BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE New Delhi) Yelahanka, Bengaluru 560119

Bachelor of Engineering
Department of Computer Science and Business Systems

IV Semester Scheme and Syllabus

2022 Scheme Effective from the AY: 2025-26

Approved in the BoS Meeting held on 31st January 2026

Scheme of IV Semester

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2025 – 26

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

UG PROGRAM: B.E. in Computer Science and Business Systems | **Semester: IV**

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC/ BSC	**BCS401**	Analysis & Design of Algorithms	TD : CB PSB : CS	3	0	0		03	50	50	100	**3**
2	IPCC	**BCB402**	Financial Management	TD : CB PSB : CS	3	0	2		03	50	50	100	**4**
3	IPCC	**BCS403**	Database Management Systems	TD :CB PSB : CS	3	0	2		03	50	50	100	**4**
4	PCCL	**BCSL404**	Analysis & Design of Algorithms Lab	TD : CB PSB : CS	0	0	2		03	50	50	100	**1**
7	ESC	**BCX405x**	ESC/ETC/PLC	TD : CB	2	2	0		03	50	50	100	**3**
8	AEC / SEC	**BXX456x**	Ability Enhancement Course/Skill Enhancement Course- IV	TD : Concerned department PSB:CS	If the course is Theory				01	50	50	100	**1**
					1	0	0						
					If the course is a lab				02				
					0	0	2						
9	BSC	**BBOC407**	Biology For Information Technology	TD / PSB: BT, CHE	2	0	0		03	50	50	100	**2**
10	UHV	**BUHK408**	Universal human values course	Any Department	1	0	0		01	50	50	100	**1**
11	MC	**BNSK459**	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	**0**
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
		BNCK459	NCC	NCC Coordinator									
		BMUC459	Music	Music teacher									
Total										**500**	**400**	**900**	**19**

PCC: Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **MC:** Mandatory Course (Non-credit), **AEC:** Ability Enhancement Course, **SEC:** Skill Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S= SDA:** Skill Development Activity, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.**K :** This letter in the course code indicates common to all the stream of engineering.
ESC: Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course

Engineering Science Course (ESC/ETC/PLC)			
BCS405A	Discrete Mathematical Structures	**BCS405C**	Optimization Technique
BCS405B	Graph Theory	**BCS405D**	Linear Algebra
Ability Enhancement Course – IV			
BCS456A	Green IT and Sustainability	**BCS456C**	UI/UX
BAIL456B	MongoDB	**BCB456D**	Business Communication

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried outbetween III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

Analysis and Design of Algorithms (3:0:0) 3
(Effective from the academic year 2025-26)

Course Code	**BCS401**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	50	Exam Hours	3

Course Objectives:

This course will enable students to:
- Explain the methods of analyzing the algorithms and to analyze performance of Algorithms.
- State algorithm's efficiencies using asymptotic notations.
- Solve problems using algorithm design methods such as the brute force method, greedy method, divide and conquer, decrease and conquer, transform and conquer,
- Dynamic programming, backtracking and branch and bound.
- Choose the appropriate data structure and algorithm design method for a specified Application.
- Introduce P and NP classes.

Preamble: The advancement in science and technology enhances the performance of processor, which proportionally affect the characteristics of computer system, such as security, scalability and reusability. Important problems such as sorting, searching, string processing, graph problems, Combinational problems, numerical problems are basic motivations for designing algorithm and analyzing it. Since algorithm design techniques are growing at a fast pace, it has become important for IT professionals to upgrade their knowledge in order to meet growing industry demand.

Module – 1

Introduction: What is an Algorithm? It's Properties. Algorithm Specification-using natural language, using Pseudo code convention, Fundamentals of Algorithmic Problem solving, Analysis Framework- Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency.

Performance Analysis: Estimating Space complexity and Time complexity of algorithms.

Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation ( ) with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples problems.

Brute force design technique: Selection sort, sequential search, string matching algorithm with complexity Analysis.

Textbook 1: Chapter 1(Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)

Textbook 2: Chapter 1(section 1.1,1.2,1.3) (10 Hours)

Module – 2

Divide and Conquer: General method, Recurrence equation for divide and conquer, solving it using Master's theorem, Divide and Conquer algorithms and complexity Analysis, Finding the maximum &minimum, Binary search, Merge sort, Quick sort.

Decrease and Conquer Approach: Introduction, Insertion sort, Topological Sorting. It's efficiency analysis.

