Curriculum for UG Degree in Bachelor in Computer Applications BCA/BCA (Honours)/ BCA (Honours with Research)and Specialization in

(i) AI & ML
(ii) Data Science

(Based on AICTE Curriculum and Credit Framework for BCA Program and Formative Assessment Guidelines under NEP-2020)

With Effect From the session 2025-26

MAHARSHI DAYANAND UNIVERSITY ROHTAK (HARYANA)

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
CC	Core Courses
AEC	Ability Enhancement Courses
MDE	Multi-Disciplinary Elective course
VAC	Value added Courses
SEC	Skill Enhancement courses
DSE	Discipline Specific Elective
OE	Open Elective

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Course Name: Bachelor in Computer Application, Bachelor in Computer Application (Honours) and Bachelor in Computer Application (Honours with Research)

Course Level/Duration/System:

Undergraduate / Three or Four years/6 or 8 Semesters with multiple entry and exit. The following option will be made available to the students joining BCA Research Program:

a. **One year:** Under Graduate Certificate in Computer Application
b. **Two years**: Under Graduate Diploma in Computer Application
c. **Three years**: Bachelor in Computer Application (BCA)
d. **Four years**: Bachelor in Computer Application with Honours: BCA (Honours) or Bachelor in Computer Application Honours with Research: BCA (Honours with Research)

Minimum Eligibility Criteria:

Minimum eligibility criteria for opting the course in the fourth year will be as follows:

1. **BCA (Honours with Research):** BCA Degree

2. **For BCA (Honours)**: BCA Degree

Note: The students who are eligible for BCA (Honours with Research) shall have choice to pursue either BCA (Honours) or BCA (Honours with Research).

SEMESTER WISE CREDIT DISTRIBUTION:

SEMESTER WISE CREDIT DISTRIBUTION OF PROPOSED BCA *[BCA (HONOURS) AND BCA (HONOURS WITH RESEARCH)]* PROGRAM:

Semester	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective course	Value added Courses	Skill Enhancement courses	Discipline Specific Elective	Total
I	8	2	2	2	5	-	19
II	12	-	-	2	7	-	21
III	11	0	0	2	4	3	20
IV	15	0	0	0	2	3	20
V	0	0	0	0	6	15	21
VI	4	1	0	0	4	10	19
BCA (Honours)							
VII	5	0	3	0	4	8	20
VIII					8	12	20
BCA (Honours with Research)							
VII	12					8	20
VIII	20						20

Category-wise distribution*

Description	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective course	Value added Courses	Skill Enhancement courses	Discipline Specific Elective	Total
BCA	50	3	2	6	28	31	120
BCA (Honours)	55	3	5	6	40	51	160
BCA (Honours with Research)	82	3	2	6	28	39	160

3 Years BCA Program	**Total Credits = 120**
4 Years BCA (Honours) and BCA (Honours with Research)	**Total Credits = 160**

Note: Students can take extra credit course from their own department or from other department as per the Admitting Body / University norms.

INDUCTION PROGRAM

The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal, (Link:https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf). For more, Refer **Appendix III.**

The student who takes an exit after one year with an award of certificate may be allowed to re-enter in to Third Semester for completion of the BCA Program as per the respective University /Admitting Body schedule after earning requisite credits in the First year.

Students can choose their specialization i.e. Stream with Discipline Specific Elective
[DSE] from Second year onwards as indicated in Appendix -I

SEMESTER III

S. No.	Course Code	University Nomenclature Course Code	Course Title	L	T	P	Credit
1	CC201	26BCA403DS01	Probability and Statistics	3	0	0	3
2	CC202	26BCA403DS02	Data Base Management System	3	0	4	5
3	SEC201	26BCA403SEC01	Python Programming	2	0	4	4
4	CC203	26BCA403DS03	Software Engineering	3	0	0	3
5	DSE201*		Professional Elective – I	1	0	4	3
6	VAC201	26Y0GXO4VA01	Yoga/Sports/NCC/NSS/Disaster Management	0	0	4	2
			TOTAL				**20**

* To be selected from the Proposed Streams with Discipline-Specific Electives - Data Science / Artificial Intelligence and Machine Learning / Full Stack Development proposed by University as indicated at the Appendix - A

SEMESTER IV

S. No.	Course Code	University Nomenclature Course Code	Course Title	L	T	P	Credit
1	CC204	26BCA404DS01	Entrepreneurship and Startup Ecosystem	1	1	0	2
2	CC205	26BCA404DS02	Computer Networks	3	0	4	5
3	CC206	26BCA404DS03	Design and Analysis of Algorithm	3	0	0	3
4	CC207	26BCA404DS04	Artificial Intelligence	3	0	4	5
5	DSE202*		Professional Elective – II	1	0	4	3
6	SEC202	26BCA404SEC 01	Design Thinking and Innovation	1	1	0	2
			TOTAL				**20**

Note:

1. At the end of the Fourth Semester every student shall undergo Summer Training / Internship / Capstone for Eight Weeks in the industry/Research or Academic Institute. This component will be evaluated during the fifth semester.
2. An **UNDER GRADUATE DIPLOMA IN COMPUTER APPLICATION** will be awarded, if a student wishes to exit at the end of Second year.

Exit Criteria after Second Year of BCA Programme

Students will have the option to exit the Bachelor of Computer Application (BCA) program after successfully completing the second year. Upon exit, they will be awarded a **UG Diploma in Computer Application**. To be eligible for this diploma, students must complete an additional 04 credits in one of the following areas:

1. **Skill-Based Subject**: A specialized course aimed at enhancing technical and practical expertise in computer applications.
2. **Work-Based Vocational Course**: A vocational course offered during the summer term, focused on building practical, industry-relevant skills.
3. **Internship/Apprenticeship**: A professional internship or apprenticeship with a minimum duration of 08 weeks, conducted after the fourth semester, offering hands-on experience in a relevant field.
4. **Social Responsibility & Community Engagement**: Involvement with an NGO or community-based organization for a minimum of 08 weeks, contributing to social initiatives and applying computer application knowledge to solve real-world challenges.
5. **Capstone Project**: Completion of a capstone project integrating the skills and knowledge gained during the first two years of the program, which can be an independent or group project.

The specific mode of completing the additional credits will be decided by the respective **University/Admitting Body**, and students will be required to complete the 08-week program or project during the summer term following their fourth semester.

Students opting for this exit will also be required to **submit an Internship/Apprenticeship Report** or complete the Capstone Project as per the schedule outlined by the University/Admitting Body before they are awarded the UG Diploma.

Re-entry Criteria in to Third Year (Fifth Semester)

The student who takes an exit after second year with an award of Diploma may be allowed to re-enter into fifth Semester for completion of the BCA Program as per the respective University / Admitting Body schedule after earning requisite credits in the Second year.

L-T-P w.r.t Open Elective and Discipline Specific Elective depends on the Courses offered by the University

SEMESTER VIII- (BCA –(Honours with Research))

S. No.	Course Code	University Nomenclature Course Code	Course Title	L	T	P	Credit
1	SEC401	28BCA408SEC01	Dissertation (For Research Track)*	-	-	-	20
			TOTAL				**20**

***The Dissertation work will start from the beginning of fourth year of BCA (Honours with Research) Program.

Students of Fourth Year shall be assessed for Project Work and Research Internship Report and Viva –Voce and Dissertation (For Research Track).

Proposed Streams with Discipline-Specific Electives (DSE)

Note: The following is indicative. Universities/Institutes may add streams / electives as per their specific requirements.

1. Data Science

S.No	Semester	Course Code	University Nomenclature Course Code	Professional Elective
1	III	DSE*201	26BCA403DSE11	Basics of Data Analytics using Spreadsheet
2	IV	DSE*202	26BCA404DSE11	Data Visualization
3	V	DSE301	27BCA405DSE11	Introduction to Data Science
4	V	DSE302	27BCA405DSE12	Time Series Analysis
5	V	DSE303	27BCA405DSE13	Machine Learning
6	VI	DSE304	27BCA406DSE11	Big Data Analytics
7	VI	DSE305	27BCA406DSE12	Exploratory Data Analysis
8	VII	DSE401	28BCA407DSE11	Business Intelligence & Analytics
9	VII	DSE402	28BCA407DSE12	Data Mining & Warehousing
10	VIII	DSE403	28BCA408DSE11	Advanced Data Visualization
11	VIII	DSE404	28BCA408DSE12	Cloud Computing for Data Analytics
12	VIII	DSE405	28BCA408DSE13	Data Security & Privacy

2. Artificial Intelligence & Machine Learning

S.No	Semester	Course Code	University Nomenclature Course Code	Professional Elective

1	III	DSE*201	26BCA403DSE21	Feature Engineering
2	IV	DSE*202	26BCA404DSE21	Introduction to ML
3	V	DSE301	27BCA405DSE21	Neural Network
4	V	DSE302	27BCA405DSE22	Digital Image Processing
5	V	DSE303	27BCA405DSE23	Natural Language Processing
6	VI	DSE304	27BCA406DSE21	Deep Learning for Computer Vision
7	VI	DSE305	27BCA406DSE22	Predictive Analysis
8	VII	DSE401	28BCA407DSE21	Explainable AI
9	VII	DSE402	28BCA407DSE22	Evolutionary Algorithm
10	VIII	DSE403	28BCA408DSE21	Speech Recognition
11	VIII	DSE404	28BCA408DSE22	Augmented Reality & Virtual Reality
12	VIII	DSE405	28BCA408DSE23	Security aspects of ML

SUMMATIVE ASSESSMENT
For Core Courses and Discipline Specific Elective Courses

For three credits of theory and two credit of practical (3:0:2)

