SYLLABUS

for

Choice Based Credit System

(CBCS)

On the basis of

Outcome Based Education

(OBE)

BACHELOR OF COMPUTER APPLICATIONS

PATNA WOMEN'S COLLEGE
Autonomous
PATNA UNIVERSITY
3rd Cycle NAAC Accredited at 'A' Grade with CGPA 3.58/4
"College with Potential for Excellence" (CPE) Status Accorded by UGC

Vision

Rooted in the life, vision, and teachings of Jesus Christ and inspired by Mother Veronica, the foundress of the Apostolic Carmel, Patna Women's College strives to become a centre of academic excellence in higher education, social responsibility, and empowerment of women.

Mission Statement

Patna Women's College, the first college for women in Bihar, is committed to the holistic development of women so as to make an effective contribution to the creation of a better society.

To this end, we strive

- To become a center of excellence in higher education for women in an atmosphere of autonomy.
- To excel in teaching-learning, research, and consultancy.
- To provide education that promotes capacity building and holistic development of a person.
- To offer subjects for competency building and motivate/animate a workforce imbued with human values.
- To promote patriotism, communal harmony and cultural integration to maintain a free and peaceful atmosphere on the campus.
- To train the students in creative arts, social service, critical thinking, and leadership in order to make an effective contribution to the creation of a new and value-based society.
- To create women leaders and to make them agents of social change.
- To develop skill oriented and value-based courses, for the all-round development of individuals.
- To promote academic exchange and academia-industry interface.
- To form young women who are 'always wise' and who will dare to 'go ahead and conquer knowledge' through, competence, commitment, delicate conscience, and compassion.

B.Sc. Computer Applications (Hons.) CBCS Syllabus

Note: 1 credit = 15 hours
1.   Theory paper: 6 credits each (5Theory and 1 Tutorial).
2.   Tutorial group of each theory paper should have a group size of 8 students.
3.   Practical paper: 6 credits each (4Theory and 2 Practical).
4.   Practical paper will not have tutorials.

Core Courses (6 credits each)

Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

Semester I
1.   Programming Fundamentals using C
2.   Computer System Architecture

Semester II
3.   Object Oriented Programming using C++
4.   Discrete Structure

Semester III
5.   Data Structure
6.   Operating System
7.   Computer Networks

Semester IV
8.   Design & Analysis of Algorithms
9.   Software Engineering
10.   Database Management Systems

Semester V
11.   Java Programming
12.   Theory of Computation

Semester VI
13.   Internet Technologies
14.   Artificial Intelligence

Generic Elective Papers (GE) (6 credits each)

Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/ subject and vice versa and such electives may also be referred to as Generic Elective.

Semester I

1. Computer Fundamentals

Semester II

2. Programming Concepts

Semester III

3. Database Management System

Semester IV

4 . Python Programming

Discipline Specific Elective (DSE) (6 credits each)

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

Semester V

DSE-1

1. Oracle

DSE-2

2. Data Mining

Semester VI

DSE-3

3. Python Programming

DSE-4

4. Project

Skill Enhancement Course (SEC)(2Credits)

Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Semester III

1. Inter Religious Studies (Value based)

Semester IV

2. Internet Security & Cyber laws

B.Sc. Computer Applications (Hons.) CBCS Syllabus

Sem	Core Course (14) 6 Credits each	Ability Enhancement Compulsory Course AECC (2) 2 Credits each	Skill Enhancement Course SEC (2) 2 Credits each	Discipline Specific Elective DSE (4) 6 Credits each	Generic Elective GE (4) 6 Credits each
I	**BCA CC101:** Programming Fundamentals using C **BCA CC102:** Computer System Architecture	English Communication हिन्दी व्याकरण और सम्प्रेषण			**BCA GE101:** Computer Fundamentals
II	**BCA CC203:** Object oriented Programming using C++ **BCA CC204:** Discrete Structure	Environmental Science			**BCA GE202:** Programming Concepts
III	**BCA CC305:** Data Structure **BCA CC306:** Operating System **BCA CC307:** Computer Networks		**IRS SEC301:** Inter-Religious Studies (Value based)		**BCA GE303:** Database Management System

IV	**BCA CC408:** Design & Analysis of Algorithms		**BCA SEC402:** Internet Security & Cyber Laws **(Skill based)**		**BCA GE404:** Python Programming
	BCA CC409: Software Engineering				
	BCA CC410 : Database Management Systems				
V	**BCA CC511 :** Java Programming				**BCA DSE501:** Oracle
	BCA CC512: Theory of Computation				**BCA DSE502:** Data Mining
VI	**BCA CC613:** Internet Technologies				**BCA DSE603:** Python Programming
	BCA CC614: Artificial Intelligence				**BCA DSE604:** Project

Course Structure for
B.Sc. Computer Applications

Semester – I	Semester – II
BCA CC101: Programming Fundamentals using C	**BCA CC203:** Object oriented Programming using C++
BCA CC102: Computer System Architecture	**BCA CC204:** Discrete Structure
ENG AEC101 : English Communication **HIN AEC101 :** हिन्दी व्याकरण और सम्प्रेषण	**EVS AEC202 :** Environmental Science
BCA GE101: Computer Fundamentals	**BCA GE202:** Programming Concepts

Semester – III	Semester – IV
BCA CC305: Data Structure	**BCA CC408:** Design & Analysis of Algorithms
BCA CC306: Operating System	**BCA CC409:** Software Engineering
BCA CC307: Computer Networks	**BCA CC410 :** Database Management Systems
IRS SEC301 : Inter-Religious Studies (Value based)	**BCA SEC402:** Internet Security & Cyber Laws
BCA GE303: Database Management System	**BCA GE404:** Python Programming
Semester – V	**Semester – VI**
BCA CC511 : Java Programming	**BCA CC613:** Internet Technologies
BCA CC512: Theory of Computation	**BCA CC614:** Artificial Intelligence
BCA DSE501: Oracle	**BCA DSE603:** Python Programming
BCA DSE502: Data Mining	**BCA DSE604:** Project (Software Development)

Details of Credits for Courses under
B.Sc. Computer Applications

Semester	Course	Theory	Practical	Tutorial	Total Credits
I. Core Course (BCA CC) (14 Papers) – 06 credits each					
I	1. Programming Fundamentals using C	4	2	-	6
	2. Computer System Architecture	5	-	1	6
II	3. Object Oriented Programming using C++	4	2	-	6
	4. Discrete Structure	5	-	1	6
III	5. Data Structure	4	2	-	6
	6. Operating System	4	2	-	6
	7. Computer Networks	5	-	1	6

IV	8. Design & Analysis of Algorithms	5	-	1	6
	9. Software Engineering	5	-	1	6
	10. Database Management Systems	4	2	-	6
V	11. Java Programming	4	2	-	6
	12. Theory of Computation	5	-	1	6
VI	13. Internet Technologies	4	2	-	6
	14. Artificial Intelligence	5	-	1	6

II. Elective Course – 06 credits each

	1. Discipline Specific Elective- DSE (4 Papers)				
V	1. Oracle	4	2	-	6
	2. Data Mining	5	-	1	6
VI	3. Python Programming	4	2	-	6
	4. Project (Software Development)	-	-	-	6
	B.1.Generic Elective / Interdisciplinary (4 Papers)				
I	1. Computer Fundamentals	4	2	-	6
II	2. Programming Concepts	4	2	-	6
III	3. Database Management System	4	2	-	6
IV	4. Python Programming	4	2	-	6

III. Ability Enhancement Courses – 02 credits each

	I. Ability Enhancement Compulsory (AECC)				
I	1. English Communication	2			2
II	2. Environmental Science	2			2
	II. Skill Enhancement Course (SEC)		-	-	
III	1. Inter Religious Studies	2	-	-	2
IV	2. Internet Security & Cyber laws	-	2	-	2
	TOTAL				**140**

Institute should evolve a system/policy about ECA / General Interest / Hobby / Sports / NCC / NSS / related courses on its own.

*wherever there is practical there will be no tutorial and vice-versa.

PROGRAM OUTCOME

After the completion of B.Sc. Honours Degree Programme, the students will be able to achieve the following outcomes:

PO1: Professional knowledge: Acquire comprehensive knowledge of major concepts, theoretical principles and experimental findings of various subjects in pure sciences.

PO2: Critical thinking and Cognitive skills: Convey the intricate science information effectively and efficiently, analyze and solve the problems related to plants, animal sciences without relying on assumptions and guesses.

PO3: Environment and sustainability: Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO4: Effective Communication: Demonstrate familiarity with and will be able to analyze both verbally and in writing issues and forms of contemporary art with a clear understanding of historical precedents.

PO5: Instruments and Experiments: Acquire the skills in handling scientific instruments, planning and performing in laboratory experiments and drawing logical inferences from the scientific experiments.

PO6: Research and Analysis: Demonstrate analytical skill and proficiency in a range of tools and techniques used in research in science and interdisciplinary programmes.

PO7: Employability and higher Education: Show proficiency in professional, employability and develop soft skills required for higher education and placements.

PO8: Ethics: Imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality in the field of science.

PO9: Science and Society: Apply reasoning acquired by the scientific knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional science practice.

PO10: Interdisciplinary Learning: Integrate academic curriculum with other co-curricular goals, such as career development, life-long learning, develop interdisciplinary learning and opportunity to extend their knowledge across all disciplines.

PO11: Nation Building: Introspect and evolve into dynamic and creative individuals capable of socially productive, constructive actions that positively impact our Nation and the World at large.

PROGRAM SPECIFIC OUTCOME

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

PSO1: Aspire for higher degrees and research work.

