

Curriculum and Credit Framework for Undergraduate Programme (Single Major) as per NEP-2020

B.Sc. Data Science (Four Year Degree Programme)

3rd & 4th Semesters

For Batch W.e.f Session: 2022-23



Department of Computer Science & Engineering

Faculty of Engineering & Technology

Chaudhary Devi Lal University

Sirsa-125055, Haryana

2023

Exit options and Credit requirements

SINGLE-MAJOR

Exit with	Credit requirement
Certificate in Data Science: After successful completion of First year (Two semesters) of the Four-Year Undergraduate Degree Programme.	48 (Including Internship of 4 Credits)
Diploma in Data Science: After successful completion of Two years (Four semesters) of the Four-Year Undergraduate Degree Programme.	94 (Including Internship of 4 Credits)
Bachelor of Data Science: After successful completion of Three years (Six semesters) of the Four-Year Undergraduate Degree Programme.	136
Bachelor of Data Science (Honours/Honours with Research) After successful completion of Four Years (Eight semesters) of the Undergraduate Degree Programme.	184

B.Sc. Data Science (3rd and 4th Semester) (Batch 2022-23 onwards)**SEMESTER-3**

COURSE CODE	COURSE TYPE	COURSE TITLE	T	P	Int. Theory	Ext. Theory	Practical	TOTAL
BSC/DS/SM/3/D SC/201	Major	Operating System	4	-	30	70	-	100
BSC/DS/SM/3/D SC/202	Major	Programming in Java	2	2	15	35	50	100
BSC/DS/SM/3/M IC/201	Minor	Data Structure	2	2	15	35	50	100
BSC/DS/SM/3/M IC/202	Minor	Artificial Intelligence	4	-	30	70	50	100
B.Sc/DS/SM/3/M DC/201	MDC	Cyber Space	3	-	25	50	-	75
Hin/AEC/102	Ability Enhancement Course	Hindi-II	2	-	15	35	-	50
Eng/AEC/101	Ability Enhancement Course	English-I	2	-	15	35	-	50
BSC/DS/SM/3/SEC/201	Skill Enhancement Course	Cyber Law & Computing Ethics	3	-	25	50	-	75
EVS/VAC/102	Value Added Course	EVS-II	2	-	15	35	-	50
CDLU/VAC/101	Value Added Course	Communication Skills	2	-	15	35	-	50

SEMESTER-4

COURSE CODE	COURSE TYPE	COURSE TITLE	T	P	Int. Theory	Ext. Theory	Practical	TOTAL
BSC/DS/SM/4/DSC/203	Major	Web Development	2	2	15	35	50	100
BSC/DS/SM/4/DSC/204	Major	Cloud Computing	4	-	30	70	-	100
BSC/DS/SM/4/DSC/205	Major	Discrete Mathematics	4	-	30	70	-	100
BSC/DS/SM/4/MIC/203	Minor	Programming with Python	2	2	15	35	50	100
BSC/DS/SM/4/DSC/204	Minor	Data Mining and Warehousing	4	-	30	70	-	100
ENG/AEC/102	AEC	English-II	2	-	15	35	-	50
BSC/DS/SM/4/SEC/202	SEC	Green Computing	3	-	25	50	-	75
CDLU/VAC/105	Value Added Course	Vedic Mathematics	2	-	15	35	-	50

**THIRD
SEMESTER**

BSC/DS/SM/3/DSC/201: Operating System							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance
<p>Note for the Paper Setter: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, eight more questions of 14 marks each will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting at least one question from each unit.</p>							
Course Objectives	The objective of this course is to get the students familiar with fundamental concepts of operating systems, namely, types of operating systems, functions of memory management module, process management module, deadlock management and file protection, etc.						
Course Outcomes	At the end of this course, the student will be able to:						
CO1	outline and define: the goals, functions and types of operating system, interprocess communication, deadlock; identify the techniques of allocation of memory, processor, and disk space.						
CO2	describe and discuss: the goals, functions and types of operating system, interprocess communication, deadlock management, techniques of allocation of memory, processor, and disk space.						
CO3	illustrate: the concepts of operating system like process scheduling, memory management, virtual memory, directory structure, disk space allocation, and process deadlocks.						
CO4	classify: operating systems, deadlock management approaches, process scheduling algorithms, disk scheduling algorithms, page replacement algorithms, directory structure, disk space allocation methods.						

Course Objectives: The objective of this course is to get the students familiar with fundamental concepts of operating systems, namely, types of operating systems, functions of memory management module, process management module, and deadlock management & file protection etc.

Course Outcome: Outline and define the goals, functions and types of operating system, inter-process communication, deadlock; identify the techniques of allocation of memory, processor, and disk space.

Unit - I

Operating Systems Overview: Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems.

Operating Systems Structures: Operating system services, systems calls and types of system calls, Virtual Machines, Operating systems generations.

Unit - II

Process Management: Process concepts, operations on process, inter-process communication process scheduling criteria, scheduling algorithms

Concurrency And Synchronization: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writer's problem, dining philosopher's problem, monitors.

Unit III

Deadlocks: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm.

Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, thrashing.

Unit IV

File System: Concept of a file, access methods, directory and disk structure, file system structure, file system implementation, directory implementation, allocation methods, free-space management.

Secondary-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling Algorithms, Disk Management, RAID Structure.