Textbook 1: Chapter 4 (Sections 4.1,4.2,4.3), Chapter 5(Section 5.1,5.3)

Textbook 2: Chapter 3(Sections 3.1,3.3,3.4,3.5,3.6) (08 Hours)

Module – 3

Greedy Method: General method, Coin Change Problem, Knapsack Problem, solving Job sequencing with deadlines Problems.
Minimum cost spanning trees: Prim's Algorithm, Krfloyduskal's Algorithm with performance analysis.
Single source shortest paths: Dijkstra's Algorithm.
Optimal Tree problem: Huffman Trees and Codes.
Transform and Conquer Approach: Introduction, Heaps and Heap Sort.
Textbook 1: Chapter 9
Textbook 2: Chapter 4(Sections 4.1,4.3,4.5,4.6) (08 Hours)

Module – 4

Dynamic Programming: General method with Examples, Multistage Graphs, Knapsack problem, Bellman-Ford Algorithm, Travelling Salesperson problem, Optimal Binary tree method.
Textbook 1: Chapter 8(Section 8.4)
Textbook 2: Chapter 5 (Sections 5.1,5.2,5.4,5.9) (07 Hours)

Module – 5

Backtracking: General method, solution using back tracking to N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Problems.

Branch and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem **NP-Complete and NP-Hard problems:** Basic concepts, non- deterministic algorithms, P, NP, NP- Complete, and NP-Hard classes.
Textbook 1: Chapter 12 (Sections 12.1,12.2) Chapter 11(11.3)
Textbook 2: Chapter 7 (Sections 7.1,7.2,7.3,7.4,7.5) Chapter 11 (Section 11.1)
(07 Hours)

Course Outcomes:

The students will be able to:

CO1: Analyze various algorithms, state the efficiency using asymptotic notations and mathematically represent the complexity of the algorithm.
CO2: Explain the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete.
CO3: Explain important algorithmic design paradigms (divide-and-conquer, greedy method, dynamic- programming and Backtracking) and apply when an algorithmic design situation calls for it.
CO4: Apply an algorithm using appropriate design strategies for problem solving.

Question paper pattern:
Assessment Details (both CIE and SEE)
1. Each internal test (two in a semester) to be conducted for forty marks.
2. Average of both the test marks are scaled down to 25 marks, a minimum of ten marks is to be scored by the student.
3. Two AATs are to be carried out in this scheme, but there is an exception for PBL (Project Based Learning- alone can be offered as AAT). It is decided to offer PBL for this course.
4. PBL is evaluated for 25 marks, a minimum of ten marks is to be scored by the student.
5. A Minimum of 20 marks to be scored in CIE out of 50 marks (Both components put together).
6. SEE examination for the Lab is to be conducted for 100 marks and reduced to 50.
7. Minimum of 18 marks is to be scored in SEE examination.
Note: A total mark of 40 is to be scored by the students in this course from both CIE and SEE together out of 100

Textbooks

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

Reference Books

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

Alternate Assessment Tools (AATs) suggested:

- **Mini Project/Project based learning**

Web links / e – resources:

https://archive.nptel.ac.in/courses/106/106/106106131/
https://archive.nptel.ac.in/courses/106/101/106101060/
https://www.youtube.com/watch?v=zJxK4rI-QjU

B.E. COMPUTER SCIENCE AND BUSINESS SYSTEM

Choice Based Credit System (CBCS)

SEMESTER – IV

Financial Management (3:0:2)4

(Effective from the academic year 2025-26)

Course Code	**BCB402**	CIE Marks	**50**
Teaching Hours/Week (L: T:P: S)	**3:0:2:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40 Hours of Theory + 20 Hours of Practical**	Total Marks	**100**
Examination Nature	**Theory/Practical**		

Course objectives:

- To gain knowledge on the various sources of finance.
- To understand the various uses for finance.
- To familiarize with the techniques used in financial management

Preamble:

Financial Management syllabus provides essential financial concepts and tools for informed decision-making. Covering financial fundamentals, time value of money, capital budgeting, cost of capital, and financing sources, it ensures a solid understanding of key finance functions. Structured into five modules with practical Excel and VBA components, it bridges theory and practice, enhancing analytical skills. Students will learn to analyze data, evaluate investments, and manage financial resources, preparing them for successful careers in finance.

Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Utilize video/animation and /or cases to illustrate the functioning of various concepts.
3. Promote collaborative learning (Group Learning) in the class.
4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
6. Introduce topics through multiple representations.
7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.
8. Discuss the real-world applications of every concept to enhance students' comprehension.
9. For practical based learning: use suitable modern tool for solving problems and record the results/observations of experiments.