PSO2: Attain Specialization in specific domains of Computer Applications.

PSO3: Gain knowledge in Software Development in Information Technology Sectors.

PSO4: Work for Banking, Insurance, Teaching and other services in Corporate and Government sectors.

PSO5: Start up new business venture through Startups and as entrepreneurs in IT sector

Computer Applications (Honours) Details of CBCS Syllabus

Core Courses (6 credits each)

Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

SEMESTER- I

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Recognize the basics of Computer Programming Concepts using C Programming Language.

CO2. Explain the concept of C character set, identifiers and keywords, variables, different data types, operators and programming constructs.

CO3. Apply the concept of advanced topics like Arrays, Functions, Pointers, Structures, Unions, Dynamic Memory Allocations and File Handling.

CO4. Create and execute different programs using Procedural programming method.

BCA CC101 : Programming Fundamentals Using C PWC (Theory : 4 credits + Practical: 2 credits)		
Unit	**Topics to be covered**	**No. of hours**
1	Overview of Procedure Oriented Programming, Character set, keywords, Data types, Casting of Data Types, Variables, Scope of Variables, Operators, Understanding precedence of Operators in expressions, Basic structure of a C program , Header Files, Compiling and Executing a C program, using comments in programs.	10
2	I/O statements, Conditional Statements (IF, IF… ELSE, Nested IF, Switch-Case), Iterative Statements (FOR, WHILE, and DO-WHILE), Use of BREAK and CONTINUE in loops, Nested loops.	10

3	Arrays (Declaring an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays), Two-dimensional Arrays, Working with Rows and Columns of a matrix. String handling and manipulation in C,	20
	Pointers – Introduction to Pointers, Pointer Arithmetic,	
	Pointers with Arrays, Structures, String	
4	Structures in C (Declaring, initializing and using simple structures), Array of structures, Concept of unions.	20
	Dynamic memory allocation, use of malloc(), calloc() , free() functions.	
	User Defined Functions- Declaring, calling and defining a User defined function	
	Concept of Pass by Value and Pass by Reference in a User Defined Function.	
	Passing Simple variables, Arrays, Structures etc. in a User Defined Function.	
	Void Functions, Functions returning values	
	Storage classes in C	
	Simple file handling operations.	
	Practical of C Programs	30
	TOTAL	**90**

Reading List :

1   Kanetkar Yashvant. (2001). *Let us C*, B&B, New Delhi

2.   Schildt Herbert. (2010). *The Complete Reference C*, Tata Mc Graw Hill, New Delhi

3.   Kamthan Ashok N. (2012). *Programming in C*, Pearson, Noida

4.   Jacquline A. Jones & Keith Harrow. (2003). *C Programming with Problem Solving*, Dream Tech Press, New Delhi

5.   Subburaj R. (2011). *Programming in C*, Vikas Publication House, Noida

6.   Jeyapoovan T. (2011). *Programming with C*, Vikas Publication House, Noida

SEMESTER- I

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1.   Recognise and understand different Number systems, Logic Gates, Basics of Boolean Algebra.

CO2.   Design Combinational and Sequential Circuits, flip – flops etc.

CO3.   Describe the design and structure of Central Processing Unit and Memory.

CO4.   Compare the design of Modern processors, Memories and I/Os.

BCA CC102 : Computer System Architecture PWC (Theory :5 credits + Tutorial: 1 credit)		
Unit	Topics to be covered	No. of hours
1	Introduction to Computers: Functional Units of Computer, Introduction to OS and Network Number systems – Decimal, Binary, Octal and Hexa-decimal number systems and their inter conversion, 1's & 2's complement, Arithmetic operations on Binary numbers, overflow & underflow.	15
2	Logic Gates, AND, OR, NOT, NOR, NAND & XOR gates and their Truth tables Boolean Algebra – Basic Operations and Boolean	20

13

	Laws, De Morgan's theorem. Sum of Product & Product of Sum, Introduction to Logic Design of Digital Circuits through Logic gates.Expression simplification through Boolean Laws and K-Map	
3	Combinational Circuit: Half Adder & Full Adder, Encoder : 4 to 2 and 8 to 3 and Decoder: 2 to 4 and 3 to 8, Multiplexer 4 x 1 and 8 x 1 and De-Multiplexers 1 x 4 and 1 x 8. Sequential Circuit: Concept of Latch and Flip Flops SR & JK, Registers, Counters	20
4	Control Unit and its General Model, Instruction Formats, Addressing modes, Central Processing Unit: Component and General register organization Memory: Main memory, Auxiliary memory Introduction to RISC and CISC	20
	Tutorials	15
	TOTAL	**90**

Reading List :

1. Abel Peter. (2000). *IBM PC Assembly Language and Programming*, PHI, New Delhi

2. Mano M Morris. (2008). *Computer System Architecture*, Pearson Education, New Delhi

3. Carphell John D. (2007), *Computer System Organization & Architecture*, Pearson Education, New Delhi

4. Stallings William. (2014). *Computer Organization & Architecture,* Pearson, Noida

5. Ram B. (2009). *Computer Fundamentals, Architecture and Organisation*, New Age International Publishers

Ability Enhancement Compulsory Courses (AECC)
English (2 Credits)

"AECC" courses are the courses based upon the content that leads to Knowledge enhancement; i. English/Hindi communication, ii. Environmental Science

SEMESTER- I

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Communicate effectively using the techniques in the area of spoken as well as written communication.

CO2. Hone their LSRW skills within their communication.

CO3. Design and answer job interview questions

CO4. Demonstrate the ability to craft professional messages that are clear yet courteous.

ENG AEC101 : English Communication PWC (Theory :2 credits)		
Unit	**Topics to be covered**	**No. of hours**
1	Communication (a) Definition of Communication (b) Stages of Communication (c) Barriers of Communication (d) Verbal and Non-verbal Communication (e) Skills of Communication – Listening, Reading, Writing, Speaking	5
2	Listening Skill (a) Meaning and Importance of Listening (b) Principles of Good listening	5
3	Writing Skills (a) Notice, Agenda, Minutes of the meeting (b) Report writing, Circulars (c) Writing Resume (d) Building vocabulary	15

4	Speaking Skill (a) Interview (b) Meeting (c) Situational Conversation	5
	TOTAL	**30**

Suggested Readings:

1.   Scot, O.; Contemporary *Business Communication*. Biztantra, New Delhi.

2.   Lesikar, R.V. & Flatley, M.E.; *Basic Business Communication Skills for Empowering the Internet Generation*, Tata McGraw Hill Publishing Company Ltd. New Delhi.

3.   Ludlow, R. & Panton, F.; *The Essence of Effective Communications*, Prentice Hall Of India Pvt. Ltd., New Delhi.

4.   R. C. Bhatia, *Business Communication*, Ane Books Pvt Ltd, New Delhi

<u>SEMESTER – I</u>

HINAECC101 – हिन्दी-व्याकरण और सम्प्रेषण

<u>परिणामः</u>

1.   विभिन्न प्रतियोगी परीक्षाओं के लिए तैयार करना।
2.   सम्प्रेषण-क्षमता की वृद्धि करना।
3.   कार्यालयी-पत्र लेखन की क्षमता विकसित करना।
4.   हिन्दी के व्याकरणिक एवं सैद्धांतिक स्वरूप की जानकारी हासिल करना।

HIN AEC101 **PWC**	हिन्दी व्याकरण और सम्प्रेषण (Theory: 2 credits)	
Unit	**Topics to be covered**	**No. of hours**
1	**हिन्दी व्याकरण और रचना :** संज्ञा, सर्वनाम, विशेषण, क्रिया, अव्यय, उपसर्ग, प्रत्यय, समास, सन्धि, पर्यायवाची शब्द, विलोम शब्द, अनेक शब्दों के लिए एक शब्द, मुहावरे एवं लोकोक्तियाँ, पल्लवन, संक्षेपण, शब्द शुद्धि, वाक्य शुद्धि, विविध प्रकार के पत्र-लेखन	15

2	**सम्प्रेषणः भाषिक सम्प्रेषण :** स्वरूप और सिद्धांत, संप्रेषण की अवधारणा और महत्व, संप्रेषण की प्रक्रिया, संप्रेषण के विभिन्न मॉडल, संप्रेषण की चुनौतियाँ	05
3	**सम्प्रेषण के प्रकार :** मौखिक और लिखित, वैयक्तिक और सामाजिक, व्यावसायिक, भ्रामक संप्रेषण, संप्रेषण बाधाएँ और रणनीति	05
4	**सम्प्रेषण के माध्यम :** एकालाप, संवाद, सामूहिक चर्चा, प्रभावी संप्रेक्षण	05
	TOTAL	**30**

<u>सहायक ग्रन्थ</u>

1. आधुनिक हिन्दी व्याकरण एवं रचना – डॉ. वासुदेव नंदन प्रसाद
2. सम्प्रेषण परक व्याकरण- सिद्धांत और स्वरूप – सुरेश कुमार

<u>SEMESTER- II</u>

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Recognize the theoretical concept of Object Oriented approach (class, objects, encapsulation, abstraction, polymorphism, Inheritance etc.)

CO2. Explain practical implementation of Object Oriented Programming using C++ and compare between Object Oriented Programming approach and procedural programming approach.

CO3. Apply the concept of Object Oriented Programming using C++ like Class, Objects, Constructors & Destructors, Function Overloading, Operator Overloading, Inheritance, friend class & friend functions, Virtual functions, File Handling etc.

CO4. Create and execute different programs using Object Oriented Programming method.