		Marks Distribution
Theory	Internal	25
	External	50
Practical		50
Total		125

For three credits of theory and one credit of practical (3:0:1)

		Marks Distribution
Theory	Internal	25
	External	50
Practical		25
Total		100

For three credits of theory (3:0:0)

		Marks Distribution
Theory	Internal	25
	External	50
Practical		0
Total		75

For two credits of theory and two credits of tutorial (2:2:0)

		Marks Distribution
Theory	Internal	50
	External	50
Practical		0
Total		100

For two credits of theory and two credits of practical (2:0:2)

		Marks Distribution
Theory	Internal	15
	External	35
Practical		50
Total		100

For two credits of tutorial and two credits of practical (0:2:2)

		Marks Distribution
Theory	Internal	50
	External	0
Practical		50
Total		100

For one credit of theory and one credit of tutorial (2:0:0)

		Marks Distribution
Theory	Internal	15
	External	35
Practical		0
Total		50

For one credit of theory and two credit of practical (1:0:2)

		Marks Distribution
Theory	Internal	5
	External	20
Practical		50
Total		75

For one credit of theory and one credit of tutorial (1:1:0)

		Marks Distribution
Theory	Internal	25
	External	25
Practical		0
Total		50

Evaluation Scheme for Practical/Lab Examination: 25 Marks

		Marks Distribution
Program 1	Flowchart/Algorithm	01
	Writing Program	01
	Execution and Program Format	02
Program 2	Flowchart/Algorithm	01
	Writing Program	01
	Execution and Program Format	02
Viva Voce		07
Practical File*		05
Attendance*		05
Total		25

***: Marks to be provided by the Internal Teacher**

Evaluation Scheme for Practical/Lab Examination: 50 Marks

		Marks Distribution
Program 1	Flowchart/Algorithm	02
	Writing Program	03
	Execution and Program Format	05
Program 2	Flowchart/Algorithm	02
	Writing Program	03
	Execution and Program Format	05
Viva Voce		20
Practical File*		05
Attendance*		05
Total		50

***: Marks to be provided by the Internal Teacher**

FORMATIVE ASSESSMENT
For Skill Enhancement Course

For two credits of theory and one credit of practical (2:0:1)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For three credits theory (3:0:0)

	Marks distribution
Written test (2 X 10)	20
MCQs/ Quizzes/ Group Discussion (2 X 10)	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For three credits practical (0:0:3)

	Marks distribution
Regular assessment through observation and class discussion	10
Lab work (practical file) / Field work (report)/Portfolio	30
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For four credits practical (0:0:4)

	Marks distribution
Regular assessment through observation and class discussion	15
Lab work (practical file) / field work (report)/Portfolio	30
Case study / Mini project (2 X 15)	30
Assignment/Seminar / Presentation (2 X 10)	20
Attendance	05
Total	**100**

For two credits of theory and two credits of practical (2:0:2)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
Total	**100**

For one credit theory and three credits practical (1:0:3)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
Total	**100**

For two credits practical (0:0:2)

	Marks distribution
Regular assessment through observation and class discussion	10
Lab work (practical file)/Field work (Report)/Mini project	20
Seminar/Presentation (2 X 7.5)	15
Attendance	05
Total	**50**

For three credits theory and two credits practical (3:0:2)

	Marks distribution
Regular Assessment through observation and class discussion	25
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
Total	**125**

For two credits tutorial (0:2:0)

	Marks distribution
Written test (2 X 10)	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	05
Attendance	05

Total	**50**

For two credits theory and one credit practical (2:0:1)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For three credits theory (3:0:0)

	Marks distribution
Written test (2 X 10)	20
MCQs/ Quizzes/ Group Discussion (2 X 10)	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For three credits practical (0:0:3)

	Marks distribution
Regular assessment through observation and class discussion	10
Lab work (practical file) / Field work (report)/Portfolio	30
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For four credits practical (0:0:4)

	Marks distribution
Regular assessment through observation and class discussion	15
Lab work (practical file) / field work (report)/Portfolio	30
Case study / Mini project (2 X 15)	30
Assignment/Seminar / Presentation (2 X 10)	20
Attendance	05
Total	**100**

For two credits theory and two credits practical (2:0:2)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
Total	**100**

For one credit theory and three credits practical (1:0:3)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
Total	**100**

For two credits practical (0:0:2)

	Marks distribution
Regular assessment through observation and class discussion	10
Lab work (practical file)/Field work (Report)/Mini project	20
Seminar/Presentation (2 X 7.5)	15
Attendance	05
Total	**50**

Formative Assessment Model
For Ability Enhancement Course

For two credits theory (2:0:0)

	Marks distribution
Written test (2 X 5)	10
Peer discussion / Debate / Extempore speech (2X 10)	20
Role play	05
Essay / Article / Report writing	10
Attendance	05
Total	**50**

For one credit theory and one credit tutorial (1:1:0)

	Marks distribution
Written test (2 X 5)	10
Peer discussion / Debate / Extempore speech (2X 10)	20
Role play	05
Essay / Article / Report writing	10
Attendance	05
Total	**50**

For one credit tutorial (0:1:0)

	Marks distribution
Written test (2 X 5)	10
Peer discussion / Debate / Extempore speech (2X 10)	05
Essay / Article / Report writing	05
Attendance	05
Total	**25**

Formative Assessment Model
For Value Added Course

For two credits theory (2:0:0)

	Marks distribution
Written test (2 X 10)	20
Class assignments / Case study / Mini project (2 X 5)	10
Quiz / seminar / Group discussion / Debate / QM profile (2 X 7.5)	15
Attendance	05
Total	**50**

For two credits practical (0:0:2)

	Marks distribution
Regular assessment through observation and class discussion	20
Field work (Report)/Mini project	15
Assignment (2 X 5)	10
Attendance	05
Total	**50**

Formative Assessment Models
For Multidisciplinary Course

For three credits theory (3:0:0)

	Marks distribution
Written test (2 X 10)	20
Class assignments / Case study / Mini project (2 X 10)	20
Book review / Essay / Seminar (1 X 10)	10
Quiz / Group discussion / Debate (2 X 10)	20
Attendance	05
Total	**75**

For two credits theory and one credit practical (2:0:1)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/Portfolio	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For three credits practical (0:0:3)

	Marks distribution
Regular assessment through observation and class discussion	10
Lab work (practical file) / field work (report)/Portfolio	30
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
Total	**75**

For two credits theory (2:0:0)

	Marks distribution
Written test (2 X 10)	20
Class assignments / Case study / Mini project (2 X 5)	10
Quiz / seminar / Group discussion / Debate / QM profile (2 X 7.5)	15
Attendance	05
Total	**50**

Formative Assessment Model

For UG/PG 4 Credit Practical Courses

For four credits of practical (0:0:4)

	Marks distribution
Regular assessment through observation and class discussion	20
Lab work (practical file) / field work (report)/Portfolio	30
Assignment/Case study / Mini project (3 X 10)	30
Seminar / Presentation (2 X 7.5)	15
Attendance	05
Total	**100**

Internship Evaluation by Formative Assessment

After completing the internship, students must prepare a comprehensive report highlighting their learning and takeaways during the internship period as per the **MDU Internship Regulations 2025**. The report shall be signed by the Internship Supervisor from the respective UTD/Centre/College and Mentor from the internship-providing organizations. Internship Supervisor and Mentor will jointly conduct evaluation of internship report and viva-voce on the time and date notified by the concerned HoDs/Directors/Principals. The mentor from the host organization may participate in the evaluation through online/offline mode. In case the respective mentor is unavailable, the relevant mentor, as decided by the concerned HOD/Director/Principal, may be utilized for evaluation.

Suggested distribution of marks is as follows:
Credit 0:0:4

<table>
<tr><th>S. No.</th><th>Components</th><th>Employability-Oriented Internship</th><th>Research-Oriented Internship</th></tr>
<tr><td>1</td><td>Assessment by Mentor
<table>
<tr><th>S. No</th><th>Details</th><th>Marks</th></tr>
<tr><td>1</td><td>Skills learned</td><td>15</td></tr>
<tr><td>2</td><td>Regularity</td><td>10</td></tr>
<tr><td>3</td><td>Conduct</td><td>5</td></tr>
<tr><td></td><td>Total(30)</td><td></td></tr>
</table></td><td>30</td><td>30</td></tr>
<tr><td>2</td><td>Internship Report</td><td>40</td><td>40</td></tr>
<tr><td>3</td><td>Viva-Voce</td><td>30</td><td>30</td></tr>
<tr><td></td><td>Total</td><td>100</td><td>100</td></tr>
</table>

Evaluation of Project Report / Dissertation

Regarding project reports/dissertations/research projects, internal and external examiners shall jointly carry out the assessment. There shall be no Internal assessment component for the Dissertation / Project Report. External examiners shall be invited from amongst the panel of examiners (ordinarily not below the rank of Associate Professor) recommended by the concerned Board of Studies.

Credit 0:0:20
Total marks for Project Report/Dissertation as per MDU/AICTE: 500

Note: -

1. From the Academic session 2026 – 2027, the pattern of Skill Enhancement Courses will be revised as follows, wherever applicable:

For Four Credit SEC	For Three Credit SEC	For Two Credit SEC
L – T – P	L – T – P	L – T – P
0 – 0 – 4	0 – 0 – 3	0 – 0 – 2
1 – 0 – 3	1 – 0 – 2	----
2 – 0 – 2	---	----

SEMESTER –III

SEMESTER –III

Probability and Statistics

CC201	26BCA403DS01	Probability and Statistics	3L:0T:0P	3 Credits
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Course Objectives

CO1:This course aims to make the students trained to handle randomness scientifically using theory of probability.