Text Books:

1. Silberschatz A., Galvin P. B., Gagne G., Operating System Concepts, Wiley India Pvt. Ltd.
2. ChauhanNaresh, Principles of Operating Systems, Oxford University Press.
3. Tanenbaum A.S., Operating System- Design and Implementation, PHI Learning.

Reference Books:

1. Deitel H.M., Operating Systems, Pearson Education.
2. Stallings William, Operating System, PHI Learning.
3. Godbole A.S., Operating Systems, Tata McGraw-Hill, New Delhi

BSC/DS/SM/3/DSC/202: Programming in Java								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal	Practical		
DSC	2T	02	Lecture	35	15	-	2 Hours	TEE/MTE/ Assignment/ Attendance
	2P	04	Practical	-	-	50	3 Hours	
<p>Note for the Paper Setter: The question paper will consist of five questions in all. The first question will be compulsory and will consist of seven short questions of 1 marks each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting at least one question from each unit.</p>								
Course Objectives	The objective of this course is to get the basic concepts and building blocks of Core Java programming languages using the modular approach which emphasizes on small programs. Learn how to write moderately complex programs efficiently. Learn making GUI-based applications in Core Java.							
Course Outcomes	By the end of this course, the student will able to:							
CO1	outline: programming environment, data types, control constructs, loops, arrays, programming approaches, threads in programming, file system for data storing, data structure library, graphical user interface concepts.							
CO2	summarize: programming fundamentals, programming approaches, multithreaded programming, data storing using file system, data structure library, GUI concepts.							
CO3	apply: basic programming concepts: to solve basic mathematical operations, data structure operations, concurrent execution of threads, user friendly interfaced programs.							
CO4	categorize: data types, programming approaches, flow controls constructs, loops, single and multithreaded programming, various classes in collection framework, GUI controls.							

Unit I

Java: Introduction of java, basic concepts, data types, reference types, operators and its types, decision controls, control statements, loops, array, string, functions, boxing & unboxing, scope of variables.

OOPS concepts in Java: Encapsulation, class, object, constructors, destructors, polymorphism: function overloading and operator overloading in java, inheritance, interface, abstract class, packages, exception handling.

Unit II

Multithreading in Java: Thread model, multithreading supporting classes and methods, creating single and multiple threaded programs, context switching,

Working with GUI in Java: Containers and components. I/O stream in Java: input and output stream, file handling operations.

Text Books:

1. Darrel Ince & Adam Freeman, Programming the Internet with Java, 2e, Addison Wesley.
2. K.A. Mughal, R.W. Rasmussen, A Programmer's Guide to Java Certification, Addison Wesley.
3. E. Balagurusamy, Programming with Java, 6e, Tata McGraw Hill.

Reference Books:

1. Herbert Schildt, The Complete Reference Java, 10e, Tata McGraw Hill.

BSC/DS/SM/3/MIC/201: Data Structure								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal	Practical		
MIC	2T	02	Lecture	35	15	-	2 Hours	TEE/MTE/ Assignment/ Attendance
	2P	04	Practical	-	-	50	2 Hours	
<p>Note for the Paper Setter: The question paper will consist of five questions in all. The first question will be compulsory and will consist of seven short questions of 1 marks each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting at least one question from each unit.</p>								
Course Objectives		To impart the basic concepts of data structures and algorithms. To understand concepts about searching and sorting techniques. To understand basic concepts about stacks, queues, lists, trees and graphs.						
Course Outcomes		After completion of the course, learners will						
CO1		define complexity and analysis of algorithms						
CO2		understand different types of array and stack						
CO3		understand different types of queues and linked list and different operations on them						
CO4		implement searching and sorting algorithms						

Unit 1

Data Structure and algorithm preliminaries: Definitions, Time and Space analysis of Algorithms, Time-Space Tradeoffs, Mathematical Notation and functions, Asymptotic Notations for complexity of algorithms, Recursion, Divide and Conquer Strategy

Array - Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation),

Stack -Implementing of stack; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack.

Unit 2

Queues- Operation on Queues, Circular queue, Priority queues and dequeue.

Linked list – Single, Double, Circular Linked List Implementation.

Trees –Binary tree,Tree Traversals, Binary Search Tree, Threaded Binary Tree ,AVL Trees, Height balanced tree , Heap and its applications.

Searching, Sorting: Searching –Linear Search, Binary Search. Sorting- Bubble sort, Selection sort, Insertion sort, Merge Sort ,Quick Sort, Heap sort.

Reference Books:

1. Seymour Lipschutz, Data Structures, McGraw-Hill Book Company, Schaum's Outline series, NewYork (1986).
2. Narasimha Karumanchi, Data Structures And Algorithms Made Easy, Career Monk.

