arguments, Argument panel, Types of recording, Automatic recording, Basic, web and desktop automatic recording, Manual recording, Data scraping, Screen scraping and its methods.
4.	Control Flow Activities and Selectors
	<ul style="list-style-type: none"> • Assign activity, Delay activity, while activity, Do while activity, If activity, Switch activity, for each activity and Break activity. • Selectors and input/output methods: Simple selectors, Generation of Dynamic selectors, passing the variables in selectors, Input methods, Output methods, Full text, Native, OCR.
5.	Automation
	<ul style="list-style-type: none"> • Excel and PDF Automation: Reading and working with rows of excel, looping with excel, Working with PDF and excel files, retrieving data from web. • Email Automation: Outlook Email activity, Get IMAP mail activity, Get POP3 mail message, get exchange mail activity, sending and receiving mail messages. • Orchestrator: Dashboard, Robots, Processes, Jobs, Queues, Schedules, Transaction



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Sr.No	Reference Books	Author	Edition	Publication
1.	Learning Robotic Process Automation with UiPath	Alok Mani Tripathi	Latest	Packt.
2.	Intelligent Control: A stochastic optimization approach	Kaushik Das Sharma, Amitava Chatterjee, Anjan Rakshit	Springer	Springer Singapore
3.	Robotic Process Automation- Guide to building robots	Richard Murdoch	Latest	Kindle Edition
4.	Robotic Process Automation and Risk Mitigation: The Definitive Guide	Mary C. Lacity and Dr. Leslie P	Latest	Willcocks
5.	Introduction to robotic process automation	Frank Casale.	Latest	Kindle Edition

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	—	1	—	2	3	—	—	—	—	—	—	—
CO3	1	—	1	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	3	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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COURSE OVERVIEW AND OBJECTIVES:

To understand the fundamentals of intelligent process automation and to relate these to usage in industry. Understanding the practical knowledge of automated tools.

COURSE OUTCOME: After completion of the course the student will be able to:

- To understand the basics of intelligent process Automation used in the industry.
- To understand what is process automation.
- To understand UI and tool windows.
- To understand the packages installed for automatic specific targets.
- To have practical knowledge on designing automated solutions.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Cognitive Process Automation concepts	8
2.	Automation in UiPath	7
3.	UiPath Life Cycle and their artifacts	7
4.	Natural Language Processing	7
5.	Image and Text Automation	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Cognitive Process Automation concepts
	<ul style="list-style-type: none"> • Introduction to CPA: Scopes and techniques of CPA, CPA features, CPA platform overview, The future of intelligent automation. 3. Exploration of the tool: UiPath architecture, Installing and Learning UiPath studio, UiPath operating model, Database installation.



2.	Automation in UiPath
	<p>Vivekananda Global University, Jaipur</p> <ul style="list-style-type: none"> • UiPath: Working with different stages, Calculation, Decision, Choice, Collection, Loop, Anchor, Understanding Business objects, Understanding UiPath processes, Pages, Multi Page and page linking, Input, Output and Startup Parameters. • End to End Automation: Creating and Managing Business objects in object studio, Creating and Managing UiPath processes in process studio, CSV/Excel to data table transfer and vice versa.
3.	UiPath Life Cycle and their artifacts
	<ul style="list-style-type: none"> • Ribbon, Toolbars Access, Library panel, project panel, Outline panel, locals panel, Debugging, Recording, Workflow execution, context menu, properties panel, Designer panel, Universal search bar. • UI Automation and System Activities: UI automation, System, Properties, Variables, Output and Arguments.
4.	Natural Language Processing
	<ul style="list-style-type: none"> • Text Analysis, Text Cleaning, Stemming, TDM and DTM, Sentiment Analysis, NLP API consumption, Build your own social media monitoring tool and Analysis of Email. • Chatbot: Handling user events and assistant Bots, Monitoring system event triggers, Hotkey triggers, Mouse triggers, System triggers, Launching an assistant bot on a keyboard event.
5.	Image and Text Automation
	<ul style="list-style-type: none"> • Image Automation: Mouse and keyboard activities, Guides/text activities, OCR-activities, Types of OCR, Image Activities, Computer Vision, Image classification, Unstructured data to structure conversion, Invoice data extraction. • Text Automation: Exception Handling, Logging, Debugging, Tracing, Connecting with Database, Executing Query with Database, Project Organization, PDF-data extraction and automation, Email automation.



Sr.No	Reference Books	Author	Edition	Publication
1.	Learning Robotic Process Automation with UiPath	Alok Mani Tripathi	Latest	Packt.
2.	Intelligent Control: A stochastic optimization approach	Kaushik Das Sharma, Amitava Chatterjee, Anjan Rakshit	Springer	Springer Singapore
3.	Robotic Process Automation- Guide to building robots	Richard Murdoch	Latest	Kindle Edition
4.	Robotic Process Automation and Risk Mitigation: The Definitive Guide	Mary C. Lacity and Dr. Leslie P	Latest	Willcocks
5.	Introduction to robotic process automation	Frank Casale.	Latest	Kindle Edition

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	—	1	—	2	3	—	—	—	—	—	—	—
CO3	1	—	1	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	3	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

COURSE OVERVIEW AND OBJECTIVES:

- To understand the fundamentals of measurement systems and to relate these to usage in industry. Understanding the applications of sensors in real time applications.

COURSE OUTCOME: After completion of the course the student will be able to:

- To discuss units, standards, error analysis and characteristics of measurement systems.
- To understand the static and dynamic characteristics of transducers.
- To describe the principle of operation, construction, and characteristics of resistance, inductance and capacitance & other transducers
- To demonstrate the various types of basic transducers.
- To understand applications of Sensors in Real time applications

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Science of Measurement and Instrumentation	8
2.	Resistive Transducers	7
3.	Inductive and Capacitive Transducers	7
4.	Other Transducers	7
5.	Sensor Applications	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Science of Measurement and Instrumentation
	9. Functional Elements of Measurement Systems. 10. Definition, principles of sensing and transduction, 11. Classification of transducers, 12. Units and standards, 13. Classification of errors Odds and uncertainty - Introduction to Calibration methods.

2.	Resistive Transducers
	<ul style="list-style-type: none"> • The principle of operation, • construction details, • characteristics and application of resistance potentiometer, • strain gauge and its signal conditioning circuits, RTD, LDR, thermistor, hot-wire anemometer and humidity sensor. • Demonstration of RTD, Strain gauge, LDR
3.	Inductive and Capacitive Transducers
	<ul style="list-style-type: none"> • Induction potentiometer • Variable reluctance transducers, LVDT - Variable reluctance Tachometer • Proximity transducers - Capacitive transducer and types - Capacitor microphone
4.	Other Transducers
	<ul style="list-style-type: none"> • A piezoelectric transducer, magnetostrictive transducer - Digital transducers - Fiber optic transducer - Hall Effect transducer - Photo electric transducer- I/P & P/I transducer. • Introduction to Smart sensors and MEMS. Points to be considered for selecting a transducer.
5.	Sensor Applications
	<ul style="list-style-type: none"> • Typical applications of sensors, • Sensors in Real time industry, • Selection criterial of the sensor as per the application, • Application Cases: Weather monitoring system, Water monitoring system, • Sensor on the Conveyor system.



Sr.No	Reference Books	Author	Edition	Publication
1.	Measurement Systems – Applications and Design	E.A. Doebelin	2012	Tata Mc Graw Hill, New York
2.	Principles of Measurement Systems	John P. Bentley	4th Edition	Pearson Education, 2005
3.	Transducer Engineering	S. Ranganathan	Latest	Allied Publishers Pvt. Ltd., 2003
4.	Sensors and Transducers	D.Patranabis	Latest	Prentice Hall of India, 2004

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	1	—	—	—	—	1	—
CO2	—	—	—	—	—	—	2	—	2	3	—	—
CO3	—	—	—	—	—	—	—	3	—	—	2	—
CO4	—	—	—	—	—	—	2	—	3	2	—	—
CO5	—	—	—	—	—	—	—	1	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Code: BCAIIPA-404

Business Process Management

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

To understand about the life cycle of business process management and its components and explanation about the architecture of business process management.