CO2:This course intends to make the students able to represent the statistical data in a systematic way and analyze it to draw meaningful information from them.

CO3:Through plentiful examples and exercises, this course provides the students scope to apply probabilistic and statistical techniques to deal with the real-life problems.

Course Content:

UNIT I:

Basic concepts of Statistics, qualitative and quantitative data, classification of data, construction of frequency distribution, diagrammatic representation of data.

Measures of Central Tendency: Arithmetic mean, median and mode—their properties **Measures of Dispersion**: Range, mean deviation, quartile deviation, variance and standard deviation.

UNIT II:

Correlation: Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.

Regression: Linear regression-fitting by least square method and interpretation.

UNIT III:

Concepts of probability: Experiment and sample space, events and operations with events, probability of an event, basic probability rules, applications of probability rules, conditional probability.

Random Variables: Discrete and continuous random variable**,** probability distribution of a random variable**,** probability mass function, probability density function,expectation and variance of a random variable.

Standard Probability Distributions: Binomial probability distribution, Poisson probability distribution, Normal probability distribution.

UNIT IV:

Sampling Distribution: Concept of Population and Sample,parameter and statistic, sampling distribution of sample mean and sample proportion.

Statistical Inference: Estimation and Hypothesis Testing (only concept).

Hypothesis Testing for a Single Population: Concept of a hypothesis testing, tests involving a population mean and population proportion (z test and t test).

Chi square test for independence of attributes and goodness of fit.

Text Books

1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing Company, 2010 (AICTE Recommended Textbook)
2. Das N. G., Statistical Methods, Combined Edition, Tata McGraw Hill, 2010.
3. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.
4. Miller Irwin and Miller Marylees, Mathematical Statistics with Applications, Seventh Edition, Pearson Education, 2005

Reference Books

1. Pal Nabendu and Sarkar Sahadeb, Statistics: Concepts and Applications, Second Edition, PHI, 2013
2. Montgomery Douglas and Runger George C., Applied Statistics and Probability for Engineers, Wiley, 2016.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, 2024.

Web Resources

1. https://nptel.ac.in/courses/111106112
2. https://nptel.ac.in/courses/111105041

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Database Management Systems

CC202	26BCA403DS02	Database Management Systems	3L:0T:4P	5 Credits
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Course Objectives

CO1:Understanding Core Concepts of DBMS

CO2:Proficiency in Database Design and SQL

CO3:Application of Advanced Database Techniques

Prerequisite: Basic knowledge of Set Theory.

Course Content:

UNIT I:

Introduction to Databases: Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators

Data Models: Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS

Database Design:Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key,Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model,Entities and Entity Sets,
Attributes and Relationships,ERDiagrams,Key Constraints and Weak Entity Sets, Extended ER Features,Introduction to the Relational Model and Relational Schema

UNIT II:

Relational Algebra and Calculus: Introduction to Relational Algebra, Operations:
Selection, Projection, Set Operations, Join Operations, Division,Tuple and Domain Relational Calculus

Structured Query Language (SQL): SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses(Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join

Advanced SQL: Analytical queries, Hierarchical queries, Recursive queries, Views, Cursors, Stored Procedures and Functions, Packages, Triggers, Dynamic SQL

Normalization and Database Design: Functional Dependencies: Armstrong's Axioms,
Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.

UNIT III:

Transaction Management:ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL,Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlocks

Database Storage and Indexing: Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection

UNIT IV:

NoSQL Databases and Big Data: Introduction to NoSQL, Data Models: Document, Key value, Column family, Graph. Uses and Features of NO/SQL document databases. CAP

theorem, BASE vs ACID, CRUD operations, MongoDB operators, Overview of Big Data Technologies: Hadoop, MongoDB, Cassandra.

Database Security and Advanced Topics: Introduction to Database Security, Access Control, Discretionary Access Control, Introduction to Data Warehousing, OLAP, Data Mining

Text Books

1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", third edition, McGraw – Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015
3. Brad Dayley, "NoSQL with MongoDB in 24 Hours", 1st edition, Sams Publishing, 2024

Reference Books

1. Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.(2019)
2. R.P. Mahapatra, Govind Verma, "Database Management Systems", Khanna Publishing House, 2025.

Web Resources

1. https://oracle-base.com/articles
2. https://forums.oracle.com/ords/apexds/domain/devcommunity/category/sql_and_pl_sql
3. https://asktom.oracle.com/ords/f?p=100:1:0

List of Practicals:

1. Draw an ER Diagram of Registrar Office
2. Draw an ER Diagram of Hospital Management System
3. Reduce The ER diagram in question no 1 into tables
4. Reduce the ER diagram of question no 2 into tables

Consider the following Schema
Supplier(SID, Sname, branch, city, phone)
Part(PID,Pname, color, price)
Supplies(SID, PID, qty, date_supplied)

DDL Commands

5. Create the above tables
6. Add a new attribute state in supplier table
7. Remove attribute city from supplier table
8. Modify the data type of phone attribute
9. Change the name of attribute city to address
10. Change a table's name, supplier to sup
11. Use truncate to delete the contents of supplies table
12. Remove the part table from database

DML Commands

1. Insert at least 10 records in tables supplier, part and supplies
2. Show the contents in tables supplier, part and supplies
3. Find the name and city of all suppliers
4. Find the name and phoneno of all suppliers who stay in 'Delhi'
5. Find all distinct branches of suppliers
6. Delete the record of the supplier whose SID is 204001
7. Delete all records of supplier table
8. Delete all records of suppliers whose city starts with capital A.
9. Find the supplier names which have 'lk' in any position
10. Find the supplier name where 'R' is in the second position
11. Find the name of supplier whose name starts with 'V' and ends with 'A'
12. Change the city of all suppliers to 'BOMBAY'
13. Change the city of supplier 'Vandana' to 'Goa'

Queries with Constraints

1. Create the supplier table with Primary Key Constraint
2. Create supplies table with Foreign key Constraint
3. Create a part table with UNIQUE Constraint
4. Create supplier Table with Check Constraints
5. Create Supplier table with Default Constraint

Queries on TCL

1. Create Savepoints
2. Rollback to SavePoints 3.Use Commit to save on

Aggregate Functions:

1. Find the minimum, maximum, average and sum of costs of parts
2. Count the total number of parts present
3. Retrieve the average cost of all parts supplied by 'Mike'

Queries on GROUP BY, HAVING AND ORDER BY Clauses

1. Display total price of parts of each color
2. Find the branch and the number of suppliers in that branch for branches which have more than 2 suppliers
3. Find all parts sorted by pname in ascending order and cost in descending order
4. Find the branch and the number of suppliers in that branch

Queries on Analytical, Hierarchical, Recursive nature.

1. Find out the 5^{th} highest earning employee details.
2. Which department has the highest number of employees with a salary above $80,000, and what percentage of employees in that department have a salary above $80,000

3. Retrieve employee table details using the hierarchy query and display that hierarchy path starting from the top level indicating if it is a leaf and there exists a cycle.
4. What is the average salary for employees in the top 2 departments with the highest average salary, and what is the hierarchy of departments and sub-departments for these top 2 departments?
5. Use recursion to retrieve the employee table and display the result in breadth first and depth first order.
6. Write a recursive query to show the equivalent of level, connect_by_root and connect_by_path
7. Use recursion to retrieve the employee table and display the result in depth first order showing id, parent_id, level, root_id, path and leaf.

Queries on Operators

1. Find the pname, phoneno and cost of parts which have cost equal to or greater than 200 and less than or equal to 600.
2. Find the sname , SID and branch of suppliers who are in 'local' branch or 'global' branch
3. Find the pname, phoneno and cost of parts for which cost is between 200 and 600
4. Find the pname and color of parts , which has the word 'NET' anywhere in its pname.
5. Find the PID and pname of parts with pname either 'NUT' or 'BOLT'
6. List the suppliers who supplied parts on '1st may2000', '12 JAN 2021' ,'17 dec 2000' ,'10 Jan 2021'
7. Find all the distinct costs of parts

Join Operators

1. Perform Inner join on two tables
2. Perform Natural Join on two tables
3. Perform Left Outer Join on tables
4. Perform Right Outer join on tables
5. Perform Full Outer Join on tables

Set Theory Operators

1.Show the use of UNION operator with union compatibility
2.Show the use of intersect operator with union compatibility
3. Show the use of minus operator with union compatibility
4. Find the cartesian product of two tables

Queries on Set Theory Operators

1. List all parts except 'NUT' and 'BOLT' in ascending order of costs
2. display all parts that have not been supplied so far
3. To display the supplier names who have supplied 'green' part with cost 500 Rupees AND 'red' part with cost 400 Rupees.

4. To display the supplier names who have supplied ‘green’ part with cost 500 Rupees OR ‘red’ part with cost 400 Rupees.
5. To Display the name of suppliers who have supplied all parts that are ‘red’ in color.

PL/SQL Programs

1. Write a PL/SQL Code to add two numbers
2. Write a PL/SQL code for Fibonacci series
3. Write a PL/SQL Code for greatest of 3 numbers
4. Write a PL/SQL code for area and circumference of a circle

PL/SQL Programs on Cursors

1. Write a Program using CURSOR to display SID and city of 1st record of supplier
2. Write a program using cursors to display the SID and City of all suppliers and then print the count of suppliers.

PL/SQL Programs on Triggers, Procedures and Functions

1. Write a Program using TRIGGER on UPDATE
2. Write a command to See the effect of trigger
3. Write a Program using PROCEDURE to increase the cost by Rs.1000 for part whose PID is passed as an argument.
4. Write a procedure to update the city of a supplier whose SID and city are passed as arguments and the procedure returns the name of supplier whose city is updated.
5. Write a function to return the total number of suppliers
6. Write a function to return the PID of part, for which the part name is passed
7. Write a function to find the sum total of costs of all parts.