BSC/DS/SM/3/MIC/202: Artificial Intelligence							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/Assignment/Attendance
<p>Note for the Paper Setter: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, eight more questions of 14 marks each will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting at least one question from each unit.</p>							
<p>Course Objective: The objective of this course is to understand knowledge representation, search algorithms, expert system and genetic algorithm.</p>							
<p>Course Outcome: After completing this course the students will be able to identify knowledge representation techniques, use search algorithm and learn the expert system and genetic algorithm.</p>							
Course Content Artificial Intelligence							
Unit I	Introduction: Background and history, overview of AI applications areas. The predicate calculus: syntax and semantic for propositional logic and FOPL, clausal form, inference rules, resolution and unification.						
Unit II	Knowledge representation: Network representation, associative network & conceptual graphs, structured representation, frames & scripts. Production system: Types of production system-commutative and non-commutative production systems, decomposable and non-decomposable production systems, control of search in production systems.						
Unit III	Search algorithms: Uninformed search (depth-first, breadth-first, depth-first with iterative deepening) and informed search (hill climbing, best first, A* algorithm, mini-max etc.), computational complexity, properties of search algorithms, admissibility, monotonicity, optimality, dominance.						
Unit IV	Rule-based expert systems: Architecture, development, managing uncertainty in expert systems, Bayesian probability theory, Fuzzy logic. Genetic algorithms: Problem representation, encoding schemes, Operators- selection, crossover, mutation, replacement etc.						
Text/Reference Books							
Text Books	George F. Luger, "Artificial Intelligence" , Pearson Education. Dan W. Patterson Introduction to Artificial Intelligence and Expert system, PHI.						
Reference Books	1. Eugene Charniak, Drew McDermott, "Introduction to Artificial Intelligence" Addison Wesley. 2. Wils J. Nilsson, Principles of Artificial Intelligence, Narosa Publishing house. 3. Jackson Peter, Introduction to Expert systems, 3e, Addison Wesley, 2000.						

B.Sc/DS/SM/3/MDC/201: Cyber Space								
Course Type	Course Component	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
					External	Internal		
MDC	Theory	03	03	Lecture	50	25	3 Hours	TEE/MTE/ Assignment/ Attendance
<p>Note for the Paper Setter: The question paper will consist of seven questions in all. The first question will be compulsory and will consist of four short questions of 2 marks each covering the whole syllabus. In addition, six more questions of 14 marks each will be set unit-wise comprising of two questions from each of the three units. The candidates are required to attempt one compulsory question and three more questions selecting at least one question from each unit.</p>								
<p>Course Objectives: Objective of this course is to make the students familiar with the functioning of the Internet, email, web-browsers, and e-commerce; surfing the Internet and downloading contents therefrom; legal and payment issues in e-commerce.</p>								
Course Content : Cyber Space								
Unit - I	<p>Basics of internet and Intranet, Applications of Internet, Evolution of Internet, Internet Service Provider (ISP).</p> <p>Introduction to HTML, Structure of HTML, Web Page, Head and Body Sections, General structure of HTML tags-starting and ending a tag, various text formatting tags in HTML, Adding images, audio and video objects, Hyper linking.</p>							
Unit - II	<p>Email: Basic Introduction, Advantages and Disadvantage, Structure of an E-Mail Message, Working of E-Mail (sending & receiving messages), Managing Email (creating new folders, deleting messages, forwarding messages, filtering messages), Configuration of Outlook Express.</p>							
Unit - III	<p>Introduction to the Functionality of Web Browsers: Internet Explorer, Netscape Navigator Concept of WWW, surfing through web sites. Web Browsing (opening, viewing, saving a web page and book mark). Searching and downloading of different sites and software. Introduction to Social Media: Twitter, Facebook, YouTube, Whatsapp, LinkedIn, their advantages/disadvantages and issues. Introduction to E-commerce, its history, advantages, challenges, payment issues, legal issues.</p>							
Text/Reference Books								
Text Books	<ol style="list-style-type: none"> Ritendra Goel, "e-commerce", New Age International Publisher, 2008 Dougals E. Comer, "Computer Network and Internet", Pearson, 2008 Thomas A. Powell, "HTML - The Complete Reference", Tata McGraw-Hill, ISBN: 0074633325 Khurana R., "HTML", APH Publishing 							
Reference Books	<ol style="list-style-type: none"> Oliver Heathcote, "Internet Right From The Start" BPB Publications 							

Hindi -II
कार्यालयी हिन्दी
HINDI/AEC/102

Credit – 2

Duration: 2 Hours per week

परीक्षा समयघंटे 2 :

कुल अंक50 :

लिखित परीक्षा :35 अंक

आंतरिक मूल्यांकन: 15 अंक

Note for the Paper Setter: The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.

पाठ्यक्रम के उद्देश्य:

कार्यालयों में हिंदी के प्रयोग को बढ़ाना

पाठ्यक्रम के उपेक्षित परिणाम:

1. कार्यालयों में हिंदी की उपयोगिता बढ़ेगी
2. मातृभाषा को बढ़ावा मिलेगा
3. हिंदी का व्यावहारिक प्रयोग बढ़ेगा

खंड एक-

कार्यालयी हिंदी का उद्देश्य

कार्यालयी हिंदीसंभावनाएं एवं स्थिति :

खंड दो-

कार्यालयी पत्राचार के प्रकार परिपत्र), ज्ञापन और सूचना आदेश(

कार्यालयी पत्राचारपत्र सरकारी-अर्द्ध एवं सरकारी :

पत्र-लेखन-सरकारी पत्र ,पत्रोत्तर उत्तर ,पत्र मूल ,पत्र आवेदन ,पत्र शिकायत ,आदेश कार्यालय ,परिपत्र , संक्षेपण ,विज्ञप्ति प्रेस ,पृष्ठकन ,अधिसूचना ,आदेश शासकीय ,लेखन-ईमेल ,पत्र सरकारी ,अनुस्मारक ,पावती लेखन विधि लेखन ,नियम ,प्रक्रिया परिभाषा अर्थ-

संदर्भ सूची:

1. प्रयोजनमूलक हिंदी—विनोद गोदरे, वाणी प्रकाशन, दिल्ली
2. प्रयोजनमूलक हिंदी सिद्धांत और प्रयुक्ति—जितेन्द्र कुमार सिंह,
3. राजभाषा सहायिका—अवधेश मोहन गुप्त,
4. पत्रकारिता हेतु लेखन—डॉ निशान सिंह, रचना पब्लिकेशन, दिल्ली
5. प्रालेखन प्रारूप—शिव नारायण चतुर्वेदी, वाणी प्रकाशन, दिल्ली

English -1

Communicative English-1

Course Code: ENG/AEC/101

Credits: 2

Duration of Examination:-2 hrs

Internal Assessment: 15

Semester End Examination: 35

Total Marks: 50

Course Objective: The course aims to introduce students to the theory, fundamentals and tools of communication and to develop effective communication skills for personal, social and professional interactions. Besides, the students shall learn the basics of English grammar and language.

Course Learning Outcomes:

- i) They will learn the importance and basics of communication
- ii) They will learn to receive, comment and respond to correspondences in English language.
- iii) They will learn to use English in their life practically.

Note for the Paper Setter: The question paper will consist of **five** questions in all. The **first** question will be compulsory and will consist of **seven** short questions of **1** mark each covering the whole syllabus. In addition, **four** more questions of **14** marks each will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one** compulsory question and **two** more questions selecting at least **one** question from each unit.

Unit-I: Listening, Reading and Speaking Skills

Definition, The Listening Process; Importance of Listening; Basic Types of Listening; Barriers to Effective Listening, Reading Comprehension, Intonation, Group Discussion, Interview

Unit II: Writing Skills:

- Report Writing
- Paragraph Writing
- Letter Writing
- E-Mail
- Resume
- Blogs and Comments on Social Media

Suggested Reading:

- I) Kumar, Sanjay and Pushp Lata. 2015. *Communication Skills*. Second Edition, New Delhi: Oxford University Press (OUP).
- II) Sethi, J. and P.V. Dhamija. 2006. *A Course in Phonetics and Spoken English*. Second Edition. New Delhi: Prentice-Hall of India.
- III) Balasubramanian. T. *A Text Book of English Phonetics for Indian Students*. Chennai: Macmillan Publishers India Ltd., 1981.
- IV) *On Track: English Skills For Success* by Orient Blackswan (Board of Editors, Solapur University).

BSC/DS/SM/3/SEC/201: Cyber Laws and Computing Ethics							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
SEC	03	03	Lecture	50	25	3 Hours	TEE/MTE/ Assignment/ Attendance
Course Content							
<p>Note for the Paper Setter: The question paper will consist of seven questions in all. The first question will be compulsory and will consist of four short questions of 2 marks each covering the whole syllabus. In addition, six more questions of 14 marks each will be set unit-wise comprising of two questions from each of the three units. The candidates are required to attempt one compulsory question and three more questions selecting at least one question from each unit.</p>							
Unit I	Cyber laws in general, IT Act 2000 and its amendments, various provisions of IT Act to deal with cyber offences and cybercrimes. Case of Section 66A of IT Act 2000.						
Unit II	Cybercrime: classification and typography, statistics, and issues; review of Indian cyber security strategy, privacy issues.						
Unit III	Intellectual Property: Copy rights, Patents, Trade Secret Laws, Key Intellectual property issues, Plagiarism, Competitive Intelligence, Cybersquatting, Information warfare policy. Ethics in business world, Ethics in IT, Ethics for IT professionals and IT users, IT professional malpractices, communications eavesdropping, ACM ethics code.						
Text/Reference Books							
Text Books	George Reynolds, "Ethics in information Technology", 5e, Cengage Learning. Debora Johnson," Computer Ethics", 3e, Pearson Education. Sara Baase, "A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet," PHI Publications. Mike W Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, 2003.						
Reference Books	Michael Cross, Norris L Johnson, Tony Piltzecker, Security, Shroff Publishers and Distributors Ltd. Hon C Graff, Cryptography and E-Commerce - A Wiley Tech Brief, Wiley Computer Publisher, 2001. Govindarajan M, Natarajan S, Senthil Kumar V S, Engineering Ethics, Prentice Hall of India, 2004.						

Environmental Studies –II

EVS/VAC/102

Credits: 2

Duration of Examination: -2 hrs

Internal Assessment: 15

Semester End Examination: 35

Total Marks: 50

Objective: The objective of this paper is to create the awareness among the students towards Environmental concepts and issues for smooth life of species and human at earth.

Note for the Paper Setter: The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.

UNIT I

Disaster Management: Floods, Cloud Burst, Earthquake, Tsunami, Landslide, Cyclone.

Natural Disaster Management: Causes, effects and control measures of natural disasters, disaster preparedness – prevention and mitigation preparedness plan, community based planning, National and international efforts in disaster Management: NDRF; IMD. Role of armed forces, mass media, society and technology in disaster management. Role of in disaster management, Post disaster recovery measures: Rehabilitation, planning and construction, long term counter disaster planning. Solid waste management, causes, effects and control measures of urban and industrial wastes.

Environmental Conservation and Society: Social issue and the Environment: From Unsustainable to sustainable development. Urban problem related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and Rehabilitation of people; its problems and concerns. Climate change, National Action Plan for Climate change (NAPCC). global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation, Consumerism and waste products.