COURSE OUTCOME: After completion of the course the student will be able to:

- Understand the business process methodology and its phases for the implementation
- Understand the basics of Business process management life cycle.
- Understand the business process management workflow and its methods.
- Understand the architecture and important properties of business process management.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Business Process Management	10
2.	Process Orchestrations and Choreographies	8
3.	Properties and Architecture of Business Process Management	9
4.	Business Process Methodology – I	7
5.	Business Process Methodology – II	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Business Process Management 14. Introduction, definition, business process life cycle, 15. classification of business process, goals, structures and organization, 16. evolution of enterprise systems architecture, 17. business process modelling foundation: Conceptual Model and Terminology, 18. Activity Models and Activity Instances, 19. Process Models and Process Instances, Process Interactions, 20. Modelling Process Data, modelling organization and operations, business process flexibility.




2.	Process Orchestrations and Choreographies
	<ul style="list-style-type: none"> • Introduction • Control Flow Patterns, • Petri Nets, Event-driven Process Chains, • Workflow Nets, Yet Another and Graph Based Workflow Language, • Business Process Modeling Notation, • Development Phases, • Process Choreography Design and implementation, • service interaction patterns.
3.	Properties and Architecture of Business Process Management
	<ul style="list-style-type: none"> • Introduction, • Data Dependencies, • Structural Soundness, Soundness, Relaxed Soundness, Weak Soundness, Lazy Soundness, • Workflow Management Architectures, Flexible Workflow Management, • Web Services and their Composition, Advanced Service Composition.
4.	Business Process Methodology – I
	<ul style="list-style-type: none"> • Introduction, • Methodology Overview, • Strategy and Organization, • Survey, • Design Phase, • Platform Selection, • Implementation and Testing, • Operation and Controlling Phase.
5.	Business Process Methodology – II
	<ul style="list-style-type: none"> • Business Process Reengineering, • Business Process Management (BPM) Implementation Methodology, • Phases for Implementation: Commit, Research, Analyze, Design and Implement and Support.



Sr.No	Reference Books	Author	Edition	Publication
1.	Business Process Management - Concepts, Languages, Architectures	Mathias Weske	Springer,2007	Springer-Verlag Berlin Heidelberg
2.	Business Process Management System	James F. Chang	Latest	Auerbach Publications, 2006.
3.	Business Process Management Practical Guidelines to Successful Implementations	John Jeston and Johan Nelis	Latest	Butterworth-Heinemann is an imprint of Elsevier, 2008
4.	Business Process Management Applied	Charles Poirier Ian Walker, J.Ross	Latest	Publishing Inc, 2005

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	3	1	2	3	2	1	—
CO2	—	—	—	—	—	3	2	3	2	1	—	—
CO3	—	—	—	—	—	1	3	3	3	3	3	—
CO4	—	—	—	—	—	1	1	3	3	1	—	—
CO5	—	—	—	—	—	1	1	2	—	2	2	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	2	3
CO-2	—	2	2
CO-3	—	—	3
CO-4	—	2	2
CO-5	—	2	2

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

Elective-II

Code: BCAIIPA-405

Introduction to Data Science

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

To understand about the importance of probability and statistics in Data Science and understand the execution flow of a Data Science project .

COURSE OUTCOME: After completion of the course the student will be able to:

- To understand the overview and definition of Data Science with its crucial role in current business world.
- To understand the importance of mathematics & Statistics in Data Science.
- To understand the role of machine learning techniques in Data Science and its different types.
- To know the integrated role of computers and its components in Data Science
- To understand the flow and process model of data science project management.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Data Science - An Overview	10
2.	Mathematics and Statistics in Data Science	9
3.	Machine Learning in Data Science	7
4.	Computers in Data Science	8
5.	Data Science Project Management	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Data Science - An Overview
	21. Introduction to Data Science, 22. Definition and description, history and development, terminologies, 23. basic framework and architecture, 24. difference between Data Science and business analytics, 25. importance of Data Science, 26. primary components of Data Science, 27. users of Data Science and its hierarchy, 28. overview of Data Science techniques, challenges and opportunities in Data Science, industrial application of Data Science techniques.

2.	Mathematics and Statistics in Data Science
	<p>Vivekananda Global University, Jaipur</p> <ul style="list-style-type: none"> • Role of mathematics, • importance of probability and statistics, • important types of statistical measures : Descriptive, Predictive and prescriptive statistics, • introduction to statistical inference, • application of statistical techniques, • linear algebra : matrix and vector theory, role of linear algebra in Data Science, • exploratory data analysis and visualization techniques, • difference between exploratory and descriptive statistics.
3.	Machine Learning in Data Science
	<ul style="list-style-type: none"> • Role of machine learning, • different types of machine learning techniques and its broad scope: Supervised, unsupervised, reinforcement and deep learning, • difference between different machine learning techniques, machine learning algorithms, • importance of machine learning in today's business,
4.	Computers in Data Science
	<ul style="list-style-type: none"> • Role of computer science in Data Science, various components of computer science being used for Data Science, role of relation data base systems: SQL, NoSQL, data warehousing, importance of operating concepts and memory management, freely available software tools: R, Python, important proprietary software tools, business intelligence tools.
5.	Data Science Project Management
	<ul style="list-style-type: none"> • Data Science project framework, execution flow of a Data Science project, various components of Data Science projects, stakeholders of Data Science project, industry use cases of Data Science implementation, challenges and scope of Data Science project management, process evaluation model, comparison of Data Science project methods, improvement in success of Data Science project models.



Sr.No	Reference Books	Author	Edition	Publication
1.	Data Science from Scratch: First Principles with Python	Joel Grus	1st Edition	O'Reilly
2.	Principles of Data Science	Sinan Ozdemir	Latest	(2016) PACKT
3.	Data Science For Dummies	Lillian Pierson	2015	O'Reilly
4.	Data Smart: Using Data Science to Transform Information into Insight	John W. Foreman	1st Edition	(2015) Wiley Publication.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	2	2	3	—	—	—	—	—	—	—
CO2	3	3	3	2	2	—	—	—	—	—	—	—
CO3	3	3	2	3	3	—	—	—	—	—	—	—
CO4	2	2	3	2	2	—	—	—	—	—	—	—
CO5	—	—	—	—	—	—	—	2	3	2	3	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	2	—
CO-2	2	3	—
CO-3	3	3	—
CO-4	3	2	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Elective-II**Code: BCAIPA-406****Pattern Recognition****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

To understand about the basic concept of ML and also the applications of ML and understand Discriminant Functions and Syntactic Approach to Pattern Recognition.

COURSE OUTCOME: After completion of the course the student will be able to:

- To provide a strong foundation to students to learn the fundamentals of Pattern Recognition techniques.
- To understand Parameter Estimation and Supervised Learning methods.
- To understand kernel methods used in pattern classification models.
- To understand Discriminant Functions and Syntactic Approach to Pattern Recognition.
- To understand the concept of basic tree models and applications in pattern recognition.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Pattern Recognition Systems	8
2.	Parameter Estimation and Supervised Learning	7
3.	Kernel Methods	7
4.	Gaussian Mixture Models and Expectation Maximization	7
5.	Tree Based Models	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Pattern Recognition Systems
	29. The Design Cycle-Learning And Adaptation-Supervised Learning- Unsupervised Learning-Reinforcement Learning-Linear Model For Classification-Discriminant Function(Two Class And Multiclass)-Least Square For Classification- Fisher's Linear Discriminant Analysis For Two And Multiple Class- Probabilistic Generative Models – Maximum Likelihood Solution.