PL/SQL Programs on Implicit Cursors

1. Insert a record using %ROWTYPE
2. Write a code using %NOTFOUND, %FOUND, %ROWCOUNT
3. Write a code using %TYPE

MongoDB Queries

1. Create a collection and insert documents into it using insertOne() and insertMany()
2. Select all documents in collection
3. Find the count of all suppliers
4. Find all records that have city = ‘Delhi’
5. Retrieve all documents that have color equal to ‘red’ or ‘green’
6. Retrieve all documents where part_name is ‘P1’ or price is less than 200.
7. Update the record of ‘Geeta’,set city = ‘Bombay’ and phoneno = ‘11223344’
8. Delete all records where price is greater than 5000
9. Display only the name and city of the supplier
10. Sort all suppliers on city and display only the first two records.

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Python Programming

SEC201	**26BCA403SEC01**	**Python Programming**	**2L:0T:4P**	**4 Credits**

Course Objectives:

CO1:Develop modular Python programs.

CO2:Apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.

CO3:Understand basic Data visualization and File handling in Python.

Prerequisites:

Understanding of Problem solving techniques using a programming language and basic data structures.

Course Content:

UNIT I:

Introduction: History and Application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/Output statements.

Strings: Creating and Storing Strings, Built-in functions for strings; string operators, String slicing and joining; Formatting Strings.

UNIT II:

Control Flow Statements: Conditional Flow statements; Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit.

Functions: Built-In Functions, Function Definition and call; Scope and Lifetime of Variables, Default Parameters, Command Line Arguments; Lambda Functions; Assert statement; Importing User defined module;

UNIT III:

Mutable and Immutable objects: Lists, Tuples and Dictionaries; Commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists, tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays.

Files: Types of Files; Creating, Reading and writing on Text and Binary Files;The PickleModule, Reading and Writing CSV Files. Reading and writing of csv and JSON files.

UNIT IV:

Exception Handling: Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions.

Data visualization: Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves.

Text Books:

1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
2. Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023.
3. Sheetal Taneja & Naveen kumar: Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications, Pearson, 2017.

Reference Books:

1. Think Python, by Allen Downey, 2 nd edition, 2015, O'Reilly. https://drive.google.com/file/d/1p9Pul6d5UvnQrO9-Q-LE2_p4YvMk5cIg/view
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
3. Introduction to Computation and Programming using Python, by John Guttag, 2 nd edition, 2016, PHI India.

Web Resources:

1. https://www.learnpython.org/
2. https://www.w3schools.com/python/default.asp

Practical List:

1. Write a program to find whether a number is a prime number.
2. Write a program to print m raise to power n, where m and n are read from the user.
3. Write a program having a parameterised function that returns True or False depending on whether the parameter passed is even or odd.
4. Write a program to print the summation of the following series upto n terms:1-2+3-4+5-6+7 - - - - - - - -n
5. Write a menu driven program to perform the following operations on strings using string built in functions.
   a. Find the frequency of a character in a string.
   b. Replace a character by another character in a string.
   c. Remove the first occurrence of a character from a string.
   d. Remove all occurrences of a character from a string.
6. Write a program that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1
7. Using Numpy module write menu driven program to do following
   a. Create an array filled with 1's.
   b. Find maximum and minimum values from an array
   c. Dot product of 2 arrays.
   d. Reshape a 1-D array to 2-D array.
8. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.

9. Consider a tuple t1=(1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations:
   a. Print contents of t1 in 2 separate lines such that half values come on one line and other half in the next line.
   b. Print all even values of t1 as another tuple t2.
   c. Concatenate a tuple t2=(11,13,15) witht1.
   d. Return maximum and minimum value from t1..
10. Write a function that reads a file file1 and copies only alternative lines to another file file2. Alternative lines copied should be the odd numbered lines.
11. Write a Python program to handle a ZeroDivisionError exception when dividing a number by zero.
12. Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
13. Write a program that makes use of a function to display sine, cosine, polynomial and exponential curves.
14. Take as input in the months and profits made by a company ABC over a year. Represent this data using a line plot. Generated line plot must include X axis label name = Month Number and Y axis label name = Total profit.

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Software Engineering

CC203	**26BCA403DS03**	**Software Engineering**	**3L:0T:4P**	**3 Credits**
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Course Objectives

CO1:To Acquire a comprehensive understanding of the software development lifecycle and its application in contemporary software engineering practices.

CO2:To Develop proficiency in project management methodologies and strategic decisionmaking for successful software project execution.

CO3:To Master the art of software design, development, and testing to produce robust and efficient software solutions.

Prerequisites: Basic understanding of Software, Applications, Programming fundamentals.

Course Content:

UNIT I:

The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.

UNIT II:

Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

UNIT III:

Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT IV:

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.

Release Management: Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring.

Product sustenance: Maintenance, updates, End of life, migration strategies.

Text Books

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023 (AICTE Recommended Textbook)
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

Reference Books

1.Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007

2.Software Engineering: Principles and Practice Hans van Vliet

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Professional Elective -I

DSE201	**26BCA403DSE01**	**Professional Elective -I (Data Science/ AIML)**	**1L:0T:4P**	**3 Credits**
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Refer to **Appendix–I** for Professional Electives and choose either one specialization from the basket of **Data Science / Artificial Intelligence and Machine Learning/ Full Stack Development**

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VAC201	**26YOGX04VA01**	**Yoga and Physical fitness /Sports/NCC/NSS/Disaster Management**	**0L:0T:4P**	**2 Credits**

Note: All the theoretical contents shall be delivered through the practical workshop mode only. No class room teaching is encouraged in this course.

YOGA

Yoga course is designed to provide students with a comprehensive understanding of physical fitness, wellness, and nutrition. This course explores the meaning and importance of yoga in the modern era, the role of sports in maintaining physical fitness, and the various components of physical wellness. Students will also learn about the significance of nutrition and weight management, equipping them with the knowledge to promote a healthy and balanced lifestyle. Through this course, students will gain insights into the holistic approach to health and wellbeing.

Course Objective(s):

i. Understand yoga's significance and its practical applications for holistic well-being.
ii. Explore subtle energy systems and their role in enhancing health through yogic practices.
iii. Examine various paths of yoga to foster self-realization and spiritual growth. iv. Master the Eight Limbs of Yoga for physical, mental, and spiritual harmony.
v. Apply yogic principles to manage psycho-somatic ailments and promote resilience.

Course Content:

Unit-I

- Yoga: Meaning and definition
- Importance of yoga in 21st century
- Introduction to Yogic Anatomy and Physiology
- Yoga & sports, Yoga for healthy lifestyle
- Types of Yoga: - Hatha yaga, laya yoga, mantra yoga,
- bhakti yoga, karma yoga, jnana yoga, raj yoga
- Study of Chakras, Koshas, Pranas, Nadis, Gunas, Vayus and its application in Yogic practices.
- Ashtang Yoga: - Yama, niyama, asana, pranayama, Pratyahar, dharna, dhyan, Samadhi : Benefits, Utilities & their psychological impact on body and mind. According to yoga concept of normality in modern psychology, concept of personality & its development, yogic management of psycho-somatic ailments: frustration, anxiety, depression

Unit- 2

- Sports for Physical Fitness: Meaning and definition
- Physical Activity – Concept, Benefits of Participation in Physical Activities
- Components and Significance of Physical Fitness -Health, Skill and Cosmetic Fitness
- Types of Physical Activities – Walking, Jogging, Running, Calisthenics, Rope Skipping, Cycling, Swimming, Circuit Training, Weight training, Adventure Sports
- Principles of Physical Fitness, Warming Up, Conditioning, Cooling Down, Methods to Develop and Measure Health and Skill related components of Physical Fitness
- Measurement of Health Related Physical Fitness (HRPF)

Unit -3

- Physical Wellness: Concept, Components
- Types of wellness: psychological, social, emotional, and spiritual.
- Significance with reference to Positive Lifestyle 2.2
- Concepts of Quality of Life and Body Image
- Factors affecting Wellness
- Wellness Programmes

Unit-4: Nutrition and Weight Management

- Concept of Nutrients, Nutrition, Balanced Diet, Dietary Aids and Gimmicks
- Energy and Activity- Calorie Intake, Energy Balance Equation
- Obesity - Concept, Causes, Obesity Related Health Problems
- Weight Management through Behavioural Modifications

Text Books / References:

- Anand O P. Yog Dawra Kaya Kalp. Sewasth Sahitya Perkashan. Kanpur.
- Brown, J.E. Nutrition Now Thomson-Wadsworth.
- Corbin et.al.Fitness& Wellness-Concepts. McGraw Hill. Publishers. New York.U.S.A
- Corbin, C. B., G. J. Welk, W. R Corbin, K. A. Welk, Concepts of Physical Fitness: Active Lifestyle for Wellness. McGraw Hill, New York, USA.