UNIT II

Demography: Human population and the Environment: Population Growth, variation among nations. Population explosion- family Welfare Programme. Human rights, Value Education. HIV/AIDS. Women and Child welfare. Role of information technology in environment and Human health. **Drug Abuse:** Concept of Health: Physical Health, Mental Health, Factors

affecting Mental and Physical Health, Management of positive mental health; Drugs and their effects: What are drugs, useful and harmful drugs, stimulant and depressant drugs, use and abuse of drugs, Concept of drug de-addiction; Legal Position on drugs: Laws related to drugs i.e. NDPS etc., Concept of Narco-terrorism, role and responsibilities of legal service authorities, Awareness Programmers on drugs; Impacts of drugs/Alcohol/Smoking on Longevity

Environmental and Social movements: Bishnoi Movement, Chipko, Appiko, Save Silent valley, Narmada Bachao Andolan, Swachh Bharat Abhiyaan, Tehri Dam Conflict.

Environmental legislation: Air (Prevention and control of pollution) Act, Water (Prevention and control of pollution) Act, Environmental Protection Act 1986. Wildlife Protection Act, Forest conservation Act. Issues involved in the enforcement of environmental legislation Public awareness. NGT (National Green Tribunal), Green Bench International agreements: Montreal Protocol, Kyoto Protocol, Convention on Climate change, Concept of Carbon footprint, Carbon credit and carbon trading, CBD: Clean development mechanism.

Suggested Readings

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt.Ltd.
2. Fundamental of Environmental studies. Mahua Basu, Xavier Savarimuthu, S.J. Cambridge University Press, -2017 Chadha, K.L. and Swaminathan, M.S. 2006. Environment and Agriculture. Malhotra Publishing House, New Delhi.
3. Cunningham, W.P. and Saigo, B.W. 1997. Environment Science. McGraw-Hill, USA.
4. Deswal, S. and Deswal, A., 2003, Energy, ecology, Environment and Society, Dhanpat Rai & co Ltd., Delhi.
5. Deswal, S. and Deswal, A. 2005. A Basic Course in Environmental Studies. Dhanpat Rai & Co Ltd., Delhi.
6. Singh, G.B. and Sharma, B.R. 1998. Fifty Years of Natural Resource Management Research, Indian Council of Agriculture Research, New Delhi.
7. Singh, N. and Sontakke, N.A. 2002. On Climatic fluctuations and Environment changes on Indo-Gangetic Plains, India.
8. Paramjit S Jaswal. Allahabad Law agency. Environmental Law.
9. A textbook of Environmental Studies. Dr. D.K Asthana, Dr. Meera Asthana. Publisher: S Chand & Co Ltd.

Value Added Course : Communication Skills
CDLU/VAC/101

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
VAC	02	02	Lecture	35	15	3 Hours	TEE/MTE/ Assignment/ Attendance

Note for the Paper Setter: The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.

Course Objective: The main aim of the course is to build competence in English grammar and vocabulary and to enhance effective communication by developing Reading, Writing, Listening and Speaking skills of students.

Course Content
VAC-01 : Communication Skills

Unit I	<p>Fundamentals of Communication Skills Scope and Significance of Communication Skills, Listening, Speaking, Reading and Writing, Technical Communication, Tools of Effective Communication.</p> <p>Writing Skills Basics of Grammar – Placing of Subject and Verb, Parts of Speech, Uses of Tenses, Active- Passive, and Narration.</p> <p>Vocabulary Building and Writing Word Formation & Synonyms, Antonyms, Words Often Confused, One-Word Substitutes, Idioms and Phrasal Verbs, Abbreviations of Scientific and Technical Words.</p>
Unit II	<p>Speaking Skills Introduction to Phonetic Sounds & Articulation, Word Accent, Rhythm and Intonation, Interpersonal Communication, Oral Presentation, Body Language and Voice Modulation (Para linguistics and Non- Verbal), Negotiation and Persuasion, Group Discussion, Interview Techniques (Telephonic and Video Conferencing).</p> <p>Technical Writing Job Application, CV Writing, Business Letters, Memos, Minutes, Notices, Report Writing & Structure, E-mail Etiquette, Blog Writing.</p>

Text/Reference Books

1. "The Essence of Effective Communication", Ludlow R. and Panton F., Pubs: Prentice Hall, 1992
2. "Effective Communication Skills", Kulbushan Kumar, Khanna Publishing House, 2019.
3. "A University Grammar of English", Quirk R. and Sidney G., 3rd Edition, Pubs: Pearson Education, 2008
4. "High School English Grammar", Wren and Martin, Pubs: S. Chand & Company Ltd, 2007
5. "Essentials of Business Communication", Guffrey M.E., 8th Edition, Pubs: South-Western College Publishing, 2009
6. "Technical Communication: Principles and Practice", Raman M. and Sharma S., 2nd Edition, Pubs: Oxford University Press, 2012
7. "Effective Business Communication", Rodrigues M.V., Pubs: Concept Publishing Company, Delhi, 2003
8. "English Vocabulary in Use", McCarthy M. and Felicity O' Dell, 2nd Edition, Pubs: 2010

FOURTH SEMESTER

BSC/DS/SM/4/DSC/203: Web Development								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal	Practical		
DSC	2T	02	Lecture	35	15	-	2 Hours	TEE/MTE/ Assignment/ Attendance
	2P	04	Practical	-	-	50	3 Hours	
<p>Note for the Paper Setter: The question paper will consist of five questions in all. The first question will be compulsory and will consist of seven short questions of 1 marks each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting at least one question from each unit.</p>								
Course Objectives		To illustrate the basic concepts and building blocks of web pages and web sites. Learn how to design and develop simple webpages.						
Course Outcomes		On completion of this course, the students will be able to understand						
CO		Learn the WWW and basic HTML tags						
CO		Learn to link web pages, placing images in web pages and frame						
CO		Understand the way to create CSS and format it						
CO		Learn the basic concepts of java script used in web development.						