BCA CC203 : Object Oriented Programming Using C++ PWC (Theory :4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Object Oriented Programming concept, Procedural vs OOP programming, OOP terminology and features, Tokens, Character set, Keywords, Data-types, Constants and variables, Expressions, Standard Library Functions and Header files. Operator and Expressions: Arithmetic Operator, Increment/Decrement Operator, Relational Operator, Logical Operator and Conditional Operators, Logical Expressions	10
2	Control statements, IF, IF…ELSE, Nested IF, Switch….Case, GoTo, Break and Continue Looping statements, While, Do-while, For statements, nested loops. Classes and Objects: Need for Classes, Declaration of Classes, Referencing class Members, Data members and Member Functions, Creation of objects, Access Specifiers	10
3	Use of Constructors and Destructors, Types of Constructors: Default, Parameterized and Copy Constructors, Operator Overloading, Function Overloading, Friend Class, Friend Function, Virtual Functions, Arrays of Objects, Inline Functions.	20
4	Concept of Inheritance, Types of inheritance: Single level, multi-level, multiple, hybrid, Function overriding, Exception handling, Introduction to Pointers, Simple File Handling.	20
	Practical of C++ Programs	30
	TOTAL	90

Reading List :

1. Balaguruswamy E. (2006). *Object Oriented Programming & C++*, Tata McGraw Hills, New Delhi

2. Venugopal, Rajkumar & Ravishankar T. (2009). *Mastering C++,* Tata McGraw Hills, New Delhi

3. Lafore Robert. (2008).*Object Oriented Programming in Turbo C++,* Galgotia Publication, New Delhi.

4. Khurana Rohit. (2008). *Object Oriented Programming with C++,* Vikas Publishing House, NOIDA.

5. Sahoo Reeta. (2007). *C++ Projects*, Khanna Book Publishing, New Delhi.

SEMESTER- II

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Define Sets and Relations, Functions, Recurrence Relation, Permutation and Combination, Algebraic Structure and Group.

CO2. Understand Prepositional Logic, Normal Forms, Basics of Inference Theory.

CO3. Describe and evaluate Number Theory and outline the basic structure of Division algorithm, G.C.D and L.C.M.

CO4. Design solutions using Graphs and Trees for problem statements.

BCA CC204 : Discrete Structure PWC (Theory :5 credits + Tutorial: 1 credit)		
Unit	Topics to be covered	No. of hours
1	Sets - finite and Infinite sets, Functions, Relations, Properties of Binary Relations, Closure, Partial Ordering Relations, counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.	20
2	Graph Theory: Basic Terminology, Types of Graphs: Directed and Undirected Graph, Weighted	10

	Graph, Null Graph, Connected Graph, Graph Representation, Euler and Hamiltonian Paths and Circuits	
3	Prepositional Logic: Introduction, Use of propositions to represent simple sentences, Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Introduction to Normal forms, Inference Theory.	25
4	Algebraic Structure and Group; Properties of Groups; Subgroup of a Group, Number Theory: Division Algorithm G.C.D and L.C.M.	20
	Tutorials	15
	TOTAL	**90**

Reading List :

1   Liu C.L and Mahopatra D.P., (1987). *Elements of Discrete Mathematics*, TMH, New Delhi

2.   Rosen Kenneth, (2013). *Discrete Mathematics and its Appplications*, Mc Graw Hill, New Delhi

3.   Tremblay J.P and Manohar R., (2016) *Discrete Mathematical Strucutres with Application to Computer Science*, McGraw Hill, New Delhi

4.   Basavaraj S. Anami, Venkanna S. Madalli, (2013). *Discrete Mathematic*s, University Press, Hyderabad

5.   Sarkar Dr. Swapan Kumar, (2016). *Discrete Mathematics*, S. Chand & Company Pvt. Ltd., New Delhi

SEMESTER- II

COURSE OUTCOME

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

CO1. Understand multidisciplinary nature of environmental studies.

CO2. Understand the concept and types of natural resources and environmental pollution.

CO3. Evaluate the anomalies created due to haphazard population growth and its impact on environment.

CO4. Understand about the organizations, conventions and legislations working on mitigation of environmental issues.

EVS AEC 202 : Environmental Science PWC (2 Credits)		
Unit	**Topics to be covered**	**No. of hours**
1	**(a) Multidisciplinary Nature of Environmental Studies:** Definition, Scope and Importance. **(b) Concept of Ecosystem: - Components, Elementary Idea of Major Ecosystem:**	07
2	**(a) Natural Resources : Land, Water, Forest And Mineral Resources :** Introduction; Earth's Resources and Man; Renewable and Non-Renewable Resources ; Natural Resources and Associated Problems ; Non-Renewable Resources ; Renewable Resources ; Non-Renewable Energy; Renewable Energy, Conservation of Natural Resources **(b) Biodiversity and its conservation: Hotspots and threats to Biodiversity :** Biodiversity ; Definition ; Keystone Species ; Conservation of Biodiversity ; Methods For The Conservation of Wildlife ; Hot Spots ; Types of Biodiversity ; Genetic, Species and Ecosystem Diversity, Threats to Biodiversity ;	10

		Endangered And Endemic Species ; Conservation of Biodiversity: In Situ And Ex-Situ ; Wildlife Sanctuaries and National Parks of India ; The Need for An Integrated Protected Area System (IPAS) ;; Beej Bachao Andolan ; List of Biosphere Reserves in India ; Tiger Reserves in India.	
3		**Environmental Pollution:**	05
	(a)	**Causes, Effects, and Control Measures ;** Types and sources of Pollution.	
		(i) **Air Pollution ;** Sources of air pollution and its impact on human health.	
		(ii) **Water Pollution and contamination:** Introduction, Types and sources; Classification of Water Pollutants. Impact on human health	
		(iii) **Soil Pollution :** Introduction: Contaminants and Degradation; Impact on human health.	
		(iv) **Noise Pollution:** Effects of Noise Pollution on Physical Health; Permitted Noise Levels; Noise-Control Techniques. Impact on human health.	
	(b)	**Public Awareness about** Greenhouse Effects; Acid Rain; Effects; Ozone Layer Depletion, Ganga Action Plan (GAP); Chipko Movement; Chernobyl disaster; Bhopal Gas Tragedy.	
	(c)	**Environment and Human Health:** Outcome of Unhygienic Environmental Conditions	
4		**Human Population and Environment and Important Organizations:**	08
	(a)	**Population Growth, Variation Among Nations :** Global Population Growth ; Population Explosion – Family Welfare	

	Program ; Urban Poverty and The Environment ; Environment and Human Health ; Environmental Health ; Examples of Linkages ; Definition of Health Impact Assessment (HIA) by WHO ; Climate and Health ; Infectious Diseases; Water borne and water related diseases, Mitigation Strategies to control adverse health impact, Role of Information Technology in Environment and Human Health.	
	(b) Important Organizations : IUCN ; WWF ; BNHS ; PETA; Important Dates and Years; Some Important Environmental Conventions ; Atmospheric conventions ; Biodiversity conventions ; Land conventions ; Hazardous wastes ; Some important Acts and Notifications in India ; Environment Action Programme – India (EAP) ; Environment Protection Act ; Penalties ; Air (Prevention and Control of Pollution) Act 1981 ; Penalties ; Water (Prevention and control of Pollution) Act ; Penalties ; Wildlife Protection Act ; Penalties ; Forest Conservation Act ; Penalties ; Issues involved in enforcement of environmental legislation.	
	TOTAL	**30**

Reading List :

1. Chandna R. C., 2002: *Environmental Geography*, Kalyani Publications, Ludhiana.
2. UNEP, 2007: *Global Environment Outlook: GEO4: Environment for Development,* United Nations Environment Programme
3. Odum, E. P. et al, 2005: *Fundamentals of Ecology,* Ceneage Learning India.
4. Singh S., 1997: *Environmental Geography,* Prayag Pustak Bhawan. Allahabad.
5. Baskar Sushmita and Baskar R. 2007 : *Environmental studies for Undergraduate Courses,* Unicorn Books, Bangalore

SEMESTER- III

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Recognize the different types of data structures such as arrays, records, linked structures, stacks, queues, trees, and graphs used in Computer Science and their representation in memory, their algorithms and applications.

CO2. Compare and contrast the benefits of dynamic and static data structures implementations.

CO3. Differentiate between the benefits of alternative implementations of data structures with respect to performance.

CO4. Analyse the computational efficiency of the principal algorithms for sorting searching and hashing.

BCA CC305 : Data Structure		
PWC (Theory :4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Elementary Data Organization. Introduction to Linear and non- linear data structures **(Introduction to Arrays, Link List Stack, Queue, Tree and Graph).** Data Structure Operations. Memory Representation of Arrays (Single and Multi-dimensional Arrays), Static representation of Stack, Queue and Circular Queue. **Polish Notation**	10
2	Searching and Sorting techniques: Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Bubble Sort, **Insertion Sort,** Quick Sort, Merging of Arrays.	15
3	Pointers & Dynamic Memory Allocation, Linked List and its advantages, Representation of Singly, Doubly and Circular Linked Lists, **Insertion, Deletion, Searching and Traversal operations on these Linked Lists.**	15
4	Introduction to Tree as a data structure, Binary Tree: Definition related terminologies, Operations	20

24

	such as Inorder, Preorder, and Postorder Traversals (recursive algorithms only), Binary Search Tree.	
	Practical of Data Structure using C	30
	TOTAL	**90**

Reading List :

1 Thareja Reema, (2016). *Data Structures using C*, Oxford Higher Education, New Delhi.

2. Balagurusamy E, (2013). *Data Structures using C, Tata McGrawHills , New Delhi.*

3. Kamthane Ashok N., (2009). *Programming with ANSI and Turbo C*, Pearson Publication, Noida

4. Lipshutz Seymour, (2012). *Data Structures Shaum's Outlines,* Tata McGrawHills , New Delhi.

5. Langsam Yedidyah, Augenstein Moshe J. & Tanenbaum Aaron M., (2005). *Data Structures using C and C++,* Pearson Education, Delhi.