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2.	Parameter Estimation and Supervised Learning
	<p>Vivekananda Global University, Jaipur</p> <ul style="list-style-type: none"> Maximum Likelihood Estimation - The Bayes Classifier - Learning The Mean Of A Normal Density - General Bayesian Learning - Nonparametric Technic – Density Estimation - Parzen Windows - K-Nearest Neighbor Estimation - Estimation Of Posterior Probabilities - Nearest-Neighbor Rule - K-Nearest Neighbor Rule.
3.	Kernel Methods
	<ul style="list-style-type: none"> Constructing Kernels – Kernel Density Estimators - Nearest Neighbor Methods – Gaussian Processes And Classification – Sparse Kernel Machines - Support Vector Machines – Maximum Margin Classifiers - Multi-Class Support Vector Machine. Graphical Models: Bayesian Networks - Generative Models - Linear Gaussian Models - Conditional Independence.
4.	Gaussian Mixture Models and Expectation Maximization
	<ul style="list-style-type: none"> K-Means Clustering - Mixtures Of Gaussian -Expectation Maximum For Gaussian Mixtures. Continuous Latent Variables: Principal Component Analysis -Applications Of Principal Component Analysis -PCA For Higher Dimensional Data - Factor Analysis. Sequential Data: Markov Models – Hidden Markov Models - Maximum Likelihood For HMM–Forward-Backward Algorithm. Combining Models.
5.	Tree Based Models
	<ul style="list-style-type: none"> Tree based model- Pros and Cons, decision tree algorithms, classification tree, characteristics of classification tree, induction algorithms, probability estimation in decision tree – Laplace correction and no match method, stopping criteria for tree development, pruning techniques and pruned tree. Classification Methods: Information Gain: ID3-C4.5-C5-J 48. Gini Index: SPRINT-SLIQ. Decision Tree Advantages and Disadvantages-Application of decision tree- Classification and Regression Trees (CART).



Sr.No	Reference Books	Author	Edition	Publication
1.	Pattern Recognition And Machine Learning	Christopher M. Bishop	Springer, 2006	Wiley & Sons, 2003
2.	Syntactic Pattern Recognition And Applications	Fu K.S.,	Latest	Prentice Hall, Eaglewood Cliffs
3.	Pattern Recognition: Techniques And Applications	Rajjan Shinghal	Latest	Oxford University Press, 2008
4.	Syntactic Pattern Recognition - An Introduction	Addison Wesley Gonzalez R.C. & Thomson M.G.	Springer	Springer, Dordrecht

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Fourth Semester

Practical Subjects

APPROVED

Code: BCAIIPA-407 Introduction to Intelligent Process Automation Lab 2 Credits [LTP: 0-0-4]

COURSE OVERVIEW AND OBJECTIVES:

To understand the fundamentals of intelligent process automation and to relate these to usage in industry. Understanding the practical knowledge of automated tools.

COURSE OUTCOME: After completion of the course the student will be able to:

- To understand the basics of intelligent process Automation used in the industry.
- To understand what is process automation.
- To understand UI and tool windows.
- To understand the packages installed for automatic specific targets.
- To have practical knowledge on designing automated solutions.

A. List of Experiments

Experiments
<ol style="list-style-type: none">1. Automation in Ui Path<ol style="list-style-type: none">a) Convert all the unstructured images to structured images used for classification.b) Build a process to classify images based on their nominal data.c) Build a process to fill the different invoice data.2. Natural Language Processing: Chatbox<ol style="list-style-type: none">a) Write a script for a bot to analyze the text from a given source.b) Connect a bot to an API to analyze the sentiment of the different text messages.c) Connect a bot to an API to summarize the input text.3. Python using AJAX<ol style="list-style-type: none">a) Write a python code to build Ajax enabled web application for product.



Sup

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	—	1	—	2	3	—	—	—	—	—	—	—
CO3	1	—	1	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	3	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



COURSE OVERVIEW AND OBJECTIVES:

- To understand the fundamentals of Robotic process automation and to relate these to various RPA tools. Understanding the performance of RPA tools.

COURSE OUTCOME: After completion of the course the student will be able to:

- To understand the basics of RPA tools used in the industry.
- To understand what RPA process.
- To understand UI and tool windows.
- To understand the packages installed for automatic specific targets.
- To have practical knowledge on designing RPA solutions

A. List of Experiments

Unit Details
<ol style="list-style-type: none"> Data Manipulation <ol style="list-style-type: none"> Read and write the data and append it to excel Prepare a process of sending and receiving mail with/without attachment Fill the data to collection or to extract form SQL database. Natural Language Processing <ol style="list-style-type: none"> Write the script to an agent in order to login for the setup created. Write a script to extract the information form Email and to analyze the same. Setup a workflow scheduler to manage work queues management



Sup

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	—	1	—	2	3	—	—	—	—	—	—	—
CO3	1	—	1	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	3	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Code: BCAI-403	Logical Reasoning and Thinking	2 Credits [LTP: 0-0-4]
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COURSE OVERVIEW AND OBJECTIVES:

- To help students learn the techniques of enhancing and sharpening their aptitude skills related to verbal ability, quantitative aptitude, logical reasoning and data presentation.

COURSE OUTCOME: After completion of this course students should be able to:-

- Learn the techniques of enhancing and sharpening their aptitude skills.
- To improve verbal ability
- To improve logical reasoning.
- The skills for data interpretation.
- To improve is quantitative aptitude, which makes them them ready to clear written aptitude tests in industries and get placed easily.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Verbal ability	6
2.	Basic quantitative aptitude	5
3.	Logical Reasoning - I	6
4.	Measures of Central Tendency	6
5.	Presentation of Data	5



B. DETAILED SYLLABUS

Unit	Unit Details
1. Verbal ability	<ul style="list-style-type: none"> Synonyms, Antonyms and One word substitutes
2. Basic quantitative aptitude	<ul style="list-style-type: none"> Speed, Time and Distance, Time and Work, Linear Equations, Progressions (Sequences & Series), Permutation and Combination, Probability, Functions, Set Theory, Number Systems, LCM and HCF, Percentages, Collection and Scrutiny of data: Primary data, questionnaire and schedule; secondary data, their major sources including some government publications.
3. Logical Reasoning - I	<ul style="list-style-type: none"> Number and Letter Series, Calendars, Clocks, Cubes, Venn Diagrams, Binary Logic, Seating Arrangement, Logical Sequence, Logical Matching, Logical Connectives, Syllogism, Blood Relations; concept of a statistical population and sample from a population; qualitative and quantitative data
4. Measures of Central Tendency	<ul style="list-style-type: none"> Objective of averaging, characteristics of good average, types of average, arithmetic mean of grouped and ungrouped data, correcting incorrect values, weighted arithmetic mean Median - median of grouped and ungrouped data merit and limitation of median, computation of quartile, decile and percentile Mode - calculation of mode of grouped and ungrouped data, merits and limitation of mode, relationship between mean, median and mode. Geometric mean and Harmonic mean.
5. Presentation of Data	<ul style="list-style-type: none"> Construction of tables with one or more factors of classification; Diagrammatic and Graphical representation of non-frequency data; Frequency distribution, cumulative frequency distribution and their graphical representation - histogram, Column Graphs, Bar Graphs, Line Charts, Pie Chart, Data Interpretation – Introduction and approaches