Unit I

Introduction to HTML: A brief history of HTML and the World Wide Web, creating a simple web page, types of tags in HTML, HTML tag, head tag, body tag, paragraph and line break, headings, text formatting tags, special characters, lists, tables, alignment and spanning within the table.

Links, Images, Forms and Frames in HTML: Linking within a web page, linking between your own web content, linking to external web content, linking to e-mail address, placing images on web page, turning images into links, working with forms, frames.

Unit II

CSS-Cascading Style Sheets: Working of CSS, basic style sheet, layout properties, formatting properties, using style classes and style id, Internal style sheet and inline styles, CSS properties, set colours, styling tables and hyperlinks.

Introduction to Java script: Syntax rules, statements, functions, variables, objects, conditions, loops, event handlers, comments, expressions and operators, data types, working with strings, numeric array.

Text Books:

1. Julie C. Meloni: Sams Teach Yourself HTML, CSS and JavaScript, Pearson Education.
2. Thomas A Powell: HTML & CSS-The Complete Reference, Tata McGraw Hill.

Reference Books:

1. Thomas A Powell: HTML-The Complete Reference, Tata McGraw Hill.

BSC/DS/SM/4/DSC/204: Cloud Computing							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance
<p>Note for the Paper Setter: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, eight more questions of 14 marks each will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting at least one question from each unit.</p>							
<p>Course Objective: The objective of this course is to understand the fundamental concepts of cloud computing, Cloud models, management, solutions and offerings. During this course the students also learn architecture of cloud and virtualization technology.</p>							
<p>Course Outcome: After completing this course the students will be able to know about cloud computing architecture, storage on cloud, virtualization and security issues.</p>							
<p><u>Course Content</u> Cloud Computing</p>							
Unit I	<p>Introduction: Essentials, Benefits and need for Cloud Computing - Business and IT Perspective, Cloud and Virtualization, Cloud Services Requirements, Cloud Computing Characteristics. Cloud Models: Cloud Characteristics, Measured Service, Cloud Models, Security in a Public Cloud Public versus Private Clouds.</p>						
Unit II	<p>Cloud Solutions: Cloud Ecosystem, Cloud Business Process Management, Cloud Service Management, Cloud Stack Cloud Offerings: Information Storage, Retrieval, Archive and Protection, Cloud Analytics Testing under Cloud, Information Security, Storage Cloud. Cloud Management: Resiliency, Provisioning, Asset Management, Cloud Governance, High Availability and Disaster Recovery.</p>						
Unit III	<p>Cloud Virtualization Technology: Virtualization Defined, Virtualization Benefits, Server Virtualization, Virtualization for x86 Architecture, Hypervisor Management Software, Logical Partitioning (LPAR) Cloud Virtualization: Storage virtualization, Storage Area Networks, Network-Attached storage, cloud server Virtualization, Virtualized data center.</p>						
Unit IV	<p>Cloud and SOA: SOA Journey to Infrastructure, SOA and Cloud, SOA Defined, SOA and IaaS, SOA-based Cloud Infrastructure Steps. Cloud Infrastructure Benchmarking: OLTP Benchmark, Business Intelligence Benchmark, e-Business Benchmark, ISV Benchmarks.</p>						
<p>Text/Reference Books</p>							
Text Books	<ol style="list-style-type: none"> 1. Kailash Jayaswal and Jagannath Kallakurchi , Cloud Computing Black Book, Dreamtech press, 2014 2. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, Cloud Computing: A Practical Approach, 1e, Tata McGraw Hill Education, 2011. 						
Reference Books	<ol style="list-style-type: none"> 1. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publishing, 2010 						