- Hoeger, W W K and S.A. Hoeger. Principles and Labs for Fitness and Wellness, Thomson Wadsworth, California, USA.
- Hoeger, W.W. & S. Hoeger Fitness and Wellness. 7th Ed. Thomson Wadsworth, Boston, USA.
- Kamlesh, M. L. & Singh, M. K.) Physical Education (Naveen Publications).
- Kansal, D.K. Text book of Applied Measurement, Evaluation & Sports Selection. Sports & Spiritual Science Publications, New Delhi.
- Kumari, Sheela, S., Rana, Amita, and Kaushik, Seema,, Fitness, Aerobics and Gym Operations, Khel Sahitya, New Delhi
- Lumpkin, A. Introduction to Physical Education, Exercise Science and Sports Studies, McGraw Hill, New York, U.S.A.
- Sarin N) Yoga DawaraRogon Ka Upchhar.Khel Sahitya Kendra
- Savard, M. and C. Svec The Body Shape Solution to Weight Loss and Wellness: The Apples & Pears Approach to Losing Weight, Living Longer, and Feeling Healthier. Atria Books, Sydney, Australia.
- Siedentop, D. Introduction to Physical Education, Fitness and Sport, McGraw Hill Companies Inc., New York, USA.
- Sri Swami Ramas. Breathing. Sadhana Mandir Trust.Rishikesh.
- Swami Ram Yoga & Married Life Sadhana Mandir Trust. Rishikesh

Course Outcome(s):

i. Gain a comprehensive understanding of yoga and its modern applications for holistic well-being.

ii. Demonstrate proficiency in yogic anatomy and physiology, enhancing yoga practice and promoting physical and energetic balance.

iii. Master the Eight Limbs of Yoga and comprehend their psychological impact, fostering personal growth and self-realization. iv. Integrate yoga principles into sports and physical fitness activities to enhance performance and prevent injuries.

v. Develop skills in wellness management and nutrition

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Sports Management

Sports Management course is designed to provide undergraduate students with a broad, foundational understanding of the dynamic field of sports management. This course will familiarize students with the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations. Students will gain insights into the roles of marketing and sponsorship in the sports industry, as well as develop proficiency in financial management techniques specific to sports organizations. Additionally, the course will explore the application of analytics and technology in sports, enhancing the strategic decision-making and fan engagement capabilities.

Course Objective(s):

i.Understand the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations. ii.Analyse the role of marketing

and sponsorship in the sports industry, with a focus on branding, target audience segmentation, and event management.

iii. Develop proficiency in financial management techniques specific to the sports industry, including revenue generation, cost management, and investment strategies.

iv. Explore the application of analytics and technology in sports, including performance evaluation, strategic decision-making, and fan engagement.

v. Apply theoretical knowledge to practical scenarios through case studies and projects, fostering critical thinking and problem-solving skills in sports management contexts.

Course Content:

Unit 1: Introduction to Sports Management

- Definition and scope of sports management
- Significance of sports management in society and its evolution over time
- Organizational structure of sports: amateur, professional, and non-profit entities
- Roles and responsibilities of key personnel: managers, coaches, and agents
- Governance bodies in sports: FIFA, IOC, and NCAA
- Legal issues: contracts, negotiations, intellectual property rights ●Ethical considerations: fair play and doping

Unit 2: Sports Marketing and Sponsorship

- Unique aspects of sports marketing
- Fan engagement strategies
- Target audience identification and segmentation
- Branding strategies for sports teams and athletes
- Sponsorship and endorsement deals
- Negotiating and managing partnerships
- Event management: planning, organizing, and promoting sports events

Unit 3: Financial Management in Sports

- Revenue generation in sports: ticket sales, broadcasting rights, merchandise sales
- Financial models: budgeting and forecasting
- Cost management: player salaries, facility expenses, operational costs
- Investment opportunities in sports
- Risk management techniques specific to sports organizations

Unit 4: Sports Analytics and Technology

- Introduction to sports analytics
- Evaluating player performance
- Devising game strategies
- Fan engagement through technology
- Analytical techniques: statistical analysis, data visualization, predictive modeling
- Key performance indicators (KPIs) in sports
- Applications of analytics: talent scouting, injury prevention, performance optimization.

Text Books :

1. Pedersen, P. M., Thibault, L., & Pedersen, P. M. (2019). Contemporary Sport Management. Human Kinetics.
2. Hoye, R., Smith, A. C. T., Nicholson, M., et al. (2021). Sports Management: Principles and Applications. Routledge.
3. Chelladurai, P., & Kerwin, S. (2017). Introduction to Sport Management: Theory and Practice. Human Kinetics.
4. Hoye, R., Cuskelly, G., & Nicholson, M. (2019). Sports Governance: A Guide for Sport Organizations. Routledge.
5. Conrad, M. (2018). The Business of Sports: A Primer for Journalists. Routledge.
6. Shank, M. D. (2019). Sports Marketing: A Strategic Perspective. Pearson.
7. Collett, P., & Fenton, W. (2019). The Sponsorship Handbook: Essential Tools, Tips and Techniques for Sponsors and Sponsorship Seekers. Kogan Page.
8. Fullerton, S. Jr., & Funk, D. C. (2019). Sports Marketing: A Practical Approach. Routledge.
9. Conrad, M. (2019). Winning in Sports Business: Essential Marketing, Finance, and Management Strategies. Routledge.
10. McCarty, L. A., & McPherson, G. (2019). Sports Event Management: The Caribbean Experience. Routledge.
11. Brown, M. T., Rascher, D., & Leeds, M. A. (2017). Financial Management in the Sport Industry. Routledge.
12. Winfree, J. A., &Rosentraub, M. S. (2017). Sports Finance and Management: Real Estate, Entertainment, and the Remaking of the Business. Taylor & Francis.
13. Foster, G., O'Reilly, N., &Cuskelly, G. (2018). Sports Business Management: Decision Making Around the Globe. Routledge.
14. Brown, M. T., & Shick, D. M. (2019). Financial Management in the Sport Industry. Routledge.
15. Conrad, M. (2018). The Business of Sports: A Primer for Journalists. Routledge.
16. Alamar, B. C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.
17. Miller, T. W. (2019). Sports Analytics and Data Science: Winning the Game with Methods and Models. FT Press.
18. Marchi, M., Albert, J., &Baumer, B. (2014). Analyzing Baseball Data with R. Chapman and Hall/CRC.
19. Schumaker, R. P., Hwang, R. S. Y., & Chen, H. (2016). Sports Data Mining. Routledge.
20. Alamar, B. C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.

References:

Course Outcome(s):

i. Demonstrate a comprehensive understanding of sports management principles, including organizational structures, legal issues, and ethical considerations.

ii. Evaluate marketing strategies and sponsorship opportunities in the sports industry, devising effective branding and promotional campaigns. iii.Apply financial management techniques to analyze revenue streams, control costs, and make informed investment decisions in sports organizations.

iv. Utilize sports analytics tools and technology to enhance performance evaluation, strategic planning, and fan engagement initiatives.

v. Synthesize course concepts through practical applications, demonstrating the ability to address real-world challenges in sports management scenarios.

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National Cadet Corps (NCC)

This course develops essential skills in discipline, leadership, and tactical operations through structured curriculum and practical exercises. It emphasizes the role of drills in fostering discipline, leadership, and teamwork, and includes comprehensive weapon handling training with a focus on safety protocols. The course teaches map reading, understanding topographical features, and navigating diverse terrains. Practical units cover the history and objectives of the National Cadet Corps (NCC), various maneuvers, parade formations, saluting protocols, and field and battlecraft techniques. By the end, learners will master discipline, leadership, weapon handling, and tactical decision-making, effectively utilizing terrain features for strategic advantages.

Course Objective(s):

1. Understand the foundational role of drill in fostering discipline and leadership within a group, enabling effective command towards achieving common goals.
2. Appreciate the importance of grace and dignity in executing foot drill movements, recognizing their significance in enhancing performance and teamwork.
3. Comprehend the criticality of weapon handling and detailed safety measures, emphasizing the importance of accident prevention through strict adherence to safety protocols.
4. Develop an awareness of diverse terrain types and their strategic significance in battle craft, enabling informed decision-making and effective utilization of terrain features for tactical advantage.

Course Content (Practical):

Unit 1:

Overview of NCC, its history, aims, objectives, and organizational structure, Incentives and duties associated with NCC cadetship; Maneuvers: Foot drill, Word of Command, Attention, and stand at ease, and Advanced maneuvers like turning and sizing; Parade formations: Parade line, open line, and closed line; Saluting protocols, parade conclusion, and dismissal procedures. Marching styles: style march, double time march, and slow march

Unit 2:

Weapon Training, Handling firearms, Introduction and characteristics of the .22 rifle; Handling Firearm techniques, emphasizing safety protocols and Best practices.

Unit 3:
Map Reading (MR): Topographical forms and technical terms, including relief, contours, and gradients, crucial for understanding terrain features; Cardinal points , magnetic variation and grid convergence

Unit 4:
Field Craft & Battle Craft (FC & BC): Fundamental principles and techniques essential for effective field and battle craft operations; Methods of judging distance, including estimation, pacing, and visual cues

References:

- DGNCC Cadet's Hand Book - Common Subjects -All Wings
- Tiwari, R. (2019). NCC: Grooming Feeling of National Integration, Leadership and Discipline among Youth. Edwin Incorporation.
- Chhetri, R.S. (2010). Grooming Tomorrows Leaders, The National Cadet Corps.
- Directorate General National Cadet Corps(2003). National Cadet Corps, Youth in Action.
- Vanshpal, Ravi (2024). The NCC Days, Notion Press.

Course Outcome(s):

1. Mastery of Discipline and Leadership through Drill Learners would demonstrate the ability to effectively command a group, foster discipline, and work collaboratively towards achieving shared objectives.
2. Mastery of Grace and Dignity in Foot Drill Performance Learners would demonstrate an understanding of how these qualities enhance performance and foster teamwork within a group setting.
3. Proficient Weapon Handling and Safety Adherence Learners would showcase a thorough understanding of the criticality of safety measures, emphasizing accident prevention through strict adherence to safety protocols.
4. Enhanced Tactical Awareness and Strategic Decision-Making Learners would gain the ability to make informed decisions and effectively utilize terrain features to gain tactical advantage during operations.