6. Pai GAV, (2009). *Data Structures and algorithms Concepts, Techniques and Applications,* Tata McGraw Hills, Delhi.

<u>SEMESTER- III</u>

<u>COURSE OUTCOME</u>

After the completion of the course, the students will attain the ability to:

CO1. State the Role of System Software (Operating System) in Computers.

CO2. Describe the important Computer System resources and the Role of OS in their management policies and algorithms

CO3. Analyse different types of Operating Systems (DOS, Windows, UNIX).

CO4. Create and execute Shell Scripts in Linux.

BCA CC306 : Operating System PWC (Theory :4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Introduction to Operating system, Types of operating systems, Functions of OS, System Calls.	5
2	Process Management- Life cycle of a Process, Process State Transition Diagram, Process Control Block and Implementation of processes, context switching, Schedulers Process Scheduling goals, Non-pre-emptive and pre-emptive scheduling algorithms- First Come First Serve, Shortest Job First, Round Robin, Priority Scheduling Concurrent processes, Concept of critical section, Semaphores Concept of Deadlock, Condition for deadlock. Concept of deadlock prevention, detection and recovery.	20
3	Memory Management, - Physical and Logical address, Fixed and Variable Partitioning, Partition Allocation Algorithm (First-fit, Best Fit, Worst Fit) Memory Allocation Strategies: Contiguous and Non Contiguous Allocation, Paging, Segmentation Virtual memory, Demand Paging, Page replacement Algorithms (FIFO, LRU and Optimal).	15
4	File system: File structure, File attributes, File operations, File access, File allocation methods, Directory structures, Disk Management and Disk scheduling techniques (FCFS, Shortest Seek Time First, Scan, Look) Introduction to I/O Management, I/O Techniques : Polling, Interrupt Driven I/O and DMA Buffering, Caching, Spooling	20
	Practical of Linux and Shell Programming	30
	TOTAL	90

Reading List :

1. Silberschatz Abraham , Galvin P eter Baer and Gagne Greg. (2006). *OPERATING SYSTEM PRINCIPLES,* John Wiley & Sons, New Delhi

2. Chauhan Naresh, (2014). *Principles of Operating System,* Oxford University Press, New Delhi

3. Stallings William, (2017). *Operating System Internal & Design Principles*, Pearson, Noida

4. Tanenbaum Andrew S., (2012)., *Modern Operating System*, PHI, New Delhi

5. Harvey M. Deltel Paul J. Destel David R. Choffnes, (2012). *Operating System*, Pearson, Noida

6. Harwani B.M.. (2015). *UNIX and SHELL,* Oxford Higher Education, New Delhi

7. Srieengan K. (2008). *Understanding UNIX*, PHI, New Delhi

8. Khurana Rohit (2014), Operating System. Vikas Publishing House Pvt. Ltd, New Delhi.

SEMESTER- III

<u>COURSE OUTCOME</u>

After the completion of the course, the students will attain the ability to:

CO1. Recognise the structure of Data Communications System and its components and basics of Networking.

CO2. Explain the concepts of Network models (OSI and the TCP – IP Reference models), functions of OSI Layers and different Protocols used in these Models.

CO3. Illustrate various Networking devices and their functions, Multiplexing, Switching Techniques, IP Addressing.

CO4. Compare different Transmission media, Flow control and Error Detection Techniques.

BCA CC307 : Computer Networks PWC (Theory : 5 credits + Tutorial: 1 credit)		
Unit	Topics to be covered	No. of hours
1	Introduction to Data Communication: Characteristics, Components, Transmission Modes. Introduction to Computer Network : Types of Network – LAN, WAN, MAN, Network Topologies: Star, Ring, Bus, Mesh, Introduction to Internet Overview of OSI Reference Model and TCP/IP Protocol suite	15
2	Characteristics of Physical Layer, Analog and Digital Signal, Multiplexing Techniques - FDM, TDM, Transmission Media, Switching Techniques: Circuit Switching, Packet Switching, Message Switching,	15
3	Connecting Devices- HUB, Switch, Bridge, Repeater, Router, Gateway and NIC Characteristics of Data Link Layer, Framing, Introduction to Flow and Error Control Characteristics of Network Layer, IP Addressing	20
4	Functionalities of Transport Layer, Session Layer, Presentation Layer and Application Layer. Protocols: Ethernet, TCP, IP, UDP, ARP, RARP, HTTP, SMTP, FTP, TELNET	25
	Tutorials	15
	TOTAL	90

Reading List :

1. Forouzan Behrouz A. (2003). *Data Communication and Networking*, Tata Mc Graw Hill, New Delhi

2. Commerce Douglas E., (2004). *Computer Network and Internet*, Pearson Education, New Delhi

3. Lingana Fred Halsall and Kulkarni Gouda, (2007). *Computer Networking and the Internet*, Pearson Education, Noida

4. Black Uyless, (1993). *Computer Network Protocol*, Standard and Interfaces, PHI Learning Pvt. Ltd., New Delhi

5. Kurose James F. & Ross Keith W., (2012). *Computer Networking A Top-down approach*, Pearson, Noida

6. Tannenbaum Andrew S. & Wetherall David J., (2012). *Computer Networks*, Pearson, Noida

SEMESTER- IV

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. State Major algorithms and data structures commonly used in different areas of Computer applications

CO2. Analyze the asymptotic performance of algorithms and write rigorous correctness proofs for algorithms.

CO3. Implement important algorithmic design paradigms and methods of analysis for different algorithms.

CO4. Apply efficient algorithms in common design situations.

BCA CC408 : Design and Analysis of Algorithms PWC (Theory :5 credits + Tutorial: 1 credit)		
Unit	**Topics to be covered**	**No. of hours**
1	**Introduction** Basic Design and Analysis Techniques of Algorithms, Correctness of Algorithm. **Algorithm Design Techniques** Iterative Techniques, Divide and Conquer, Greedy Algorithms	20
2	**Sorting and Searching Techniques** Elementary Sorting Techniques–Bubble Sort,	25

	Insertion Sort, Merge Sort, advanced sorting techniques - Heap Sort, Quick Sort, searching techniques, Medians & Order Statistics, Complexity Analysis	
3	**Lower Bounding Techniques** Decision Trees Balanced Trees Red-Black Trees	17
4.	**Graphs** Graph Algorithms–Breadth First Search, Depth First Search and its applications, Minimum Spanning Trees String Processing, String Matching.	13
	Tutorials	15
	TOTAL	**90**

Reading List :

1. Cormen T.H., Leiserson Charles E., Rivest Ronald L and Stein Clifford, (2009). Introduction to Algorithms, PHI, New Delhi

2. Sarabasse & Gelder A.V., (1999). Computer Algorithm – Introduction to Design and Analysis, Publisher – Pearson, New Delhi

3. Levitim Dr. Anany, (2012). Introduction to Design & Analysis of Algorithm, Pearson, New Delhi.

4. Pandey Hariom, (2008). Design & Analysis of Algorithm, University Science Press, Imprint of Laxmi Publications, New Delhi.

5. Dave Parag Himanshu, (2009). Design & Analysis of Algorithm, Pearson Education, New Delhi.

SEMESTER- IV

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Illustrate the basics of software – its characteristics, SRS and its components.

CO2. Classify the fundamentals of different software process models & techniques to construct larger, and more complex software systems

CO3. Apply software engineering concepts to design, develop and maintain the software.

CO4. Implement Software Testing for good Software Quality Assurance.

BCA CC409 : Software Engineering		
PWC (Theory :5 credits + Tutorial: 1 credit)		
Unit	Topics to be covered	No. of hours
1	The Evolving Role of Software, Software Characteristics, Software Engineering approach, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).	20
2	Software Requirement Analysis: Requirement Analysis and Modelling Techniques, Software Project Management: Project Estimation, Project Scheduling, Risk Management.	20
3	Software Design: Design Concepts, Approaches to Software Design, Introduction to User Interface Design, Software Coding	15
4	Software Testing: Unit Testing, Integration Testing, System Testing, Black-Box Testing, White-Box Testing. Software Quality: Software Quality Assurance, Metrics for Process and Projects.	20
	Tutorials	15
	TOTAL	**90**

Reading List :

1. Pressman R.S. (2001). *Software Engineering A Practitioner's Approach ,* MC Graw Hill New Delhi

2. Mall Rajiv, (2014). *Fundamentals of Software Engineering ,* PHI Learning Pvt. Ltd, India

3. Sabharwal Sangeeta. (2008) *Software Engineering,* New Age International*,* New Delhi

4. Stephens Rod., (2015). *Begining Software Engineering*, Willey India, New Delhi.

5. Aggarwal K.K. (2005). *Software Engineering*, New Age International, New Delhi

SEMESTER- IV

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Understand the fundamental elements of Database Management System using basic concepts of data model, entity-relationship model, database design etc.

CO2. Design ER-Models to represent simple database application scenarios and convert them into tables.

CO3. Implement Normalization for the optimization of Database Design

CO4. Use MS-Access package as Database Management software.