BSC/DS/SM/4/DSC/205: Discrete Mathematics							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC	04	04	Lecture	70	30	3 Hours	TEE/MTE/Assignment/Attendance
<p>Note for the Paper Setter: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, eight more questions of 14 marks each will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting at least one question from each unit.</p>							
<p>Course Objective: The objective of this course is to enable students to learn set theory, relations, function and graph theory. Boolean algebra, counting and lattice are also covered in this course.</p>							
<p>Course Outcome: After completing this course the students will be able to illustrate sets and elements, representation of relations, graphs and multigraphs, Boolean algebra operations, group and subgroups lattices.</p>							
Course Content Discrete Mathematics							
Unit I	<p>Set Theory: Set introduction, Universal set, Empty set, subset, Venn Diagrams, set operations, finite set, infinite set, power set, Inclusion-Exclusion principle, Proof techniques.</p> <p>Relations: Introduction, Composition of relation, Types of relations, closure properties, Equivalence relation, Partial ordering relation, n-ARY relations.</p> <p>Functions: introduction, one-to-one, onto, invertible functions, mathematical functions, recursively Defined functions, Cardinality.</p>						
Unit II	<p>Graph theory: Introduction to graphs, graph terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, planar graphs, graph coloring, introduction to trees, application of trees.</p> <p>Algebraic systems: Operations, Properties on operations, Groups, subgroups, Semi group, permutation groups, isomorphism, homomorphism and normal subgroups.</p>						
Unit III	<p>Boolean Algebra: Basic definitions, duality, truth tables, Boolean functions, basic logical operations on propositions, proposition and truth tables, tautologies and contradictions, algebra of propositions, Logical implication, Normal forms, predicate logics.</p>						
Unit IV	<p>Ordered sets and Lattice theory: Ordered set, Hasse diagram, Lattices and algebras systems, principles of duality, distributive and complimented lattices.</p> <p>Counting: The basics of counting, the pigeonhole principle, permutations and combinations, inclusion-exclusion principle, application of inclusion-exclusion.</p>						
Text/Reference Books							
Text Books	1. Seymour Lipschutz, Marc Lars Lipson, Discrete Mathematics, McGraw-Hill International Editions, Schaum's Series.						
Reference Books	1. Bernard Kolman, Robert C. Busbym, Discrete Mathematical Structures for Computer Science, Prentice-Hall of India Pvt. Ltd.						

BSC/DS/SM/4/MIC/203: Programming with Python								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal	Practical		
MIC	2T	02	Lecture	35	15	-	2 Hours	TEE/MTE/ Assignment/ Attendance
	2P	04	Practical	-	-	50	3 Hours	
<p>Note for the Paper Setter: The question paper will consist of five questions in all. The first question will be compulsory and will consist of seven short questions of 1 marks each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting at least one question from each unit.</p>								
Course Objectives		The objective of this course is to get the students hands on practice with scripting/programming concepts of Python language						
Course Outcomes		At the end of this course, the student will be able to :						
CO1		define: installations, working, structures, control statements, operators, lists ,object oriented programming concepts, python libraries.						
CO2		explain: conditional & control statements ,strings, OOPs ,file handling concepts ,libraries and packages of python programming.						
CO3		categorize:datatypes,dictionaries,conditional&controlstatements,functions,python libraries.						
CO4		design: basic and advanced applications in python.						

Unit I

Introduction: Structure of a Python Program, Control flow, Interpreter shell, Tokens, Identifiers, Reserved keywords, Literals, Variables, Python basic operators.

Numeric data types: int, float, complex, using string data type, Scope of a Variable, Working with: String, List, Tuples and Dictionaries.

Control Structures: Conditional blocks using if, else and elif, for loops in python, while loops, continue, break and else.

Organizing python codes using functions & modules: creating modules, using modules and built-in modules.

Unit II

Object Oriented Programming: Concept of class, Object and Instances, Constructor, Class Attributes and Destructors, Built-in Class Attributes, Inheritance.

File Handling: Creating, Opening, Closing, Writing & Reading File Content, Deleting a File.

Python NumPy: Array Slicing, Array Indexing, Data Types, Array Shape & Reshape, Array Join, Array Split, Random.

Python Pandas: Data Frames, Read CSV

Text Books

1. Chun, J Wesley, "Core Python Programming", 2e, Pearson, 2007.
2. E. Balagurusamy, "Introduction to Computing and problems solving using Python", McGraw Hill Education, 2016

Reference Books

1. Barry and Paul, "Head First Python", 2e, O Reilly, 2010.
2. Lutz and Mark, "Learning Python", 4e, O Reilly, 2009

BSC/DS/SM/4/MIC/204: Data Mining and Warehousing							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/Assignment/Attendance
<p>Note for the Paper Setter: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, eight more questions of 14 marks each will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting at least one question from each unit.</p>							
Course Objectives		The objective of this course is to get the students familiar with different concepts of data warehouse and data mining, association rule mining, classification and prediction.					
Course Outcomes		At the end of this course, the student will be able to :					
CO1		define: the concepts of data mining, data pre-processing, outliers, data warehouse , association rule mining, data classification prediction and cluster Analysis.					
CO2		describe: key process of data mining ,data warehousing, OLAP, data warehousing to data mining , association rule, classification and prediction methods.					
CO3		apply: association rules. use: decision induction, Bayesian and back propagation classification methods.					
CO4		differentiate: operational database systems and data warehousing, single dimensional and multidimensional association rules, and data mining classification methods.					

Unit I

Data Mining: Introduction, Motivation, Importance, Knowledge discovery process, data mining, kind of data, functionalities, interesting patterns, classification of data mining system, applications and trends in Data Mining, major issues in Data Mining

Unit II

Data Pre-processing: Introduction and need of pre-processing, data cleaning, data integration and transformation, data reduction, discretization and concept hierarchy generation.

Unit III

Data warehouse and OLAP Technology for Data Mining: data warehouse, difference between operational database systems and data warehouse, A Multidimensional Data Model, Data warehouse Architecture, Data warehouse Implementation, data warehousing to data mining, Data warehouse usage.

Unit IV

Classification: Basic concept of classification, classification by decision tree induction, Bayesian classification, rule-based classification, classification by back propagation, and other classification methods.

Text Books

1. Ale Berson, Stephen Smith, KorthTheorling, "Data Mining", Tata McGraw Hill.
2. Pieter Adriaans and Dolf Zantinge, "Data Mining", Addison-Wesley Longman.
3. Sam Anahory, "Data Warehousing in the Real World", Addison-Wesley Longman.