Sr. N	Reference Books	Author	Edition	Publication
1	Statistics for Management	Richard I Levin, David S. Rubin	5th Edition	Pearson Prentice
2	Business Statistics	Bajpai, N	Latest Edition	Pearson
3	Business Statistics	Sharma J.K.	Latest Edition	Pearson Education
4	Quantitative Methods for Business	Anderson; David R, Dennis J. Sweeney and Thomas A. Williams	Latest Edition	Prentice-Hall, West Publishing
5	CAT Complete course	Mittal	Latest Edition	UPKAR publications

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	—	3	3	3	—	—	—
CO2	—	—	—	—	—	—	3	3	3	—	—	—
CO3	—	—	—	—	—	—	3	3	—	3	—	—
CO4	—	—	—	—	—	—	3	3	—	—	—	—
CO5	—	—	—	—	—	—	3	3	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	—	—
CO-2	—	—	—
CO-3	—	—	—
CO-4	—	—	—
CO-5	—	—	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

TEACHING AND EXAMINATION SCHEME FOR Bachelor of Computer Application

(Specialization in Artificial Intelligence)

Semester V

S. No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAIIPA501	HSM	Six Sigma and Lean Methods	3	0	0	3	3
2	BCAIIPA502	PC	Digital Image Processing	2	0	0	2	2
3		PE	Elective-III	2	0	0	2	2
4		PE	Elective-IV	3	0	0	3	3
5		PE	Elective-V	3	0	0	3	3
6		GE	Generic Elective-I	3	0	0	3	3
7	BCAIIPA511	PC	Digital Image Processing Lab	0	0	2	2	1
8		PE	Elective-III Lab	0	0	2	2	1
9	BCAI501	PR	Mini Project	0	0	8	8	4
10	BCAI502	HSM	Working Towards Placements	0	0	4	4	2
11	BCAI503	ST	Summer Project Seminar II	0	0	2	2	1
TOTAL				16	0	18	34	25

Course Code	Program Elective-III
BCAIIPA503	Test Automation using Selenium
BCAIIPA504	Software Testing

Course Code	Program Elective-V
BCAIIPA507	Embedded Systems
BCAIIPA508	Design Thinking

Course Code	Program Elective-IV
BCAIIPA505	Introduction to web Services
BCAIIPA506	Digital Signal Processing

Course Code	Program Elective-III Lab
BCAIIPA512	Test Automation using Selenium Lab
BCAIIPA513	Software Testing Lab

Course Code	Generic Elective-I
BCAIIPA509	Introduction to IoT
BCAIIPA510	Cloud Computing

Core Theory Subjects**Code: BCAIIPA501****Six Sigma and Lean Methods****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

The program will produce case studies and examples from organizations already in control of business development programs.

COURSE OUTCOME: After completion of the course the student will be able to:

- Understand the background and use of this variety of ways to improve
- Understand and apply Lean to work problems
- Understand and apply Six Sigma to work problems
- Understand and apply process management
- Understand what is the best way to be different
- business problem solver
- Understand the requirements for performing a Green Belt Six Sigma certificate

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Lean & Six Sigma Background and Fundamentals	10
2.	The scope of tools and techniques	8
3.	Six sigma methodologies	9
4.	Six sigma implementation and challenges	7
5.	Evaluation and continuous improvement methods	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Lean & Six Sigma Background and Fundamentals
	30. Historical Overview – Definition of quality – What is six sigma -TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions
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2.	The Scope of Tools and Techniques
	<ul style="list-style-type: none"> Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter – Tools for measurement – Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis – Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving – Tools for improvement – Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis – Tools for control – Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.
3.	Six Sigma Methodologies
	<ul style="list-style-type: none"> Design For Six Sigma (DFSS), Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder
4.	Six Sigma Implementation and Challenges
	<ul style="list-style-type: none"> Tools for implementation – Supplier Input Process Output Customer (SIPOC) – Quality Function Deployment or House of Quality (QFD) – alternative approach – implementation – leadership training, close communication system, project selection – project management and team – champion training – customer quality index – challenges – program failure, CPQ vs six sigma, structure the deployment of six sigma – cultural challenge – customer/internal metrics
5.	Tree Based Models
	<ul style="list-style-type: none"> Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S



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Sr.No	Reference Books	Author	Edition	Publication
1.	What is Lean Six Sigma	Michael L. George, David Rowlands, Bill Kastle	Latest	McGraw – Hill 2003
2.	The Six Sigma Handbook	Thomas Pyzdek	Latest	McGraw – Hill 2000
3.	Six Sigma, Basic Steps and Implementation	Fred Soleimannejad	Latest	AuthorHouse, 2004
4.	Managing Six Sigma: A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success	Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows	Latest	John Wiley & Sons, 2000

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	2	3	2	—	—	—	—	—	—	—
CO2	—	—	3	1	3	—	—	—	—	—	—	—
CO3	—	—	1	2	1	—	—	—	—	—	—	—
CO4	—	—	3	2	3	—	—	—	—	—	—	—
CO5	—	—	2	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	—	1	1
CO-2	2	3	2
CO-3	3	1	—
CO-4	2	2	3
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

Code: BCAIIPA502

Digital Image Processing

2 Credits [LTP: 2-0-0]

COURSE OVERVIEW AND OBJECTIVES:

To understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

COURSE OUTCOME: After completion of the course the student will be able to:

- Explain fundamentals of image processing
- Compare transformation algorithms
- Contrast enhancement, segmentation and compression techniques

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	Image Enhancement in The Spatial Domain	9
3.	Image Enhancement in Frequency Domain	8
4.	Image Segmentation	7
5.	Image Compression	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction
	<ul style="list-style-type: none"> • Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relation • ships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

2.	Image Enhancement in The Spatial Domain
	<ul style="list-style-type: none"> Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
3.	Image Enhancement in Frequency Domain
	<ul style="list-style-type: none"> Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.
4.	Image Segmentation
	<ul style="list-style-type: none"> Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.
5.	Image Compression
	<ul style="list-style-type: none"> Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.



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Sr.No	Reference Books	Author	Edition	Publication
1.	Digital Image Processing	Rafael C G., Woods R E. and Eddins S L	3rd Edition	Prentice Hall, 2008
2.	Image Processing, analysis and Machine Vision	Milan Sonka	4th Edition	Thomson Press India Ltd
3.	Fundamentals of Digital Image Processing	Anil K. Jain	2nd Edition	Prentice Hall of India
4.	Digital Image Processing	S. Sridhar	2nd Edition	Oxford University Press,2016

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

Code: BCAIPA503

Test Automation using Selenium

2 Credits [LTP: 2-0-0]

COURSE OVERVIEW AND OBJECTIVES:

To understand the testing web applications. Some testing of java applications or programming at a basic level in java, or other compatible web programming language

COURSE OUTCOME: After completion of the course the student will be able to:

- Understand the importance of browser coverage and distinguish various options for testing UI of web applications. (K2)
- Understand the relationship of Web UI with the underlying HTML and JavaScript with DOM Inspection. (K2)
- Recall the History of Selenium and various tools in its suite along with their purpose. (K1)
- Recognize the purpose and API of Web UI Automation at Browser, Page, Element levels. (K2)
- Understand and Explain the purpose of JUnit annotations, fixtures, assertions. (K3)

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Web UI Automation	10
2.	Introduction to Selenium	9
3.	Automating the Web UI With Selenium	7
4.	Beyond Simple Selenium Code Constructs	8
5.	Putting Together a Basic Framework	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Web UI Automation
	<ul style="list-style-type: none"> • Introduction, UI Automation with Actual Browsers, UI Automation with Actual Browsers with Screen Size Simulation, Using Headless Browsers, Web UI: User vs Browser point of view