BCA CC410 : Database Management System PWC (Theory : 4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Concept of Database and DBMS, Data Base System versus File System, Views of Data, Data models (Relational, Hierarchical, Network and Object-oriented), Layered architecture of DBMS.	10

2	Entity Relationship(ER) Modeling: Entity: Entities and Entity sets, Attributes, Relationships and Relationship sets, ER Diagram, Codd's Rule.	15
3	Relationship Database Model, Structure of Relational Database, Data Dependency and Concept of Relational Keys, Normalization and Normal forms: INF, 2NF, and 3NF Mapping ER Models to Relational Database	20
4	Introduction to Transaction Processing : Transaction and Transaction states, ACID properties, Concurrent transactions and Schedules, Concept of serializability and Conflict serializability and Concurrency Control (Concurrency problems, locks and its types , 2Phase Locking, Timestamping).File Structure and Indexing Overview of File organizations Sequential, Indexed, and Direct Access files.	15
	Practical using MS - Access	30
	TOTAL	**90**

Reading List :

1. Singh Ikvinder Pal (2014), Database Management Systems and Oracle, Khanna Book Publishing CO (P) Ltd, New Delhi.

2. Silberschatz,A. Korth H. F. and Sudarshan S. (2011). *Database Systems Concepts*,Tata McGraw Hill, New Delhi

3. Elmasri Ramez , Navathe Shamkant B. (2016). *Fundamentals of Database Systems* Pearson Education Limited, New Delhi

4. Chopra Dr. Rajiv. (2010) *Database Management System (DBMS) A Practical Approach*, S Chand Publications, New Delhi

5. Lambert Joan , Cox Joyce (2010). *Microsoft® Access® 2010 Step by Step* Microsoft Press,

6. Lambart Steve, Dow M, Lambert III and Preppemau Joan (2012). Microsoft Office Access 2007 Step by Step, PHI Learning Pvt Limited, New Delhi.

SEMESTER- V

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Describe the fundamental concepts and features of Java Programming language.

CO2. Implement Object Oriented Programming Concepts (class, constructor, overloading, inheritance, overriding) in java.

CO3. Implement concepts of Run time Polymorphism, Multithreading and Exception Handling in Java.

CO4. Create and Use Packages and Interfaces in a Java program and Develop Graphical User Interface applications and Web based applications in Java by importing applet, AWT and Swing.

BCA CC511 : JAVA Programming PWC (Theory :4 credits + Practical: 2 credits)		
Unit	**Topics to be covered**	**No. of hours**
1	Java Architecture and Features, Difference between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords, Data Types, Operators, Expressions, Executing Basic Java Programs	15
2	Conditional and Looping Statements, Java methods, Definition, Scope, Passing and Returning Arguments, Type Conversion and Type Checking, Using Arrays(1-D and 2-D)	15
3	Defining and Using Classes in Java, Constructors, Method Overloading, Class Variables and Methods, Objects as parameters, final keyword Built-in Java Class Methods, Java Strings: Java String class, Creating and Using String Objects.	15
4	Inheritance (Single Level and Multilevel), Method Overriding, Interfaces and Packages (Swing), Java Applets, Event handling in Java.	15

Practical using JAVA	30
TOTAL	**90**

Reading List :

1. Balaguruswamy E. (2014), *Programming with Java ,4th Edition*, McGraw Hill, New Delhi

2. Malhotra Sachin and Choudhury Saurabh. (2003). Programming *in Java*, Oxford University Press, New Delhi

3. Hubbard John R. (2004). *Programming with JAVA Schaum's Series*, McGraw Hill, New Delhi

4. Sagayaraj S., Denis R, Karthik P and Gajalakshmi D, (2018). *Java Programming,* Universities Press, Hyderabad

5. Schildt Herbert, (2010). *Java: A Beginner's Guide,* Oracle Press, New York

6. Majithia Ravi. (2015). *Java EE: from Trainee to Trained*, Himalaya Publishing House, Mumbai

SEMESTER- V

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Define the basic concepts and applications of Theory of Computation.

CO2. Mathematical foundations, algorithmic principles and computer science theory to model and design computer-based systems.

CO3. Apply computational mathematics in the field of Computer Applications.

CO4. Recognize the mathematical approaches of Abstract Machines and their related languages.

BCA CC512 : Theory of Computation PWC (Theory :5 credits + Tutorial: 1 credit)		
Unit	Topics to be covered	No. of hours
1	Language and Grammars: Alphabets, Strings, Basic Operations on strings and Languages, Concatenation, Kleene Star, Regular Expressions and Languages. **Backus – Naur Form**	15
2	Types of Grammars and Chomsky- Hierarchy, Derivation Trees, Finite state machines with and without outputs. Finite State Automata- DFA and NFA and their equivalence.	20
3	Regular Sets and Pumping Lemma, Kleen's Theorem, Regular Grammar, **Introduction of Moore Machine and Mealy Machine.**	20
4	Introduction to Pushdown Automata, Linear Bound Automata and Turing Machine. Introduction to Context free Grammar, Context Sensitive Grammar and Unrestricted Grammar	20
	Tutorials	15
	TOTAL	**90**

Reading List :

1. Gupta Amit. (2010). *Theory of Automata and Formal Language*, Khanna Book Publishing, New Delhi

2. Mishra KLP and Chandrasekhar N. (2011). *Theory of Computer Science Automata, Languages and Computation*, PHI Learning Pvt. Ltd., New Delhi

3. Daniel I.A.Cohen. (1996). *Introduction to computer theory*, John Wiley

4. Lewis & Papadimitriou, (1997). *Elements of the theory of computation*, PHI Learning Pvt. Ltd., New Delhi.

5. Hoperoft, Aho, Ullman. (2006). *Introduction to Automata theory, Language & Computation*, Pearson Education.

6. Linz P. (2006). *An Introduction to Formal Language and Automata,* Publication Jones Bartlett

SEMESTER - VI

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. State basics of Internet Technologies

CO2. Illustrate various Java technologies like JavaScript, JDBC, JSP, Java Beans etc widely used in web development processes.

CO3. Develop and execute Programs using above mentioned technologies.

CO4. Create dynamic, interactive web applications, database driven applications.

BCA CC613 : Internet Technologies		
PWC **(Theory :4 credits + Practical: 2 credits)**		
Unit	Topics to be covered	No. of hours
1	**Java** Use of Objects, Array and ArrayList class	5
2	**JavaScript** Data types, operators, functions, control structures, events and event handling **JDBC** JDBC Fundamentals, Establishing Connectivity, Creating and Executing SQL Statements, Working with Result Set Objects.	25
3	**JSP** Introduction to JavaServer Pages, HTTP and Servlet Basics, Problem with Servlets, JSP Processing, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests and Users, Database Access.	20
4	**Java Beans** Java Beans Fundamentals, JAR files,	10

	Introspection, Developing a simple Bean, Connecting to DB	
	Programming of Internet Technologies	30
	TOTAL	**90**

Reading List :

1. Kogent Learning Solutions Inc, (2009) *Web Technologies HTML, JavaScript, PHP, Java, JSP,ASP.NET, XML and AJAX Black Book,* Dreamtech Press, New Delhi.

2. Zambon Giulio, Sekler Michael (2008), *Beginning JSP, JSF and Tomcat Web Development From Novice to Professional,* Apress, USA.

3. Puntambekar A.A. (2021), *Advanced Java & J2EE*, Technical Publications, Ist Edition, Pune, Maharashtra

4. Keogh Jim, (2002). *The Complete Reference J2EE*, TMH, New Delhi

5. Majithia Ravi, (2015). *Java EE: from Trainee to Trained*, Himalaya Publishing House, Mumbai

6. Bangia Ramesh, (2011). *Multimedia & Web Technology*, Khanna Book Publishing CO (P) Ltd, New Delhi

SEMESTER- VI

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Recognise the concept of AI and its applications in diverse fields.

CO2. Describe the key components of the Artificial Intelligence field.

CO3. Outline the concepts of Natural Language processing and Knowledge representation,

CO4. Classify Types of Learning and identify Expert Systems Architecture.

Unit	Topics to be covered	No. of hours
	BCA CC614 : Artificial Intelligence	
	PWC (Theory :5 credits + Tutorial: 1 credit)	
1	Definition of AI, History and Scope, AI Techniques, Characteristics of AI problems, Intelligent Agents. AI Approaches: Problem Solving with State-Space Search and example (a) Eight Tile Puzzle Problem (b) Travelling Salesman Problem (c) Water Jug Problem	15
2	Knowledge Representation: Introduction, Propositional Calculus, Predicate Calculus and Quantifiers Game Solving (Adverbial Search): Introduction, Game Tree, Simple introduction to a) Minimax algorithm (b) Horizon effect problem	15
3	Fuzzy set theory-Definition, Membership function, Representation, Types and Characteristics of fuzzy-sets, Simple theorems on Fuzzy sets operations (Union, Intersection and Negation of fuzzy-sets only).	15
4	Learning: Introduction and Concept, Types of learning. Expert systems: Introduction, Characteristics and Need of ES, ES Architecture.	15
	Tutorials	30
	TOTAL	**90**

Reading List :

1.   Padhy N.P. (2005). *Artificial Intelligence and intelligent Systems*, Oxford Publications, New Delhi

2.   Chopra Rajiv, (2012). *Artificial Intelligence: A Practical Approach*, S. Chand Publications, New Delhi

3.   Patterson D W, (1990). *Introduction to Artificial Intelligence and Expert Systems*, PHI, New Delhi

4. Charnak Eugene, (2005). *Introduction to Artificial Intelligence*, Pearson, Noida

5. Manro Sunita, Manro Rajan, (2016). *Artificial Intelligence*, Kalyani Publishers, New Delhi.

Generic Elective Papers (GE) (6 credits each)

Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S: A core course offered in a discipline/subject may be treated as an elective by other discipline/ subject and vice versa and such electives may also be referred to as Generic Elective.