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National Service Scheme (NSS)

This course provides students with an in-depth understanding of the National Service Scheme (NSS), including its history, philosophy, aims, objectives, and organizational structure. It equips students with knowledge about various NSS programmes and activities, emphasizing their relevance and importance. The course also develops skills in community mobilization, teaching students effective techniques for engaging and mobilizing community stakeholders. Additionally, it cultivates an appreciation for volunteerism and shramdan (voluntary labor), highlighting their role in community development initiatives. By the end of the course,

students will have a comprehensive understanding of NSS, enhanced leadership and team-building skills, and a strong sense of social awareness and patriotism.

Course Objective(s):

1. To provide students with an understanding of the history, philosophy, and basic concepts of the National Service Scheme (NSS).
2. To familiarize students with the aims, objectives, and organizational structure of NSS.
3. To equip students with knowledge about NSS programmes, activities, and their relevance.
4. To develop an understanding of community mobilization techniques and their importance in NSS activities.
5. To cultivate an appreciation for volunteerism, shramdan (voluntary labor), and their role in community development initiatives.

Course Content:

Unit 1: Introduction and Basic Concepts of NSS

National Service Scheme (NSS) - history, philosophy, and fundamental concepts, aims and objectives, providing clarity on the organization's overarching goals. Symbols of NSS - Emblem, flag, motto, song, and badge; Organizational structure of NSS

Unit 2: NSS Programmes and Activities

Diverse programmes and activities conducted under the aegis of the National Service Scheme (NSS); Significance of commemorating important days recognized by the United Nations, Centre, State Government, and University; Examination of the methodology for adopting villages/slums and conducting surveys; Financial patterns of the NSS scheme

Unit 3:Community Mobilization

Dynamics of community mobilization within the framework of the National Service Scheme (NSS); Functioning of community stakeholders; The conceptual lens of community development

Unit 4: Volunteerism and Shramdan in the Indian Context: Roles and Motivations within the NSS Framework

Ethos of volunteerism and shramdan (voluntary labor) within the cultural context of India and the framework of the National Service Scheme (NSS); Motivations and constraints shaping volunteer engagement; Role of NSS volunteers in initiatives such as the Swatch Bharat Abhiyan and Digital India

References:

1. Ministry of Youth Affairs and Sports, Government of India. (2022). National Service Scheme (NSS) Manual.
2. Agarwalla, S. (2021). NSS and Youth Development. Mahaveer Publications
3. Bhattacharya, P. (2024). Stories Of NSS (English Version). Sahityasree.
4. Borah, R. and Borkakoty, B. (2022). NSS in Socioeconomic Development. Unika Prakashan.
5. Wondimu, H., & Admas, G. (2024). The motivation and engagement of student volunteers in volunteerism at the University of Gondar. *Discover Global Society*, *2*(1), 1-16.

6. Saha, A. K. (2002). Extension Education–The Third Dimension Needs and Aspirations of Indian Youth. *Journal of Social Sciences*, *6*(3), 209-214.
7. Mills, S. (2013). "An instruction in good citizenship": scouting and the historical geographies of citizenship education. *Transactions of the Institute of British Geographers*, *38*(1), 120–134. http://www.jstor.org/stable/24582445
8. Mishra, S. K., Sachdev, S., Marwaha, N., & Avasthi, A. (2016). Study of knowledge and attitude among college-going students toward voluntary blood donation from north India. *Journal of blood medicine*, 19-26.
9. Mukherji, B. (2007). Community Development in India. Orient Longmans.
10. History Background of NSS and its Philosophy, Aims and Objectives
11. https://www.osmania.ac.in/NSS%20URL/9.%20%20Historical%20Background%20of%
20NSS%20and%20its%20Philosophy,%20Aim.pdf
12. In Defence of Nationalism https://www.mkgandhi.org/indiadreams/chap03.htm
13. Unlocking Youth Potential for Nation Building: Strengthening NYKS and NSS 14.https://www.undp.org/india/projects/strenghtening-nyks-and-nss

Course Outcome(s):

1. Students will demonstrate an understanding of the history, philosophy, and objectives of the National Service Scheme (NSS), thereby fostering increased social awareness and patriotism among them.
2. Students will be able to organize and conduct various NSS programmes and activities effectively and through it understand the importance of leadership and team building.
3. Students will develop skills in community mobilization and partnership building.
4. Students will appreciate the importance of volunteerism and shramdan in societal development and thus, be able to understand role of community participation.

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DISASTER MANAGEMENT

In our rapidly evolving 21st-century world, challenges emerge in diverse forms, transcending borders and intertwining economic, societal, and environmental realms. These challenges profoundly affect vulnerable communities, magnifying their susceptibility to climate-related shocks and disasters. As we navigate through these complexities, it becomes increasingly evident that aligning strategies with global Sustainable Development Goals (SDGs) across various geographical scales is paramount. This alignment incorporates perspectives of environmental sustainability, climate adaptation, and disaster resilience. In light of these considerations, this course aims to equip students with the knowledge and skills necessary to address and mitigate the impacts of disasters in a holistic manner.

Course Objective(s):

- to provide understanding of the concepts related to disaster
- to highlight the importance and role of disaster management

- to enhance awareness of institutional processes and management strategies to mitigate the impacts of disasters

Course Content:

Unit 1: Concepts and Terminologies
Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made); Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial); Defining Vulnerability (Physical Vulnerability; Economic Vulnerability; Social Vulnerability)

Unit 2: Key concepts of Disaster Management Cycle
Components of disaster management cycle (Phases: Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning); Disaster risk reduction (DRR), Community based disaster risk reduction

Unit 3: Initiatives at national and international level
Disaster Risk Management in India and at international level: Related policies, plans, programmes and legislation; International strategy for disaster reduction and other initiatives

Unit 4: Emergency Management
Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil and Hazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflicts

Training and Demonstration Workshops (at least two workshops) be organized in association with the NIDM, NDRF, NCDC, Param Military, Fire Brigade, CISF, local administration etc.

Readings

1. Sharma, S.C. (2022), Disaster Management, Khanna Book Publishing.
2. Clements, B. W., (2009): Disasters and Public Health: Planning and Response, Elsevier Inc.
3. Dunkan, K., and Brebbia, C. A., (Eds.) (2009): Disaster Management and Human Health Risk: Reducing Risk, Improving Outcomes, WIT Press, UK.
4. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
5. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.
6. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
7. Carter, N. (1991) Disaster Management: A Disaster Management Handbook. Asian Development Bank, Manila.
8. Govt. of India (2008) Vulnerability Atlas of India. BMTPC, New Delhi.
9. Govt. of India (2011) Disaster Management in India. Ministry of Home Affairs, New Delhi.
10. Matthews , J.A., (2002) Natural Hazards and Environmental Change, Bill McGuire, Ian Mason.

E-Resources http://www.ndma.gov.in/en/
http://nidm.gov.in/ https://www.unisdr.org/
http://www.emdat.be
https://www.weather.gov/safety/
https://www.preventionweb.net/risk/vulnerability

Course Outcomes:
Upon successful completion of this course, students will be able to:

i. Articulate the critical role of disaster management in reducing risks and enhancing resilience

ii. Identify and describe key institutional frameworks and processes in disaster management.

iii. Conduct risk assessments and develop disaster management plans for specific scenarios

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SEMESTE

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SEMESTER –IV

Entrepreneurship and Startup Ecosystem

CC 204	**26BCA404DS01**	**Entrepreneurship and Startup Ecosystem**	**1L:1T:0P**	**2 Credits**
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Course Objective(s):

- To understand Entrepreneurship and its types
- To understand that not all ideas can be turned into viable business models and guestimate business potential of an idea
- To understand different type of finances available and financing methods
- To be able to draft business plans on an identified idea
- To understand the nuances of operating a startup – low budget marketing, stabilizing operations, build a team from scratch and scaling the business
- To know what is a Family Business and how is it different from Entrepreneurship

Course Content:

Unit 1: Introduction to Entrepreneurship & Family Business

- Definition and Concept of entrepreneurship
- Entrepreneur Characteristics
- Classification of Entrepreneurs
- Role of Entrepreneurship in Economic Development –Start-ups
- Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.

Unit 2: Evaluating Business opportunity

- Sources of business ideas and opportunity recognition
- Guesstimating the market potential of a business idea
- Feasibility analysis of the idea
- Industry, competition and environment analysis

Unit 3: Building Blocks of starting ventures

- Low cost Marketing using digital technologies
- Team building from scratch
- Venture Funding
- Establishing the value-chain and managing operations ●Legal aspects like IPR and compliances

Unit 4: Start-up Ecosystem

- Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc.
- Know various govt. schemes like Start-up India, Digital India, MSME etc.
- Sources of Venture Funding available in India
- Source of Technology, Intellectual Property management **Text Books (Latest Edition):**

1. *Startup India Leaning Program* by Start Up India available at www.startupindia.gov.in
2. *Entrepreneurship,* Rajeev Roy, Oxford University Press
3. *Entrepreneurship: Successfully Launching New Ventures* by R. Duane Ireland Bruce R. Barringer, Pearson Publishing
4. *Family Business Management* by Rajiv Agarwal, Sage Publishing
5. Anish Tiwari (2003), "Mapping the Startup Ecosystem in India", *Economic & Political Weekly*
6. Ramachandran, K, *Indian Family Businesses: Their survival beyond three generations*, ISB Working Paper Series

References

Course Outcome(s):

At the end of the course, the student would be able to -

- ●Understand basic building blocks of creating a venture
- Be able to identify a business opportunity and translate it into a viable business model

- Identify the elements of the Indian entrepreneurship ecosystem and take relevant benefits from the constituents
- Know the legacy of family businesses and key differentiations from entrepreneurship

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Computer Networks

CC205	26BCA404DS02	Computer Networks	3L:0T:4P	5 Credits
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Course Objectives:

CO1:Understand the fundamental concepts of Computer Networks and their applications.
CO2:Develop problem-solving skills related to network design, implementation, and troubleshooting.
CO3:Implement network protocols and configure network devices.