2.	Introduction to Selenium
	<ul style="list-style-type: none"> History, Power of Selenium, Selenium Suite, Simplified Selenium Architecture
3.	Automating the Web UI With Selenium
	<ul style="list-style-type: none"> Introduction, Browser Level Automation: Launching/closing different browsers, Navigation, Inquire window and URL information; Page Level Automation: Inquire page level information, Element Identification in depth – ID, Name, Class Name, Link Text, Partial Link Text, CSS Selectors – coverage of different variants, Xpath – coverage of different variants; Element Level Automation: State inquiry, Basic Actions
4.	Beyond Simple Selenium Code Constructs
	<ul style="list-style-type: none"> Better Waiting, Handling Drop-down Lists, Matching Multiple Elements, Handling Nested Element, Uploading a File, JavaScript Execution, Handling Windows/Tabs, Handling Frames, Handling Alerts, Taking Screenshots, Action Chains, Keyboard Actions, Handling Cookies, Headless Browsing with HtmlUnitDriver
5.	Putting Together a Basic Framework
	<ul style="list-style-type: none"> Long Exercise: Automating End To End Scenarios, Refactoring the code to create and use a WebAutomator class which wraps construction and interactions with WebDriver, Next Steps: (High Level Walkthrough and Demo), Implementing Event Listener, Page Object Design Pattern, Using Page Factories, Pages as Loadable Components, Selenium Grid



Sr.No	Reference Books	Author	Edition	Publication
1.	A Practitioner's Guide to Test Automation using SELENIUM	Aditya Garg, Ashish Mishra	2012	Tata McGraw Hill
2.	'Test automation using Selenium web driver with Java	Navneesh Garg	1st Edition	Test Automation Using Selenium with Java
3.	'Mastering Selenium Web driver	Mark Collin	2nd Edition	Ingram short title
4.	'Selenium WebDriver Practical guide	Satya Avasarala	2nd Edition	Packt Publishing Limited

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	—	1	—	2	3	—	—	—	—	—	—	—
CO3	1	—	1	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	3	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

Program Elective-III

Code: BCAIIPA504

Software Testing

2 Credits [LTP: 2-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- Design test cases suitable for a software development for different domains.
- Identify suitable tests to be carried out.

COURSE OUTCOME: After completion of the course the student will be able to:

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	8
2.	TEST CASE DESIGN STRATEGIES	8
3.	LEVELS OF TESTING	8
4.	TEST MANAGEMENT	9
5.	TEST AUTOMATION	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction
	<ul style="list-style-type: none"> • Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples- Developer/Tester Support of Developing a Defect Repository.

2.	TEST CASE DESIGN STRATEGIES
	<p>Vivekananda Global University, Jaipur</p> <ul style="list-style-type: none"> Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.
3.	LEVELS OF TESTING
	<ul style="list-style-type: none"> The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.
4.	TEST MANAGEMENT
	<ul style="list-style-type: none"> People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- .The Technical Training Program.
5.	TEST AUTOMATION
	<ul style="list-style-type: none"> Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.



Sr.No	Reference Books	Author	Edition	Publication
1.	Software Testing – Principles and Practices	Srinivasan Desikan and Gopalaswamy Ramesh	2006	Pearson Education
2.	Software Testing	Ron Patton	2nd Edition	Sams Publishing, Pearson Education, 2007
3.	Practical Software Testing	Ilene Burnstein	Springer	Springer International Edition, 2003
4.	Software Testing in the Real World – Improving the Process	Edward Kit	2nd Edition	Pearson Education, 1995

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	3	3	2	—	—	—	—	—	—	—
CO2	3	3	2	2	3	—	—	—	—	—	—	—
CO3	2	3	3	2	2	—	—	—	—	—	—	—
CO4	2	2	3	3	3	—	—	—	—	—	—	—
CO5	2	3	2	2	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	3	1
CO-2	2	3	1
CO-3	2	3	—
CO-4	3	2	—
CO-5	3	2	1

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Program Elective IV**Code: BCAIIPA505****Introduction to Web Services****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.

COURSE OUTCOME: After completion of the course the student will be able to:

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- To Understand XML concepts
- To Understand paradigms needed for testing Web Services
- To explore different Test Strategies for SOA-based applications

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Evolution and Emergence of Web Services	8
2.	Web Services	9
3.	Web Services And Soa	8
4.	Web 2.0	9
5.	Web 3.0	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Evolution and Emergence of Web Services
	<ul style="list-style-type: none"> • Evolution of distributed computing, Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA).




2.	Web Services
	<p>Vivekananda Global University, Jaipur</p> <ul style="list-style-type: none"> Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services. Ajax – Improving web page performance using Ajax, Programming in Ajax. CORBA
3.	WEB SERVICES AND SOA
	<ul style="list-style-type: none"> The Web services framework; Services (as Web Services); Service Registry; Service descriptions (with WSDL); Messaging (with SOAP), Transactions, Coordination, Business Activity, Orchestration, Choreography; Addressing, Reliable Messaging, Policies, Metadata, Security, Notification and Events; Semantic Web Services; REST full Services
4.	Web 2.0
	<ul style="list-style-type: none"> Interactive and social web: Blogs, wikis, and social networking sites – The technology behind these applications- AJAX, RSS and syndication, Ruby on Rails, Open APIs,
5.	Web 3.0
	<ul style="list-style-type: none"> Semantic Web, Widgets, drag & drop mashups (iGoogle) - The technology behind these applications- RDF Web based Information Systems, Search engines, Recommender Systems, Web Mining



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Sr.No	Reference Books	Author	Edition	Publication
1.	Understanding SOA with Web Services	Eric Newcomer, Greg Lomow	2005	Pearson Education
2.	Developing Enterprise Web Services– An Architect’s Guide	Sandeep Chatterjee, James Webber	2nd Edition	Pearson Education
3.	Web Programing Building Internet Applications	Chris Bates	2nd Edition	WILEY

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	2	—	—	—	3	—	—	—	2	1	1	—
CO2	3	—	—	—	2	—	—	—	2	1	1	—
CO3	3	—	—	—	2	—	—	—	2	2	—	—
CO4	2	3	—	—	3	—	—	—	2	1	1	—
CO5	3	—	3	—	2	—	—	—	3	2	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	—	3
CO-2	—	—	—
CO-3	2	—	2
CO-4	2	—	—
CO-5	—	—	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development.



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Program Elective IV**Code: BCAIPA506****Digital Signal Processing****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To provide a thorough understanding and working knowledge of design, implementation and analysis DSP systems.
- To make students aware about the meaning and implications of the properties of systems and signals.

COURSE OUTCOME: After completion of the course the student will be able to:

- Use concepts of trigonometry, complex algebra, Fourier transform, z-transform to analyze the operations on signals and acquire knowledge about Systems
- Select proper tools for analog-to-digital and digital-to-analog conversion. Also select proper tools for time domain and frequency domain implementation.
- Design, implementation, analysis and comparison of digital filters for processing of discrete time signals
- Integrate computer-based tools for engineering applications
- Employ signal processing strategies at multidisciplinary team activities.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Signals And Systems	8
2.	Frequency Transformations	9
3.	Iir Filter Design	8
4.	Fir Filter Design	9
5.	Finite Word Length Effects In Digital Filters	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Signals And Systems
	<ul style="list-style-type: none"> • Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution – Correlation.




2.	Frequency Transformations
	<ul style="list-style-type: none"> • Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms - Decimation – in – time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering – DCT – Use and Application of DCT.
3.	IIR Filter Design
	<ul style="list-style-type: none"> • Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.
4.	FIR Filter Design
	<ul style="list-style-type: none"> • Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques.
5.	Finite Word Length Effects In Digital Filters
	<ul style="list-style-type: none"> • Binary fixed point and floating point number representations – Comparison - Quantization noise – truncation and rounding – quantization noise power- input quantization error- coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling.