SEMESTER- I

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Explain basic components, structure and functions of a Computer System

CO2. Classify the types of Software, Hardware and Peripherals of Computer System

CO3. Outline the functions of Operating systems and Programming languages

CO4. Use MS-Office package for creating professional, documents, spreadsheets and presentations.

BCA GE101 : Computer Fundamentals		
PWC (Theory :4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Introduction, History of Computers, Characteristics of Computers, Basic Computer Organization, Classification of Computers, Generations of Computers. Generation of Computer Languages, Translators, Application of Computers	20

	Input Devices, Pointing Devices, Handheld Devices, Optical Devices, Audio-Visual Input Devices, Output Devices	
2	Computer Memory & Processor: Introduction, Memory Hierarchy, Processor Registers, Cache Memory, Primary Memory RAM& Types of RAM, ROM (PROM, EPROM, EEPROM), Secondary Storage Devices	10
3	Introduction to Computer Software, Classification of Computer Software, Applications and System Software Introduction to Operating System, Functions of Operating System, Types of Operating System	20
4	Introduction to Networking, Advantages & Disadvantages of Networking, Types of Network LAN,WAN etc., Transmission Media, Network Topology. Overview of Emerging Technologies: Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems.	10
	LAB of MS-OFFICE	30
	TOTAL	**90**

Reading List :

1. Thareja Reema. (2014). *Fundamental of Computers*, oxford Publication New Delhi.

2. Ram B. (2000). *Fundamental of Computers*, New Age International, New Delhi

3. ITL Education Solutions Limited, (2011). *Introduction to Computer Science*, Pearson. India

4. Sinha Pradeep Kumar & Sinha Priti. (2011). *Computer Fundamentals*, BPB Publication, New Delhi

5. Nagpal D.P. (2013). *Computer Fundamental Concepts System & Applications*, S.Chand, New Delhi.

SEMESTER- II

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Recognize the basics of Computer Programming Concepts using C Programming Language.

CO2. Explain the concept of C character set, identifiers and keywords, variable different data types, operators and programming constructs.

CO3. Apply the concept of advanced topics like Arrays, Functions, Pointers, Structures in various programmes

CO4. Create and execute different programmes using Procedural programming method.

Unit	Topics to be covered	No. of hours
BCA GE202 : Programming Concepts **PWC (Theory : 4 credits + Practical: 2 credits)**		
1	Overview of Procedure oriented programming, Flowcharts. Introduction to C language Data types, Defining and Initializing Variables, Scope of Variables, Keywords, Casting of Data Types, Operators in C, main() function, Compiling and Executing a Program, Using Comments in Programs, Character I/O (getc, getchar, putc), printf(), scanf(), Basic Header Files (stdio.h, conio.h, math.h, string.h, etc).	10
2	Simple Expressions in C, Understanding precedence of Operators in Expressions, Conditional Statements (IF, IF… ELSE, Nested IF, Switch-Case), Iterative Statements(FOR, WHILE, and DO-WHILE), Use of BREAK and CONTINUE in Loops, Nested loops.	10

3	Use of functions, Call by Value, Call by Reference, Functions returning value, void function, One Dimensional Arrays (Declaring an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays / Strings), Two-dimensional Arrays, Working with Rows and Columns of a matrix.	20
4	Understanding use of structures, Declaring, initializing and using simple structures, Manipulating individual members of structures, Array of Structures, Understanding Pointer Variable, Simple use of Pointers, Pointer arithmetic.	20
	Practical of C Programs	30
	TOTAL	**90**

Reading List :

1. Kanetkar Yashvant. (2001). *Let us C*, B&B, New Delhi

2. Schildt Herbert. (2010). *The Complete Reference C*, Tata Mc Graw Hill, New Delhi

3. Kamthane Ashok N. (2012). *Programming in C*, Pearson, Noida

4. Jacquline A. Jones & Keith Harrow. (2003). *C Programming with Problem Solving*, Dream Tech Press, New Delhi

5. Subburaj R. (2011). *Programming in C*, Vikas Publication House, Noida

6. Jeyapoovan T. (2011). *Programming with C*, Vikas Publication House, Noida

SEMESTER- III

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Recognize the fundamental concept of Relational Database Management System using relational data model, entity-relationship model, relational database design and relational algebra.

CO2. Design ER-Models to represent simple database application scenarios and convert them into relational tables.

CO3. Execute SQL commands as a tool for Database Management.

CO4. Design and Execute queries for information storage and retrieval using SQL.

BCA GE303 : Database Management System PWC (Theory : 4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Concept of Database and DBMS, Data Base System versus File System, Views of Data, Data Models (Relational, Hierarchical, Network and Object-oriented), Layered Architecture of DBMS.	10
2	Entity Relationship(ER) Modeling: Entity: Entities and Entity sets, Attributes. Relationships and Relationship Sets, ER Diagram.	15
3	Relational Database Model, Structure of Relational Database, Data dependency and Concept of Relational Keys, Normalization and Normal Forms: 1NF, 2NF and 3NF.	15
4	Introduction to SQL Managing Tables and Data: • Creating and Manipulating Tables (Including constraints) • Data manipulation Command like insert, update, delete	20

• SELECT statement with WHERE, GROUP BY and HAVING, ORDER BY, Special operator like IN, BETWEEN, LIKE		
Practical Using SQL	30
TOTAL	**90**

Reading List :

1. Silberschatz, A. Korth H. F. and Sudarshan S. (2011). *Database Systems Concepts*,Tata McGraw Hill, New Delhi

2. Elmasri Ramez , Navathe Shamkant B. (2016). *Fundamentals of Database Systems* Pearson Education Limited, New Delhi

3. Chopra Dr. Rajiv. (2010) *Database Management System (DBMS) A Practical Approach*, Chand Publications, New Delhi

4. Singh Ikvinder Pal (2014), Database Management Systems and Oracle, Khanna Book Publishing CO (P) Ltd, New Delhi.

5. Bayross Ivan (2009). SQL, Pl/SQL: The Programming Language of Oracle, BPB Publications, New Delhi

SEMESTER- IV

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. State the basics of Python Programming language using various data types, Programming constructs

CO2. Explain Python Functions, Modules and Packages and apply these concepts in programs.

CO3. Create and execute simple Python Programs.

CO4. Implement Object Oriented Programming concepts using Python.

BCA GE404 : Python Programming PWC (Theory : 4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Introduction To Python: Features of Python, Advantages of Python, Python variables, Python basic operators Python Data Types: Declaring and using Numeric data types: int, float, complex Use of Tuple data type	6
2	Python Program Flow Control : Conditional blocks using if, else and elif, Simple For loops in Python For loop using ranges, string, list and dictionaries Use of While loops in Python Loop manipulation using pass, continue, and break. Programming using Python conditional and loops block	12
3	Strings in Python: Creating Strings, Traversing a String, Special String Operators: Concatenating Strings, Replicating Strings. Lists in Python: Introduction, Creating / Declaring List, Accessing the List Elements, Traversing a list, Comparing Lists.	15
4	Concept of Class, object and instances Constructor, class attributes and destructors. Inheritance , Overloading Operators Programming using OOPS support Python Functions, Modules And Packages: Organizing Python codes using functions.	27
	Practical of Python Programming	30
	TOTAL	**90**

Reading List :

1. Thareja Reema (2017). Python Programming Using Problem Solving Approach, Oxford Publication, New Delhi

2. Lutz Mark , (2013). *Learning Python: Powerful Object-Oriented Programming*, O'Reilly Media, Inc., USA

3. Zelle John M. (2004). *Python Programming: An Introduction to Computer Science,* Jem Leisy USA

4. Rossum Guido Van , Python Dev Team (2016). *Python 36 Tutorial : * ART POWER International PUB

5. Dawson Michael. (2010). Python Programming for the Absolute Beginner, Cengage Learning, USA

Discipline Specific Elective (DSE) (6 credits each)

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

SEMESTER - V

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Define relational database concepts and design.

CO2. Implement design principles including the E-R method and Normalization approach for logical design of databases.

CO3. Formulate and Execute various SQL queries for information storage and retrieval.

CO4. Design and Execute PL/SQL blocks using Procedures, Functions, Packages and Triggers, Views, Cursors etc.