Prerequisites:

1. Basic Networking Knowledge: Familiarity with basic networking concepts such as IP addressing and network topologies.
2. Programming Skills: Ability to write basic network programs and scripts in languages such as Python or C.
3. Operating Systems: Understanding of OS concepts related to networking, such as process management and memory allocation

Course Content:

UNIT I: Introduction to Computer Networks

Overview of Computer Networks: Definition and Objectives, Applications and Examples Network Components and Architecture

Network Models: OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions Comparison between OSI and TCP/IP Models

Network Topologies: Physical vs. Logical Topologies, Common Topologies: Star, Ring, Bus, Mesh, Hybrid, Advantages and Disadvantages of Each Topology

Data Transmission: Analog vs. Digital Signals, Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Bandwidth and Latency

Networking Devices: Routers, Switches, Hubs, Bridges, Gateways, Functions and Configurations of Each Device.

UNIT II: Data Link Layer and Networking Protocols

Data Link Layer Fundamentals: Functions of the Data Link Layer, Framing, Error Detection, and Error Correction, Flow Control Mechanisms.

Ethernet: Ethernet Standards and Frame Structure, MAC Addressing and ARP, Ethernet Switching: Basic Concepts and Methods

Network Protocols: Introduction to TCP/IP Protocol Suite, IP Addressing: IPv4 and IPv6 Subnetting and CIDR Notation

Address Resolution Protocol (ARP): ARP Operation and Table, ARP Spoofing and Security Considerations

Virtual LANs (VLANs): Concept of VLANs, VLAN Tagging and Configuration, Benefits and Use Cases

UNIT III: Network Layer and Transport Layer

Network Layer: IP Routing: Static vs. Dynamic Routing,Routing Protocols: RIP, OSPF, BGP, Network Address Translation (NAT)

Transport Layer: TCP vs. UDP: Characteristics and Use Cases, TCP Handshake and Connection Management, Flow Control and Congestion Control in TCP

Congestion Control Algorithms: Techniques: Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery, TCP Variants: TCP Reno, TCP Vegas.

Quality of Service (QoS): QoS Principles and Mechanisms, Differentiated Services (DiffServ) and Integrated Services (IntServ)

Network Security Fundamentals: Threats and Vulnerabilities, Basic Security Mechanisms: Firewalls, VPNs, Encryption

UNIT IV: Application Layer and Emerging Technologies

Application Layer Protocols: HTTP/HTTPS: Structure and Operation, FTP, SMTP, POP3, IMAP: Protocols and Uses, DNS: Domain Name System and Resolution

Network Applications: Web Browsing, Email Communication, File Transfer, Voice over IP (VoIP) and Streaming.

Emerging Technologies: Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT) and Its Impact on Networking

Network Management: SNMP: Simple Network Management Protocol, Network Monitoring Tools and Techniques.

Future Trends in Networking: 5G and Beyond, Network Automation and Artificial Intelligence in Networking.

Text Books:

1. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.

Reference Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2019.
3. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2023.
4. Mastering PC Hardware & Networking, Khanna Publishing House, 2024.

Web Resources:
1. Cisco Networking Academy - Online Courses and Resources 2.
NetworkLessons.com - Tutorials on Various Networking Topics

Lab Programs:
1. Configure Basic Network Settings:
   a) IP Address Configuration
   b) Subnet Mask and Gateway Settings 2. Implement Network Protocols:
   a) Write a simple Python script to perform DNS resolution.
   b) Implement a basic HTTP client-server application.
3. Network Simulation:
   a) Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate network topologies.
   b) Configure routers and switches in a simulated environment.
4. Performance Measurement:
   a) Measure network performance using tools like `ping`, `traceroute`, and `iperf`.
   b) Analyze network traffic using Wireshark.
5. Implement VLANs:
   a) Configure VLANs on a switch and verify using simulation tools.
6. Set Up a Simple Web Server:
   a) Deploy a basic web server and configure HTTP/HTTPS access.
7. Network Security Lab:
   a) Implement basic firewall rules and VPN configurations.
   b) Perform vulnerability scanning and analyze results.
8. Network Troubleshooting:
   a) Diagnose and resolve common network issues.
   b) Use troubleshooting commands and techniques to fix connectivity problems.

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Design and Analysis of Algorithms

CC206	26BCA404DS03	Design and Analysis of Algorithms	3L:0T:0P	3 Credits
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Course Objectives
CO1:This course envisions to impart to students the understanding of basic algorithm designing paradigms.

CO2:This course introduces the basic knowledge on how to analyse an algorithm.
CO3:This course expects to enable a student to synthesize efficient algorithms in common design situations and real-life problems.

Prerequisite: Knowledge of Data Structures

Course Content:

UNIT I:

What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity.
Asymptotic notations (O, Ω, Θ) to measure growth of a function and application to measure complexity of algorithms.
Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication.
Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.

UNIT II:

The Divide & Conquer Design Technique:

The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication.

Lower bound for comparison-based sorting.

The Greedy Design Technique:

The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.

UNIT III:

The Dynamic Programming Design Technique:

The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem.

Algorithms on Graphs:

Breadth First Search, Depth First Search, finding connected components, depth first search of a directed graph, topological sorting.

UNIT IV:

Limitations of Algorithmic Power:

Backtracking Method: n-Queen problem; sum of subsets problem/ Hamiltonian circuit problem/vertex cover problem.

Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.

Text Books

1. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House (AICTE Recommended Textbook)
2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.
3. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.
4. Levitin Anany, Introduction to Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012

Reference Books

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of Computer Algorithms, Addison Wesley Publications, Boston, 1983.
2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

Web Resources

1. https://nptel.ac.in/courses/106101060
2. https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf

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Artificial Intelligence

CC207	26BCA404DS04	Artificial Intelligence	3L:0T:4P	5 Credits
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Prerequisites:

Basic understanding of computer science concepts, including data structures and algorithms. Proficiency in minimum one programming language, such as Python.

Course Content:

UNIT I: Introduction to Al

What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents. Knowledge-Based Agents**:** Introduction to Knowledge-Based Agents, The Wumpus World as an Example World. Problem-solving: Problem-solving agents.

UNIT II: Advanced Search Techniques

Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search. Adversarial Search & Games: Two-player zero-sum games,

Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP. Evolutionary Search Techniques**:** Introduction to evolutionary algorithms, Genetic algorithms, Applications of evolutionary search in AI.

UNIT III: Logical Reasoning and Uncertainty

Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting. Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems. Introduction to Planning: Blocks World problem,

Strips; Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Introduction to Fuzzy set theory.

UNIT IV: Domains and Applications of AI

Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks, and their Applications. Expert Systems: The architecture and role of expert systems include two case studies. Legal and Ethical Issues: Concerns related to AI.

Text Books:

1. M.C. Trivedi, *A Classical Approach to Artificial Intelligence*, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J, *Artificial Intelligence: A new Synthesis*, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Dan W Patterson, *Introduction to Artificial Intelligence & Expert Systems*, PHI Learning 2010.
4. Rajiv Chopra, *Data Science with Artificial Intelligence, Machine Learning and Deep Learning*, Khanna Book Publishing Company, 2024.

Reference Books:

1. M.C. Trivedi, *Introduction toAI and Machine Learning*, Khanna Book Publishing Company, 2024.
2. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd edition, Prentice Hall
3. Van Hirtum, A. & Kolski, C. (2020). *Constraint Satisfaction Problems: Algorithms and Applications*. Springer
4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024.

Course Outcomes:

CO1: Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents.

CO2: Gain insights about Uninformed and Heuristic search techniques and apply them to solve search applications.

CO3: Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.

CO4: Obtain insights about Planning and handling uncertainty through probabilistic reasoning and fuzzy sets.

CO5: Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI

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Artificial Intelligence Lab

Prerequisites: Basic understanding of algorithms and data structures (e.g., trees, graphs, lists). Proficiency in Python programming, including libraries like NLTK for NLP tasks.

LAB Experiments

The lab experiments may be implemented in Python. Libraries like NLTK, Tensorflow and Keras may be used for Machine learning experiments.

Suggested list of Experiments (not limited to):

1. Demonstrate basic problem-solving using Breadth-First Search on a simple grid.
2. Implement Depth-First Search (DFS) on a small graph.
3. Solve the Water Jug Problem using Breadth First Search (BFS).
4. Implement a Hill Climbing search to find the peak in a numeric dataset.
5. Apply the A* Search algorithm to find the shortest path in a 4x4 grid.
6. Implement the Minimax search algorithm for 2-player games. You may use a game tree with 3 plies.
7. Solve the 4 – Queens Problem as a CSP backtracking problem.
8. Use constraint propagation to solve a Magic Square puzzle.
9. Apply optimization techniques to find the maximum value in a list.
10. Represent and evaluate propositional logic expressions.
11. Implement a basic rule-based expert system for weather classification.
12. Implement a basic AI agent with simple decision-making rules.
13. Implement a basic Rule-Based Chatbot.
14. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for text content.
    a) Tokenizing
    b) Filtering Stop Words
    c) Stemming
    d) Part of Speech tagging
    e) Chunking
    f) Named Entity Recognition (NER)
15. Perform Image classification for a given dataset using CNN. You may use Tensorflow /Keras.