Sr.No	Reference Books	Author	Edition	Publication
1.	Digital Signal Processing – Principles, Algorithms & Applications	John G. Proakis & Dimitris G. Manolakis	4th Edition	Pearson education / Prentice Hall, 2007
2.	Digital Signal Processing	Emmanuel C. Ifeachor, & Barrie W. Jervis	2nd Edition	Pearson education / Prentice Hall, 2002
3.	Discrete Time Signal Processing	Alan V. Oppenheim, Ronald W. Schafer & Hohn. R. Back	2nd Edition	Pearson Education, 2005
4.	Digital Signal Processing	Andreas Antoniou	2001	Tata McGraw Hill, 2001

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	—	—	—	—	—	1	—	—	—	—	1	—
CO2	—	—	—	—	—	—	2	—	2	3	—	—
CO3	—	—	—	—	—	—	—	3	—	—	2	—
CO4	—	—	—	—	—	—	2	—	3	2	—	—
CO5	—	—	—	—	—	—	—	1	—	—	1	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

Program Elective-V**Code: BCAIPA507****Embedded Systems 3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To impart knowledge in various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool

COURSE OUTCOME: After completion of the course the student will be able to:

- Acquire a basic knowledge about fundamentals of microcontrollers
- Acquire a basic knowledge about programming and system control to perform a specific task.
- Acquire knowledge about devices and buses used in embedded networking
- Develop programming skills in embedded systems for various applications.
- Acquire knowledge about basic concepts of circuit emulators.
- Acquire knowledge about Life cycle of embedded design and its testing.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Embedded System	10
2.	Real Time Operating System	8
3.	Interface with Communication Protocol	9
4.	Design of Software Embedded Control	7
5.	Interfacing with Embedded Controller	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Embedded Systems
	<ul style="list-style-type: none"> • Organization Embedded computing – characteristics of embedded computing applications – embedded system design challenges; Build process of Real time Embedded system – Selection of processor; Memory; I/O devices-Rs-485, MODEM, Bus Communication system using I 2 C, CAN, USB buses, 8 bit –ISA, EISA bus.

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2.	Real Time Operating System
	<p>Vivekananda Global University, Jaipur</p> <ul style="list-style-type: none"> • Introduction to RTOS; RTOS- Inter Process communication, Interrupt driven Input and Output Nonmaskable interrupt, Software interrupt; Thread – Single, Multithread concept; Multitasking Semaphores.
3.	Interface with Communication Protocol
	<ul style="list-style-type: none"> • Design methodologies and tools – design flows – designing hardware and software Interface. system integration; SPI, High speed data acquisition and interface-SPI read/write protocol, RTC interfacing and programming.
4.	Design of Software Embedded Control
	<ul style="list-style-type: none"> • Software abstraction using Mealy-Moore FSM controller, Layered software development, Basic concepts of developing device driver – SCI – Software - interfacing & porting using standard C & C++ ; Functional and performance Debugging with benchmarking Real-time system software – basics of contemporary RTOS – VXWorks, UC/OS-II
5.	Interfacing with Embedded Controller
	<ul style="list-style-type: none"> • Programmable interface with A/D & D/A interface; Digital voltmeter, control- Robot system; - PWM motor speed controller, serial communication interface. Standard single purpose processor's peripherals: timers, counters, watchdog timers, UART, LCD controllers, keypad controllers. Applications: Digital camera-washing machine-cell phones-home security systems-finger print identifiers-cruise control-printers Automated teller machine.



Sr.No	Reference Books	Author	Edition	Publication
1.	Embedded Systems – Design and Applications with the 68HC 12 and HCS12	Steven F. Barrett, Daniel J. Pack	2008	Pearson Education, 2008
2.	Embedded Systems- Architecture, Programming and Design	Raj Kamal	2006	Tata McGraw Hill, 2006
3.	PIC Microcontroller and Embedded Systems- Using Assembly and C for PIC18	Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey	2008	Pearson Education, 2008
4.	Fundamentals of Embedded Software	Daniel W. Lewis	2004	Prentice Hall India, 2004

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	—	—	—	—	—	—	—	—
CO2	2	—	3	2	—	—	—	—	—	—	—	—
CO3	2	1	—	1	—	—	—	—	—	—	—	—
CO4	1	1	2	1	—	—	—	—	—	—	—	—
CO5	1	2	1	3	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	—
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	—
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Signature

Program Elective-V

Code: BCAIIPA508

Design Thinking

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To expose the student with state of art perspectives, ideas, concepts, and solutions related to the design and execution of innovation driven projects using design thinking principles.
- To prepare the mindset and discipline of systemic inspiration driven by an educated curiosity aimed find new sources of ideas, new connections and new models specially outside their regular operating atmosphere.

COURSE OUTCOME: After completion of the course the student will be able to:

- Understand the importance of Design Thinking.
- Evaluate the quality of your information and your emotions; keep thinking straight.
- Identify skills and personality traits of successful problem solving.
- Apply standard problem-solving heuristics to aid in problem solving.
- Apply problem-solving techniques to programming activities.
- Formulate and successfully communicate the solutions to problems.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Design Thinking Introduction	10
2.	Team Formation, Documentation and Canvas	8
3.	Design Thinking Exercise	9
4.	Problem Solving Skills Introduction	7
5.	Problem Solving Techniques	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Design Thinking Introduction
	<ul style="list-style-type: none"> • Introduction, Need of Design Thinking, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, Tools for Design Thinking, Relevance of Design and Design Thinking in Engineering

2.	Team Formation, Documentation and Canvas
	<p>VIVEKANANDA GLOBAL UNIVERSITY, JAIPUR</p> <ul style="list-style-type: none"> Team Building Domain Selection (Society/Industry project), Log Books-need, types of log book, preparation of log book, Importance of Documentation, Strategy Design.
3.	Design Thinking Exercise
	<ul style="list-style-type: none"> Formation of Team and aspects for the selection, Domain selection, Observation exercise, Design activities through Canvas, Brainstorming for the problem, Users Interview conduction, generation of records via logbooks.
4.	Problem Solving Skills Introduction
	<ul style="list-style-type: none"> Developing logical thinking. Introduction to Problem Solving in Computer Science domain, Errors in reasoning; verbal reasoning; analogy problems lateral thinking
5.	Problem Solving Techniques
	<ul style="list-style-type: none"> Deductive and hypothetical reasoning; computational problem solving; generating, implementing, and evaluating solutions; interpersonal problem solving.



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Sr.No	Reference Books	Author	Edition	Publication
1.	Strategies for Creative Problem Solving	H. S. Fogler and S. E. LeBlanc	2nd Edition	Pearson, Upper Saddle River, NJ, 2008
2.	Problem Solving & Comprehension	A. Whimbey and J. Lochhead	6th Edition	Lawrence Erlbaum, Mahwah, NJ, 1999
3.	Effective Problem Solving	M. Levine	2nd Edition	Prentice Hall, Upper Saddle River, NJ, 1994

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	1	—	—	—	—	—	—	—	—
CO2	2	—	1	2	—	—	—	—	—	—	—	—
CO3	2	1	3	1	—	—	—	—	—	—	—	—
CO4	1	1	2	1	—	—	—	—	—	—	—	—
CO5	1	2	2	3	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



Sud

Generic Elective - I

APPROVED

Code: BCAIIPA509

Introduction to IoT

3 Credits [LTP: 3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the concepts of Internet of Things and can able to build IoT applications.