Unit	Topics to be covered	No. of hours
	BCA DSE501 : Oracle **PWC (Theory : 4 credits + Practical: 2 credits)**	
1	Relational **Data Model,** Concept of **Functional Dependency and Relational Keys, Integrity Rules** Normalization Techniques, , Introduction to ORACLE	10
2	Introduction to SQL * Plus: SQL Commands and Data types, Operators and Expressions.	5
3	Managing Tables and Data: DDL statements : Creating and Altering Tables (Including constraints), Data Integrity. DML statements : Insert, Update, Delete SELECT statement with WHERE, GROUP BY and HAVING, ORDER BY, Special operators like IN, BETWEEN, LIKE. DCL statements: Grant, Revoke TCL statements : Commit, Rollback, Savepoint Built in functions: String Functions: Rpad, Lpad, Lower, Upper, Initcap, Length, Substr, Instr. Aggregate functions: Avg, Count, Max, Min, Sum, etc. Date Functions: Date, Add_months, Last_day, Months_between, Next_day Numeric Functions: POWER(), FLOOR(), SQRT() ROUND(), MOD(). Introduction to Join	15
4	Other Database Objects: View and types, Introduction to PL/SQL: SQL v/s PL/SQL, PL/SQL Block Structure %TYPE and %ROWTYPE, Function and Procedure, Cursor (Implicit, Explicit), Trigger (Before and after trigger).	30
	Practical using SQL and PL\SQL	30
	TOTAL	**90**

Reading List :

1. Bayross Ivan , (2009). *SQL, Pl/SQL: The Programming Language of Oracle*, BPB Publications, New Delhi

2. Schwarz Baron, (2012) *High Performance My SQL*, O'Reilly, USA

3. Vaswani Vikram, (2004). *The Complete Reference My SQL*, Mc Graw Hill Educations

4. Singh Dr. Ikvinder Pal, (2014). *Database Management System & Ora*cle, Khanna Book Publishing Co. (P) Ltd, New Delhi

5. Gehani Narain, *(*2008) *The Database Book Principles and Practice using My SQL*, Universities Press, Hyderabad

6. Gehani Narain, Annamalai Melliyal*, (*2012). *The Database Book Principles and Practice using Oracle Database System*, Universities Press, Hyderabad

SEMESTER- V

<u>**COURSE OUTCOME**</u>

After the completion of the course, the students will attain the ability to:

CO1. Understand the concept of Machine learning and its types in computer science.

CO2. Analyze a variety of Machine learning algorithms.

CO3. Apply the algorithms to a real problem and optimize the models learnt.

CO4. Evaluate the models generated from data.

BCA DSE501 : Machine Learning		
PWC (Theory :4 credits + Practical: 2 credits)		
Unit	**Topics to be covered**	**No. of hours**
1	**Introduction to Machine Learning:** Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical	10

	Learning: Bayesian Method, The Naive Bayes Classifier	
2	**Softwares for Machine Learning and Linear Algebra Overview :** Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tool such as Python/ MATLAB.	10
3	**Linear Regression:** Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection. **Logistic Regression:** Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables	20
4	**Regularization :** Regularization and its utility, The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance. Introduction to Neural Networks.	20
	Practicals on Machine Learning, using Python / MATLAB software	30
	TOTAL	**90**

Reading List :

1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.

2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.

3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.

4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

5. Jeeva Jose, Introduction to Machine Learning using Python, Khanna Book Publication, 2020

6. Jain V.K., Machine Learning, Khanna Book Publication, 2019

SEMESTER - V

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Define fundamental concepts of Data Mining, Data Warehouse Process and architecture

CO2. Classify and Compare data mining and data ware housing techniques.

CO3. Design data warehouse with dimensional modelling.

CO4. Apply OLAP operations in different case studies.

	BCA DSE502 : Data Mining PWC (Theory :5 credits + Tutorial: 1 credit)	
Unit	**Topics to be covered**	**No. of hours**
1	Introduction to Data Warehousing, Features, **Architecture of Data warehouse,** lifecycle of Data warehouse, Data Flow from warehouse to operational systems	10
2	Concept of Data mining, **Overview:** Predictive and Descriptive supervised and unsupervised learning techniques, process of knowledge discovery in databases, pre-processing methods	20
3	**Data Mining Techniques:** Association Rule Mining, Classification and Regression Techniques, Clustering, Scalability and data management issues in Data Mining algorithms, Measures of Interestingness Applications of Data Mining	25
4	OLAP : Introduction, Multidimensional data model, Features and Advantages of OLAP , types of OLAP Servers (ROLAP, MOLAP, HOLAP, WOLAP, DOLAP, SOLAP), Data Warehouse vs. DBMS,OLAP operations - Roll up, Drill down, Slice, Dice, Pivot	20
	Tutorial	15
	TOTAL	**90**

Reading List :

1. Pudi Vikram, Krishna P.Radha, (2014). *Data Mining*, Oxford University Press, New Delhi

2. Yanchang Zhao & Yonghua Cen, (2014). *Data Mining Application with R*, Academic Press, New Delhi

3. Singh Dr. Ikvinderpal, (2014). *Data Mining and Warehouse*, Khanna Book Publishing Co. (P) Ltd, New Delhi

4. Linoff Gordon S., Berry Michael J.A., (2015). *Data Mining Techniques,* Wiley India Pvt Limited, New Delhi

5. Pujara Arun K., (2005). *Data Mining Techniques*, University Press, Hyderabad

6. Dunham Margaret H., (2006). *Data Mining: Introductory And Advanced Topics,* Pearson Education India, New Delhi

SEMESTER - V

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Define fundamental concepts of Data Science

CO2. Identify various data sources for gathering real world data.

CO3. Prepare, clean, and validate structured and unstructured data for effective data analysis.

CO4. Use Data analysis tools to uncover trends and patterns in data to support decision making process.

BCA DSE502 : Introduction to Data Science PWC (Theory : 4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	Data Scientist's Tool Box: Turning data into actionable knowledge, introduction to the tools that will be used in building data analysis software: version control, markdown, Git, GitHub, R, and RStudio.	15

2	R Programming Basics: Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling.	15
3	Getting and Cleaning Data: Obtaining data from the web, from APIs, from databases and from other sources in various formats. Basics of data cleaning and making data tidy.	15
4	Exploratory Data Analysis: Essential exploratory techniques for summarizing data, applied before formal modeling commences, eliminating or sharpening potential hypotheses about the world that can be addressed by the data, common multivariate statistical techniques used to visualize high-dimensional data Concepts and tools behind reporting modern data analyses in a reproducible manner, To write a document using R markdown, integrate live R code into a literate statistical program, compile R markdown documents using knitr and related tools.	15
	Practicals on Data Science	30
	TOTAL	**90**

Reading List :

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly, 2013.

2. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking" by O'Reilly, 2013.

3. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley & Sons, 2013.

4. Ian Ayres, "Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart" Ist Edition by Bantam, 2007.

5. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1st Edition, by Wiley, 2013.

6. Matthew A. Russel, "Mining the Social Web: Data mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More", Second Edition, by O'Reilly Media, 2013

SEMESTER- VI

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. State the basics of Python Programming language using various data types, Programming constructs

CO2. Explain Python Functions, Modules and Packages and apply these concepts in programs.

CO3. Create and execute simple Python Programs.

CO4. Implement Object Oriented Programming concepts using Python.

BCA DSE603 : Python Programming		
PWC **(Theory :4 credits + Practical: 2 credits)**		
Unit	Topics to be covered	No. of hours
1	Introduction To Python: Understanding Python variables, Python basic Operators, Understanding python blocks Python Data Types: Declaring and using Numeric data types: int, float, complex Using string data type and string operations, Defining list and list slicing, Use of Tuple data type	6
2	Python Program Flow: Control Conditional blocks using if, else and elif, Simple for loops in python For loop using ranges, string, list and dictionaries Use of while loops in python	12

	Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block	
3	Concept of class, object and instances Constructor, class attributes and destructors Real time use of class in live projects Inheritance, overloading operators Adding and retrieving dynamic attributes of classes Programming using OOPs support Python Functions, Modules And Packages: organizing Python codes using functions, organizing Python projects into modules Importing own module as well as external module Programming using functions, modules and external packages	27
4	I/O and Error Handling In Python: Introduction Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Using Pipes as Data Streams, Handling IO Exceptions, Working with Directories, Metadata, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions	15
	Practical using Python	30
	TOTAL	**90**

Reading List :

1. Thareja Reema (2017). *Python Programming Using Problem Solving Approach*, Oxford Publication, New Delhi

2. Lutz Mark, (2013). **Learning Python:** *Powerful Object-Oriented Programming*, O'Reilly Media, Inc., USA

3. Zelle John M. (2004). **Python Programming:** *An Introduction to Computer Science,* Jem Leisy USA

4. Rossum Guido Van, Python Dev Team (2016). **Python 36 Tutorial** *:* ART POWER International PUB

5. Dawson Michael. (2010). Python Programming for the Absolute Beginner, Cengage Learning, USA

<u>SEMESTER- VI</u>

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Understand the basic concepts, characteristics and benefits of cloud computing.

CO2. Explain the key technical issues and service models of Cloud Computing.

CO3. Enumerate characteristics of public, private and hybrid cloud deployment models.

CO4. Understand the key security and compliance challenges of Cloud Computing.

BCA DSE603 : Cloud Computing		
PWC (Theory :4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	**Recent trends in Computing :** Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing.	15
2	**Cloud Computing Architecture**: Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models- Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS)	15

3	**Deployment Models of Cloud Computing :** Public cloud, Private cloud, Hybrid cloud, Community cloud,), Case study of Service model using Google App Engine, Microsoft Azure, Amazon EC2.	15
	Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling.	
4	**Cloud Security :** Infrastructure Security- Network level security, Host level security, Application level security,Data security and Storage - Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in cloud computing	15
	Practicals on Cloud Computing	30
	TOTAL	**90**

Reading List :

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

5. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications , Adobe Reader ebooks available from eBooks.com,2010

6. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach ,McGraw Hills, 2010.

7. Dimitris N. Chorafas, Cloud Computing Strategies ,CRC Press, 2010

SEMESTER- VI

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Formulate projects with clearly identified scope and requirements.

CO2. Understand the practical implementation of Software Development Life Cycle.

CO3. Implement programming theories, concepts and principles & use latest computing tools for Software Development.

CO4. Develop team building capacity and work ethics for successful project development and management.