Reference Books

1. Chanchal Singh, "Data Mining and Warehousing", Wiley.

English-II

Communicative English-II

Course Code: ENG/AEC/102

Credits: 2

Duration of Examination: -2 hrs

Internal Assessment: 15

Semester End Examination: 35

Total Marks: 50

Note for the Paper Setter: The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.

Course Objective: The course aims to introduce students to the theory, fundamentals and tools of communication and to develop effective communication skills for personal, social and professional interactions. Besides, the students shall learn the basics of English grammar and language.

Course Learning Outcomes:

- i) They will learn the importance and basics of communication
- ii) They will learn the basics of English Grammar
- iii) They will learn to receive, comment and respond to correspondences in English language.
- iv) They will learn to use verbal and non-verbal modes of communication.

Note for the Paper Setter: The question paper will consist of **five** questions in all. The **first** question will be compulsory and will consist of **seven** short questions of **1** mark each covering the whole syllabus. In addition, **four** more questions of **14** marks each will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one** compulsory question and **two** more questions selecting at least **one** question from each unit.

Unit - I: Basics of Communication:

Communication Skills: Introduction, Definition, The Importance of Communication, Forms of Communication, Types of Communication- Verbal and Non-Verbal Communication; The Communication Process- Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context.

Barriers to Communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers

Unit II: Basics of English Grammar :

Use of Tenses, Common Legal Terms, Vocabulary-Synonym and Antonyms, Affixes- Prefixes and Suffixes, Articles

Suggested Reading:

- I) Raymond Murphy. *English Grammar in Use* .Cambridge Uni. Press.
- II) Kumar, Sanjay and Pushp Lata. 2015. *Communication Skills*. Second Edition, New Delhi: Oxford University Press (OUP).
- III) B.K. Das, A. David: *A Remedial Course in English For Colleges Book 1 and 2*. OUP.

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
SEC	03	03	Lecture	50	25	3 Hours	TEE/MTE/ Assignment/ Attendance
Course Content Green Computing							
<p>Note for the Paper Setter: The question paper will consist of seven questions in all. The first question will be compulsory and will consist of four short questions of 2 marks each covering the whole syllabus. In addition, six more questions of 14 marks each will be set unit-wise comprising of two questions from each of the three units. The candidates are required to attempt one compulsory question and three more questions selecting at least one question from each unit.</p>							
Unit I	The concept, importance and issues involved in Green Computing/ Information Technology; Carbon footprint in manufacturing of computing and IT products; other effluents in IT manufacturing; the concept of design for environment;						
Unit II	Carbon footprint in operations of IT/computing gadget; green IT usage; Data centre and server farms design, power, cooling and location; virtualization; BPR for sustainable IT/computing.						
Unit III	Disposal practices in e-waste; e-waste recycling, formal vs. informal e-waste recycling; extended producer responsibility; IT for paperless offices; IT for saving travel cost, time and environment; Electronic waste management regulations in India; IEEE 1680 standard for green computing.						
Text/Reference Books							
Text Books	1. John Lamb, The Greening of IT – How Companies Can Make a Difference for the Environment” IBM Press, 2009.						
Reference Books	1. Toby J. Velete, Anthony T. Velete, Robert Elsenpeter, Green IT – Reduce Your Information System’s Environmental Impact While Adding to the Bottom Line” 1e, McGraw-Hill, 2008.						

Vedic Mathematics

Marks (Theory): 35 Marks

(Total) : 50

Marks (Internal Assessment): 15

Time : 2 Hrs

Credits: 02

Note for the Paper Setter: The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.

Course Outcomes (COs): At the end of the course, the students will be able

CO1: Discuss the rich heritage of mathematical temper of Ancient India Learning Outcomes: Overcome the fear of maths, Improved critical thinking

CO2: Familiarity with the mathematical underpinnings and techniques, Ability to do basic maths faster and with ease.

UNIT-I

Vedic Maths- High Speed Addition and Subtraction Sessions/Lectures, Vedic Maths: History of Vedic Maths and its Features, Vedic Maths formulae: Sutras and Upsutras, Addition in Vedic Maths: Without carrying, Dot Method, Subtraction in Vedic Maths: Nikhilam Navatashcaramam Dashatah, Fraction-Addition and Subtraction.

UNIT II

Vedic Math - Miracle Multiplication and Excellent Division, Multiplication in Vedic Maths: Base Method (any two numbers upto three digits), Multiplication by Urdhva Tiryak Sutra, Miracle multiplication: Any three-digit number by series of 1's and 9's, Division by Urdhva Tiryak Sutra (Vinculum method).

Books suggested:

1. The Essential of Vedic Mathematics, Rajesh Kumar Thakur, Rupa Publications, New Delhi 2019.
2. Vedic Mathematics Made Easy, Dahaval Bathia, Jaico Publishing, New Delhi 2011
3. Vedic Mathematics: Sixteen Simple Mathematical formulae from the Vedas, Jagadguru Swami Sri Bharati Krishna Trithaji, Motilal Banarasidas, New Delhi 2015.
4. Learn Vedic Speed Mathematics Systematically, Chaitnaya A. Patil 2018. 17 Suggested Readings
5. A Modern Introduction to Ancient Indian Mathematics, T S Bhanumurthy, Wiley Eastern Limited, New Delhi.