COURSE OUTCOME: After completion of the course the student will be able to:

- Understand general concepts of Internet of Things (IoT) (Understand)
- Recognize various devices, sensors and applications (Knowledge)
- Apply design concept to IoT solutions (Apply)
- Analyze various M2M and IoT architectures (Analyze)
- Evaluate design issues in IoT applications (Evaluate)
- Create IoT solutions using sensors, actuators and Devices (Create)

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to IoT	8
2.	M2M to IoT	8
3.	M2M vs IoT An Architectural Overview	8
4.	Constraints affecting design in IoT world	9
5.	Developing IoT solutions	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to IoT
	<ul style="list-style-type: none"> • Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

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2.	M2M to IoT
	<ul style="list-style-type: none"> • Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT
3.	M2M vs IoT An Architectural Overview
	<ul style="list-style-type: none"> • Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT. IoT Reference Architecture- Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment.
4.	Constraints affecting design in IoT world
	<ul style="list-style-type: none"> • Introduction, Technical design Constraints, Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.
5.	Developing IoT solutions
	<ul style="list-style-type: none"> • Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.



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Sr.No	Reference Books	Author	Edition	Publication
1.	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle	1st Edition	Academic Press, 2014
2.	Internet of Things (A Hands-on-Approach)	Vijay Madiseti and Arshdeep Bahga	1st Edition	VPT, 2014
3.	Rethinking the Internet of Things: A Scalable Approach to Connecting Everything	Francis daCosta	1st Edition	Apress Publications, 2013
4.	Getting Started with the Internet of Things	Cuno Pfister	2011	O'Reilly Media, 2011

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	3	2	1	—	—	—	—	—	—	—
CO2	3	3	2	—	—	—	—	—	—	—	—	—
CO3	2	2	—	3	—	—	—	—	—	—	—	—
CO4	3	1	3	—	3	—	—	—	—	—	—	—
CO5	2	2	—	2	—	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	2	—
CO-2	1	3	—
CO-3	2	1	—
CO-4	3	2	—
CO-5	2	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development.



Generic Elective - I**Code: BCAIIPA-510****Cloud Computing****3 Credits [LTP: 3-0-0]****COURSE OVERVIEW AND OBJECTIVES:**

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud computing so that they are able to identify the vendors and assess the risk involved in cloud migration.
- To enable students be aware of the various governance issues in cloud and how to manage the same.

COURSE OUTCOME: After completion of this course students should be able to:-

- Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures..
- Analyze the risks involved in migrating the existing infrastructure to cloud.
- Assess various cloud service providers and generate effective cloud infrastructure by optimizing the cost involved.
- Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.
- Design and develop backup strategies for cloud data based on features.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Fundamentals of Cloud Computing	9
2.	Cloud Delivery Models 6.0 Management	8
3.	Cloud Platforms	9
4.	Cloud Computing - Challenges, Risk and Mitigation	8
5.	Managing the Cloud	8



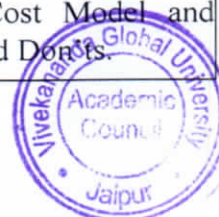
Vivekananda Global University, Jaipur

B. DETAILED SYLLABUS

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Unit	Unit Details
1.	Fundamentals of Cloud Computing
	Cloud Computing Basics – History of Cloud Computing, Characteristics of Cloud Computing, Need for Cloud computing, Advantages and Possible Disadvantages of cloud computing, Cloud Deployment Models – Public, Private, Hybrid, Community, Other deployment Models. Evolving Data Center into Private Cloud, Datacenter Components, Extracting Business value in Cloud Computing – Cloud Security, Cloud Scalability, Time to Market, Distribution over the Internet, Cloud Computing Case Studies.
2.	Cloud Delivery Models
	Introduction to Cloud Services, Infrastructure as a Service (IaaS) – Overview, Virtualization, Container, Pricing Models, Service Level Agreements, Migrating to the Cloud, IaaS Networking options, Virtual Private Cloud(VPC), IaaS Storage – File and Object storage, Data Protection, IaaS security, Benefits, Risks and Examples of IaaS. Platform as a Service (PaaS) – Overview, IaaSvsPaaS, PaaS Examples, benefits and risks. Software as a Service (SaaS) – Introducing SaaS, SaaS Examples – Office 365, Google G Suite, Salesforce.com , Evaluating SaaS – user and vendor perspective, Impact of SaaS, Benefits and risks of SaaS. Other Services on Cloud, Cloud Delivery Models Considerations
3.	Cloud Platforms
	Introducing Cloud Platforms, Evaluating cloud platforms, Cloud Platform technologies – Amazon Web Services, Microsoft Azure, Google Cloud Platform, Salesforce.com, and Impact of Cloud platforms. Private Cloud Platforms – Introducing Private clouds – Microsoft Azure stack, Open stack, AWS Greengrass, Impact of Private clouds Cloud Migration : Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies
4.	Cloud Computing - Challenges, Risk and Mitigation
	Cloud Storage, Application performance, Data Integration, Security. Ensuring Successful Cloud Adoption: Designing a Cloud Proof of Concept, Vendor roles and capabilities, moving to the Cloud. Impact of Cloud on IT Service Management. Risks and Consequences of Cloud Computing – Legal Issues, Compliance Issues, Privacy and Security.
5.	Managing the Cloud
	Managing and Securing Cloud Services, Virtualization and the Cloud, Managing Desktops and devices on the cloud, SOA and Cloud computing, Managing the Cloud environment, Planning ²⁶⁸ for the Cloud – Economic Cost Model and Leveraging the Cloud, Cloud computing resources, Cloud Dos and Don'ts.

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Sr. N	Reference Books	Author	Edition	Publication
1	CLOUD ESSENTIALS CompTIA® Authorized Courseware for Exam CLO-001	Kirk Hausman, Susan L. Cook, Telmo Sampaio	Latest Edition	Wiley & Sons
2	Cloud Computing for Dummies	Judith Hurwitz , Robin Bloor , Marcia Kaufman , Fern Halper	Latest Edition	Wiley
3	Cloud Computing: Concepts, Technology & Architecture	Erl	2014	Pearson Education
4	Cloud Computing: A Practical Approach for Learning and Implementation	Srinivasan	2014	Pearson Education

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	—	—	—	—	—	1	—	1	—	—	—
CO2	2	—	—	—	—	—	1	—	1	—	—	—
CO3	1	3	—	—	—	—	1	—	1	—	—	—
CO4	3	—	—	—	—	—	1	—	1	—	—	—
CO5	2	—	—	—	—	—	1	—	1	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	3	—	—
CO-2	2	—	—
CO-3	—	3	—
CO-4	2	—	—
CO-5	—	2	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development

Fifth Semester

Practical Subjects

APPROVED

Code: BCAIIPA-511

Digital Image Processing Lab

1 Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- To provide a thorough understanding and working knowledge of design, implementation and analysis DSP systems.
- To make students aware about the meaning and implications of the properties of systems and signals.

COURSE OUTCOME: After completion of the course the student will be able to:

- Use concepts of trigonometry, complex algebra, Fourier transform, z-transform to analyze the operations on signals and acquire knowledge about Systems
- Select proper tools for analog-to-digital and digital-to-analog conversion. Also select proper tools for time domain and frequency domain implementation.
- Design, implementation, analysis and comparison of digital filters for processing of discrete time signals
- Integrate computer-based tools for engineering applications
- Employ signal processing strategies at multidisciplinary team activities.

A. List of Experiments

List of Experiments

1. Write a program for image enhancement
2. Write a program for image compression
3. Write a program for color image processing
4. Write a program for image segmentation
5. Write a program for image morphology
6. Image Restoration
7. Edge detection
8. Blurring 8 bit color versus monochrome
9. Mini Project (Select One)
 - a. Take a hand written document, Perform preprocessing and try to segment into characters
 - b. Take an image, design fuzzy rules for content based image retrieval.
 - c. Take an image, design a neural network for content based image retrieval.



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	—	1	3	—	—	—	—	—	—	—
CO2	2	—	3	2	1	—	—	—	—	—	—	—
CO3	2	1	—	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	2	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Program Elective-III lab

Code: BCAIIPA-512

Test Automation using Selenium Lab

1 Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- To understand the testing web applications. Some testing of java applications or programming at a basic level in java, or other compatible web programming language.