BCA DSE604 : Project PWC
Software Development Project Work
A student has to undertake a software development project work of six(6) weeks duration during the 6th semester. The students can develop a website Mobile Applications, IOT and AI based Projects or any other relevant field. After completion of the project, the student has to submit a project report which will be evaluated by an External Examiner.

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Review the fundamental concepts of a digital image processing system.

CO2. Analyze images in the frequency domain using various transforms.

CO3. Evaluate the techniques for image enhancement and image restoration.

CO4. Categorize various compression techniques.

BCA DSE604 : Digital Image Processing		
PWC (Theory :4 credits + Practical: 2 credits)		
Unit	Topics to be covered	No. of hours
1	**Introduction:** What is image processing, Types of image processing, Applications of image processing, what is image, Types of image, Digital image representation in computer, Advantage of image processing, Disadvantage of image processing.	13
2	**Image Pre-processing:** What is pre-processing, Gray scale image, Binary image, RGB Image, HSV Image. **Operations on image:** Image resizing, Image Rotation, Image Translation, Image Transpose. **Image Arithmetic:** Image Addition, Image Subtraction, Bitwise operation, (AND,OR,NOT, XOR).	16
3	**Image Restoration:** Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Kernal filter, Thresholding.	15
4	**Image Restoration Technique:** Image Blurring, Types of blurring, Gaussian Blur, Median blur, bilateral Filter. **Edge detection:** Laplacian, Soble X,Seble Y, Canny edge detection, **Image Segmentation:** Boundary detection-based techniques, line detection, Circle detection, Edge detection, Hough transform,	16
	Practicals on Digital Image Processing	30
	TOTAL	**90**

Reading List :

1. R C Gonzalez , R E Woods, Digital Image Processing, 3rd Edition, PearsonEducation.2008.
2. A K Jain, Fundamentals of Digital image Processing, Prentice Hall of India.1989.
3. K R Castleman, Digital Image Processing, Pearson Education.1996
4. Schalkoff, Digital Image Processing and Computer Vision, John Wiley and Sons.1989.
5. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
6. I kvinderpal Singh, Digital Image Processing
7. Munesh Chandra Trivedi , Digital Image Processing

Skill Enhancement Course (SEC) (2 Credits)

Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

SEMESTER- III

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Develop Inter-religious harmony & better understanding of other religions.

CO2. Interpret the different religions of the world.

CO3. Identify the common elements that bind different religions together.

CO4. Acquaint with the salient features of different religions.

IRS SEC301 : Inter-Religious Studies (Value Based) (02credits) PWC		
Unit	Topics to be covered	No. of hours
1	Nature and Need of Inter-Religious study, Scope of Comparative Religion.	05

2	Salient Features of Hinduism, Jainism and Buddhism, Salient Features of Christianity, Islam and Sikkhism.	10
3	Similarities and Differences among Religions, Conflicting truth claims of different religions and inter-religious Harmony.	10
4	Religious Tolerance, Secularism.	05
	TOTAL	**30**

Reading List :

1. Chaudhary, C. Neeraj (1979). "Hinduism",B.I.Publication,New Delhi.
2. Devraj,N.K.,(1917)-"Hinduism and Christanity" Asian Publishing House.
3. Gordh, George, -''Christian Faith and its Cultural Exoperssion'', Printed in USA.
4. Hick, John,- ''Philosophy of Religion'', Prentice Hall of India.
5. Hopfe, M.Lewis(1983)- ''Religion of the World'', Macmillan Publishing Co. Inc, New York
6. Masih,Y. (1990)- ''Comparitive study of Relgion'',Motilal Banarasidass.
7. Sethi,S. Arijit, Pummer, Reinhard, (1979)-''Comparitive Religion'', Vikas Publishing House pvt. ltd, Delhi.
8. Singh, B.N.,(1994)-''Vishwa Dharma Darshan ki Samasyain'', Ratna Printing Works.
9. Tiwari, Nath Kedar,(1983)-''Comparative Religion'', Motilal Banarasidass.
10. Ward, CHS (1998) – 'Early Buddhism", Caxton Publication, Delhi.

SEMESTER- IV

COURSE OUTCOME

After the completion of the course, the students will attain the ability to:

CO1. Identify different types of Cyber Threats and Cyber Crimes.

CO2. Describe Internet Security Architecture, Encryption and Decryption techniques.

CO3. Outline important Cyber Laws.

CO4. Implementation of various Security Mechanisms for preventing Cyber attacks.

Unit	Topics to be covered	No. of hours
BCA SEC402 : Internet Security and Cyber laws **PWC (Theory : 2 credits)**	
1	Introduction to Information security, Network Security Model, Security Issues, and Security Services	5
2	Encryption and Decryption Techniques Using Java Programming.	9
3	Virus, Installation of Anti-virus, Security of Social Media Sites	10
4	Introduction to Cyber Laws and Cyber Security, Introduction to Virtual Private Network.	6
	TOTAL	**30**

Reading List :

1. Pfleeger C. P. and Pfleeger S. L, *Security in Computing*, PHI
2. Stallings W *Network Security Essentials - Applications and Standards*, PHI
3. Gupta Prakash C., (2015). *Cryptography and Network Security,* PHI Learning Pvt Ltd, New Delhi
4. Singh Brijendra, (2012). *Network Security and Management*, PHI Learning Pvt Ltd, New Delhi
5. Ahamad Faiyaz, (2013). Cyberlaw and Information Security, Dreamtech Publications

<u>Ability Enhancement Compulsory Course (AECC)</u>
<u>(2 credits each)</u>

<u>SEMESTER – I, SEMESTER – II</u>

<u>COURSE OUTCOME</u>

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

CO1. After completion of the course, the student will Understand multidisciplinary nature of environmental studies.

CO2. Understand the concept and types of natural resources and environmental pollution.

CO3. Evaluate the anomalies created due to haphazard population growth and its impact on environment.

CO4. Understand about the organizations, conventions and legislations working on mitigation of environmental issues.

EVS AEC202 : Environmental Science PWC (2 Credits)		
Unit	Topics to be covered	No. of hours
1	(a) Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance. (b) Concept of Ecosystem: - Components, Elementary Idea of Major Ecosystem:	07
2	(a) Natural Resources : Land, Water, Forest And Mineral Resources : Introduction; Earth's Resources and Man; Renewable and Non-Renewable Resources ; Natural Resources and Associated Problems ; Non-Renewable Resources ; Renewable Resources ; Non-Renewable Energy; Renewable Energy, Conservation of Natural Resources (b) Biodiversity and its conservation: Hotspots and threats to Biodiversity : Biodiversity ; Definition ; Keystone Species Conservation of Biodiversity ; Methods For The Conservation of Wildlife ; Hot Spots ; Types of Biodiversity ; Genetic, Species and Ecosystem Diversity, Threats to Biodiversity ; Endangered And Endemic Species ; Conservation of Biodiversity: In Situ And Ex-Situ ; Wildlife Sanctuaries and National Parks of India ; The Need for An Integrated Protected Area System (IPAS) ; Beej Bachao Andolan ; List of Biosphere Reserves in India ; Tiger Reserves in India.	10

3	Environmental Pollution:	05
	(a) Causes, Effects, and Control Measures ; Types and sourcesof Pollution.(i) Air Pollution; Sources of air pollution and its impact on human health.(ii) Water Pollution and contamination: Introduction,Types,and sources; Classification of Water Pollutants. Impact on human health. (iii) Soil Pollution: Introduction: Contaminants and Degradation; Impact on human health. (iv) Noise Pollution: Effects of Noise Pollution on Physical Health; Permitted Noise Levels; Noise-Control Techniques. Impact on human health.	
	(b) Public Awareness about Greenhouse Effects; Acid Rain; Effects; Ozone Layer Depletion, Ganga Action Plan (GAP); Chipko Movement; Chernobyl disaster; Bhopal Gas Tragedy.	
	(c) Environment and Human Health: Outcome of Unhygienic Environmental Conditions	
4	Human Population and Environment and Important Organizations:	08
	(a) Population Growth, Variation Among Nations : Global Population Growth ; Population Explosion – Family Welfare Program ; Urban Poverty and The Environment ; Environment and Human Health ; Environmental Health ; Examples of Linkages ; Definition of Health Impact Assessment (HIA) by WHO ; Climate and Health ; Infectious Diseases; Water borne and water related diseases,Mitigation Strategies to control adverse health impact, Role of Information Technology in Environment and Human Health.	
	(b) Important Organizations : IUCN ; WWF ; BNHS ; PETA; Important Dates and Years; Some Important Environmental Conventions ; Atmospheric conventions ; Biodiversity	

	conventions ; Land conventions ; Hazardous wastes ; Some important Acts and Notifications in India ; Environment Action Programme – India (EAP) ; Environment Protection Act ; Penalties ; Air (Prevention and Control of Pollution) Act 1981 ; Penalties ; Water (Prevention and control of Pollution) Act ; Penalties ; Wildlife Protection Act ; Penalties ; Forest Conservation Act ; Penalties ; Issues involved in enforcement of environmental legislation.	
	TOTAL	**30**

Reading List :

1. Chandna R. C., 2002: Environmental Geography, Kalyani Publications, Ludhiana.

2. UNEP, 2007: Global Environment Outlook: GEO4: Environment for Development, United Nations Environment Programme

3. Odum, E. P. et al, 2005: Fundamentals of Ecology, Ceneage Learning India.

4. Singh S., 1997: Environmental Geography, PrayagPustak Bhawan. Allahabad.

5. Baskar Sushmita and Baskar R. 2007 :Environmental studies for Undergraduate Courses, Unicorn Books, Bangalore

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