Course outcomes:

CO1: Apply Uninformed Search Algorithms and Implement Heuristic Search techniques
CO2: Analyze and Solve Constraint Satisfaction Problems
CO3: Develop Rule-Based Systems
CO4: Implement and Evaluate Optimization Techniques
CO5: Apply and illustrate the NLP concepts

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Professional Elective -II

DSE202	**26BCA404DSE01**	Professional Elective -II **(Data Science/ AIML)**	**1L:0T:4P**	**3 Credits**
Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

Refer to **Appendix–I** for Professional Electives and choose either one specialization from the basket of **Data Science /Artificial Intelligence and Machine Learning.**

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SEC 202	26BCA404SEC01	Design Thinking and Innovation	1L:1T:0P	2 Credits

Course Objectives:

Operating under turbulent and uncertain business environment, 'innovation' has become the key driver of organizational success for all companies. Managers are expected to be leading this change by navigating companies into rapid evolution of new products/services and business models.

The primary focus of DTI is to help learners develop creative thinking skills and apply design based approaches/tools for identifying and implementing innovation opportunities into implementable projects. Following a learning-by-doing approach, the objectives of the course are –

1.Introduce students to design-based thinking approach to solve problems
2.Observe and assimilate unstructured information to well framed solvable problems
3. Introduce student to templates of ideation
4. Understand the importance of prototyping in the innovation journey
5.Implementing innovation projects

Course Content:

Unit 1: Basics of Design Thinking

1. Understand the concept of innovation and its significance in business
2. Understanding creative thinking process and problem solving approaches
3. Know Design Thinking approach and its objective
4. Design Thinking and customer centricity – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product.
5. Discussion of a few global success stories like AirBnB, Apple, IDEO, Netflix etc.
6. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement

Unit 2: Learning to Empathize and Define the Problem

1. Know the importance of empathy in innovation process – how can students develop empathy using design tools
2. Observing and assimilating information
3. Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences.
4. What are wicked problems
5. Identifying wicked problems around us and the potential impact of their solutions

Unit 3 : Ideate, Prototype and Implement

1. Know the various templates of ideation like brainstorming, systems thinking

2. Concept of brainstorming – how to reach consensus on wicked problems
3. Mapping customer experience for ideation
4. Know the methods of prototyping, purpose of rapid prototyping.
5. Implementation

Unit 4 : Feedback, Re-Design & Re-Create

1. Feedback loop, focus on User Experience, address ergonomic challenges, user focused design
2. Final concept testing,
3. Final Presentation – Solving Problems through innovative design concepts & creative solution

Text Books (Latest Edition):

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

Reference Book

1.Design Thinking by Nigel Cross, Bloomsbury

Course Outcome(s):

By the end of the course, students will be able to –

- Propose real-time innovative product designs and Choose appropriate frameworks, strategies, techniques during prototype development.
- Know wicked problems and how to frame them in a consensus manner that is agreeable to all stakeholders using appropriate frameworks, strategies, techniques during prototype development.
- Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products

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L: Lecture; T: Tutorial; P: Practical

	भारतीय भाषाएं Sanskrit and Modern Indian Languages														
Semester II															
Department of Sanskrit	संस्कृत भाषा परिचय Introduction to Sanskrit Language	25SKTX02AE01	1	1	0	00	1	1	0	02	-	-	-	-	100

Semester –I

Name of Program	BBA/BCA	Program Code	
Name of the course	संस्कृत भाषा तथा आधुनिक भारतीय भाषाएं Sanskrit and Modern Indian Languages	**Course Code**	25SKTX01AE01
Hours/Week		**Credits**	L: 1, T: 1, P:0 Total Credits: 0
Max. Marks	100		

Course Objectives:-

1. To make students aware of the importance of language.
2. To make students aware of the origin and development of a language.
3. To make students aware of various language families especially Indo European language family.
4. To understand the general introduction to Vedic & Classical Sanskrit and their Literature.
5. To familiarize the students about the contribution of Sanskrit to modern Indian Languages.

Course Outcomes:-

On successful completion of this course, the students will we able to have knowledge regarding:-

1. Origin, Development and Importance of a Language.
2. Indo European and Indo Iranian Language families.
3. Vedic Sanskrit and its Literature.
4. Classic Sanskrit and its Literature.
5. Contribution of Sanskrit to Ancient and Modern Indian Languages.

Unit –I

General introduction to language
भाषा का सामान्य परिचय

i. Importance of language
भाषा का महत्व
ii. Origin and development of language
भाषा का उद्भव और विकास
iii. Language families
भाषा परिवार

Unit –II

General introduction to Indo European language family
भारोपीय परिवार का सामान्य परिचय

i. Indo European language family
भारोपीय भाषा परिवार

ii. Indo-Iranian branch
भारत - ईरानी शाखा

Unit –III

General introduction to Vedic and Classical Sanskrit Languages
वैदिक तथा लौकिक संस्कृत का सामान्य परिचय

i. Vedic Sanskrit and its Literature
वैदिक संस्कृत तथा उसका साहित्य

ii. Classical Sanskrit and its literature
लौकिक संस्कृत तथा उसका साहित्य

Unit –IV

General introduction to Pali, Prakrit, Apbhransh and Modern Indian Languages
पालि, प्राकृत, अपभ्रंश तथा आधुनिक भारतीय भाषाओं का सामान्य परिचय

i. Pali, Prakrit and Apbhransh languages
पालि, प्राकृत तथा अपभ्रंश भाषाएं

ii. Modern Indian Languages
आधुनिक भारतीय भाषाएं

iii. Contribution of Sanskrit to Modern Indian Languages
संस्कृत का आधुनिक भारतीय भाषाओं को प्रदाय

Note: Evaluation will be based on formative assessment.

	Marks distribution
Written test (2 X 10)	20
Peer discussion / Debate / Extempore speech (2X 20)	40
Role play	10
Essay / Article / Report writing	20
Attendance	10
Total	**100**

Suggested Readings:-

1. भाषा विज्ञान एवं भाषाशास्त्र डॉ0 कपिलदेव द्विवेदी विश्वविद्यालय प्रकाशनए वाराणसी।
2. भाषाविज्ञान, डॉ0 कर्णसिंह, साहित्य भण्डार, सुभाष बाजार, मेरठ।
3. A manual of Sanskrit phonetics by C. Uhlenbeck.
4. Linguistic Introduction to Sanskrit by B.K. Ghosh.
5. Language, its nature, development and origin, O. Jesperso.

Semester –II

Name of Program	BBA/BCA	Program Code	
Name of the course	संस्कृत भाषा परिचय Introduction to Sanskrit Language	**Course Code**	25SKTX02AE01
Hours/Week		**Credits**	L: 1, T: 1, P:0 Total Credits: 0
Max. Marks	100		

Course Objectives:-

1. To make students aware of Sanskrit sound – Vowels, Consonants etc.
2. To make students aware of points of articulation.
3. To understand the basic principles of conditional phonetic changes.
4. To understand the structure of words and sentences.
5. To familiarize the students about the nominal compounding.

Course Outcomes:-

On successful completion of this course, the students will be able to:-

1. The basic structural knowledge of Sanskrit Language.
2. Develop an interest in Sanskrit.
3. Get motivated to study the Sanskrit.
4. Know the structure of sentences.
5. Know the structure of compounding.

Unit –I

General introduction to Sanskrit Sounds
संस्कृत ध्वनियों का सामान्य परिचय

i. Vowels (Simple Vowels, Complex Vowels)
स्वर(अच्) (शुद्ध स्वर, संयुक्त स्वर)

ii. Consonants (Stops Nasal, Semi Vowels, Sibilants, Anusvara and Visarga)
व्यञ्जन(हल्) (स्पर्श नासिक्य, अन्तस्थ, ऊष्म, अनुस्वार, विसर्ग)

iii. Points of Articulation (Throat, Roof, Palate, Teeth, Lips, Nose)
उच्चारण स्थान (कण्ठ, मूर्धा, तालु, दन्ताः, ओष्ठौ, नासिका)

Unit –II

General introduction to Conditional Phonetic Changes
सन्धि का सामान्य परिचय

i. Phonetic change where vowel is replaced
स्वरसन्धि

ii. Phonetic change where consonant is replaced
व्यञ्जनसन्धि

iii. Phonetic change where visarga is replaced
विसर्गसन्धि

Unit –III

General introduction to the Structure of Sentences
वाक्य संरचना का सामान्य परिचय

i. Sentence
वाक्य
ii. Word (Subanta, Tinanta, Kridanta, Taddhita)
पद (सुबन्त, तिङन्त, कृदन्त, तद्धित)

Unit –IV

General introduction to Nominal Compounding
समास का सामान्य परिचय

i. Avyayeebhava , Tatpurusha
अव्ययीभाव, तत्पुरुष
ii. Dvandva, Bahuvreehi
द्वन्द्व, बहुव्रीहि

Note: Evaluation will be based on formative assessment.

	Marks distribution
Written test (2 X 10)	20
Peer discussion / Debate / Extempore speech (2X 20)	40
Role play	10
Essay / Article / Report writing	20
Attendance	10
Total	**100**

Suggested Readings:-

1. Mishra, Dr. Yadunandan, Anuvada Chandrika, Chaukhambha Orientaliya, Delhi, 2021.
2. Apte, Vaman Shivram, students Guide to Sanskrit Composition, The Standard Publishing Company, Girgaon, Bombay, 1925.
3. Tripathi, Dr. Brahmananda, Rupa Chandrika, Chaukhamba Surbharati Prakashan, Varanasi, 2008.
4. Kridanta Rupa Mala – Srijan Jha – App. Available on Google Play Store.
5. Online tools for Sanskrit grammer developed by computational linguistics group, Department of Sanskrit, University of Delhi:http://du.ac.in.