COURSE OUTCOME: After completion of the course the student will be able to:

- Understand the importance of browser coverage and distinguish various options for testing UI of web applications.
- Understand the relationship of Web UI with the underlying HTML and JavaScript with DOM Inspection.
- Recognize the purpose and API of Web UI Automation at Browser, Page, Element levels.
- Understand and Explain the purpose of JUnit annotations, fixtures, assertions.

A. List of Experiments

Experiments

1. Implement software development and database fundamentals through agile.
2. Get started with Functional Testing, TDD and DevOps Integration.
3. Test and monitor your applications through Non-functional and API testing.
4. Learn mobile automation and Cloud Testing
5. Automation test Engineer Capstone.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	1	2	—	1	3	—	—	—	—	—	—	—
CO2	—	1	—	2	3	—	—	—	—	—	—	—
CO3	1	—	1	1	3	—	—	—	—	—	—	—
CO4	1	1	—	1	2	—	—	—	—	—	—	—
CO5	1	2	—	3	2	—	—	—	—	—	—	—

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CO-PSO Mapping

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COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	1
CO-2	3	2	—
CO-3	2	2	—
CO-4	3	3	2
CO-5	3	3	—

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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Program Elective III Lab

APPROVED

Code: BCAIIPA-513

Software Testing Lab

1 Credits [LTP: 0-0-2]

COURSE OVERVIEW AND OBJECTIVES:

- Design test cases suitable for a software development for different domains.
- Identify suitable tests to be carried out.

COURSE OUTCOME: After completion of the course the student will be able to:

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

A. List of Experiments

Experiments
1. Grading System (grades : Distinction, First Class, Second Class, Third Class, Fail, Absent) based on marks
2. Write a C/C++/Java Program. Write set of test cases to test the program (test Link) Based on testing assign PASS?FAIL results. Generate test report
3. Triangle program (categorize type of triangle) based on sides and angles give in the input
4. Write a C/C++/Java Program. Write set of test cases to test the program (test Link) Generate test report
5. Prime Number generation. Write a C/C++/Java Program. Write set of test cases to test the program (test Link). Generate test report

Surf



Code: BCAI501

Mini Project

4 Credits [LTP: 0-0-8]

COURSE OVERVIEW AND OBJECTIVES:

- The objective of Mini Project is to enable the student to take up investigative study in field of Computer application with emphasis on their specialization. This is expected to provide a good initiation for the student(s) in Industry practices. The students are expected to investigate, model and present their work either individually or in groups (to be decided by the department) to the departmental committee.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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COURSE OVERVIEW AND OBJECTIVES:

- The objective of this course is to enable the student to learn the techniques of enhancing and sharpening their aptitude skills related to verbal ability, quantitative aptitude, logical reasoning. This course also aims to enhance students presentation and interview skills with resume writing.

COURSE OUTCOME: After completion of this course students should be able:-

- To solve questions related to verbal and non-verbal abilities.
- To solve questions related to quantitative and logical reasoning.
- To enhance their professional presentation skills.
- To enhance their interview skills.
- To write professional and impressive resumes..

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Verbal non-verbal ability	12
2.	Quantitative and Logical Reasoning	11
3.	Presentation Skills	11
4.	Interview Skills	11
5.	Resume Writing	11



B. DETAILED SYLLABUS

Unit	Unit Details
1.	Verbal non-verbal ability
	<ul style="list-style-type: none"> Synonyms, antonyms, one-word substitute
2.	Quantitative and Logical Reasoning
	<ul style="list-style-type: none"> Speed, Time and Distance, Time and Work, Linear Equations, Progressions (Sequences & Series), Permutation and Combination, Probability, Functions, Set Theory, Number Systems, LCM and HCF, Percentages, Collection and Scrutiny of data: Primary data, questionnaire and schedule; secondary data, their major sources including some government publications. Number and Letter Series, Calendars, Clocks, Cubes, Venn Diagrams, Binary Logic, Seating Arrangement, Logical Sequence, Logical Matching, Logical Connectives, Syllogism, Blood Relations;
3.	Presentation Skills
	<ul style="list-style-type: none"> Effective communication skills, better presentation skills.
4.	Interview Skills
	<ul style="list-style-type: none"> Mock interviews
5.	Resume Writing
	<ul style="list-style-type: none"> Resume Writing for various jobs.

CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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COURSE OVERVIEW AND OBJECTIVES:

- The objective of Summer Project is to enable the student to take up investigative study in field of Computer application with emphasis on their specialization. This is expected to provide a good initiation for the student(s) in Industry practices. The students are expected to investigate, model and present their work either individually or in groups (to be decided by the department) to the departmental committee.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Project Initiation	5
2.	Resource Planning	5
3.	Execution	7
4.	Report Writing	7
5.	Submission	4



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B. DETAILED SYLLABUS

APPROVED

Unit	Unit Details
1. Project Initiation	
	<ul style="list-style-type: none"> During this phase of Project Student needs to find out the concept of his interest, on the topic he wants to proceed.
2. Resource Planning	
	<ul style="list-style-type: none"> Once the student has finalized the project topic, he/she needs to find out the technologies he would need to accomplish the task. Whether he already has the knowledge of the skill set he is going to use or he would want to learn. The student also needs to specify the hardware specifications according to their project topic.
3. Execution	
	<ul style="list-style-type: none"> With all the desired hardware and software skills student would be expected to execute the project.
4. Report Writing	
	<ul style="list-style-type: none"> After the execution of the project student needs to prepare a documentation which consists all the steps of project life cycle starting from concept planning till the execution and maintenance, if the project goes live.
5. Submission	
	<ul style="list-style-type: none"> In this step the student needs to prepare a presentation, with the live demo of project in order to accomplish the successful submission of his/her project. With the presentation, the report or documentation prepared in the previous step also needs to be submitted. This report than can be used for the junior batch students who can learn from their senior batch projects.



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CO-PO Mapping

COs and POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping

COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



TEACHING AND EXAMINATION SCHEME FOR

Bachelor of Computer Application

(Specialization in Artificial Intelligence)

Semester VI

S.No	COURSE CODE	COURSE TYPE	COURSE NAME				CONTACT HOURS	CREDIT POINTS
				L*	T*	P*		
1	BCAI601	ST	Major Project / Internship	-	-	40	40	20
TOTAL				-	-	40	40	20



Sixth Semester Project

Code: BCAI601

Major Project

20 Credits [LTP: 0-0-40]

COURSE OVERVIEW AND OBJECTIVES:

- To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The practical training aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.
- The purpose of practical training is not only to get acquainted with the culture of companies, but also to realize something of importance for the company visited. By working in a group within the company, it is expected that the trainee gets a better insight in the practical aspects of the industry. This is intended to facilitate the transition from the thorough theoretical education, dispensed at our University, into an industrial professional career.

COURSE OUTCOME: After completion of this course students should be able:-

- To take up investigative study in field of Computer application with emphasis on their specialization.
- To provide a good initiation for the student(s) in Industry practices.
- To investigate, model and present their work either individually or in groups to be decided by the department) to the departmental committee.
- Develop work habits and attitudes necessary for job success
- Develop the coordination of experiential learning programs and the integration of experiential learning into the total curriculum.

CO-PO Mapping

COs and Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3

CO-PSO Mapping



A handwritten signature in blue ink, appearing to be 'Suf'.

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COs and PSOs	PSO-1	PSO-2	PSO-3
CO-1	2	3	2
CO-2	3	3	3
CO-3	3	2	2
CO-4	1	1	1
CO-5	2	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability and Skill Development



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