Module – 1

Financial Management: Introduction – Meaning of Financial Management, Finance, Financial Services, Financial Managers, Scope of Financial Management - Finance functions: Investment, Financing and Dividend decisions, Key activities of the Financial Manager, Objectives of Financial Management - Profit Maximization vs. Wealth Maximization

Textbook 1: Chapter 1 **(8 Hours)**

Module – 2

The Time value of money: Timelines and Notation, Future Value of a Single Amount, Present Value of a Single Amount, Future Value of an Annuity, Present Value of an Annuity, Present Value of a Perpetuity, Intra-year Compounding and Discounting. (Theory & Problems)

Textbook 2: Chapter 6 **(8 Hours)**

Module – 3

Capital Budgeting: Nature of Capital Budgeting, Evaluation Techniques - Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), Payback Period, Accounting Rate of Return (ARR).

Textbook 1: Chapter 5 **(8 Hours)**

Module – 4

The Cost of Capital: Preliminaries, Cost of Debt and Preference, Cost of Equity, Determining the proportions, Weighted Average Cost of Capital, Weighted Marginal Cost of Capital, Factors affecting the Weighted Average Cost of Capital.

Textbook 2: Chapter 14 **(8 Hours)**

Module – 5

Sources of Long-Term Finance: Equity Capital, Internal Accruals, Preference Capital, Term Loans, Debentures. **Working Capital Management:** Nature of working capital – Concepts and Definitions of Working Capital, **Planning of Working Capital -** Need for working capital, Determinants of working capital. **Working Capital Financing:** Accruals, Trade credit, Commercial banks.

Textbook 1: Chapter 9 Textbook 2: Chapter 17 **(8 Hours)**

PRACTICAL COMPONENT OF IPCC

Note: Experiments (Suggested & not limited) to be conducted using **MS Excel** or **other spreadsheet tool**. Students are required to develop necessary interfaces by making use of **VBA** and/or **Macros** for data input and import file containing financial/transactional data.

SL. No.	Experiments
1	Mr. Raghu sells goods for which he offers the following option of payment: (i) Pay Rs.2500 now, or (ii) Pay Rs.900 each at the end of first year, second year and third year from now. The customer having an opportunity cost of 10%, find the best option between these options (Compare PV of series of Rs.900 with Rs.2500)
2	A bank makes an offer to deposit with it a sum of Rs.16000 and then receive a return of Rs.1800 p. a. perpetually. Suggest the choice on the offer to be accepted by an investor whose opportunity rate of return is 12%. Comment on the decision change if his rate of return is 10%
3	A recurring deposit of Rs.100 is made in the beginning of each of the next 4 years starting from now @ 6%. Find the total deposit at the end of 4 years, 6 years, 10 years and 15 years.
4	A company is establishing a sinking fund to retire Rs.500000, 8 percent debentures, 10 years from today. The company plans to put a fixed amount into the fund each year for 10 years. The first payment will be made at the end of the current year. The company anticipates that the funds will earn 6 per cent a year. Calculate equal annual contributions must be made to accumulate Rs. 500000, 10 years from now.

5	A machine is available for Rs.170000 and has a life of 5 years. It is expected to generate cash flows of Rs.20000, Rs.50000, Rs.60000, Rs.40000, and Rs.75000. Find out the NPV of the machine given the required rate of return as 10%.
6	A firm is evaluating a proposal costing Rs.160000 and expected to generate cash flows of Rs.40000, Rs.60000, Rs.50000, Rs.50000, and Rs.40000.There is no salvage value thereafter. Find out the IRR of the proposal. Find the IRR, if the hurdle rate of the firm is 12% and suitability for consideration.
7	ITC Ltd. has decided to purchase a machine to augment the company's installed capacity to meet the growing demand for its products. There are three machines under consideration of the management. The relevant details including estimated yearly expenditure and sales are given below. All sales are on cash. Corporate Income Tax rate is 30%. The economic life of Machine 1 is 2 years, while it is 3 years for the other two. The scrap values are Rs.40000, RS.25000, and Rs.30000 respectively. You are required to find out the most profitable investment based on 'Pay Back Method'.

	Machine 1	**Machine 2**	**Machine 3**
Initial Investment required	300000	300000	300000
Estimated annual sales	500000	500000	500000
Estimated cost of production:			
Direct materials	40000	40000	40000
Direct labour	50000	50000	50000
Factory overheads	60000	60000	60000
Administration costs	20000	20000	20000
Selling and distribution costs	10000	10000	10000

8	Calculate the explicit cost of debt for each of the following situations: a) Debentures are sold at par and floatation costs are 5 per cent. b) Debentures are sold at a premium of 10 percent and floatation costs are 5 percent of issue price. c) Debentures are sold at a discount of 5 percent and floatation costs are 5 percent of issue price. Assume: i) Coupon rate of interest in debentures is 10 percent ii) Face value of debentures is Rs.100 iii) Maturity period is 10 years iv) Tax rate is 35 per cent.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

CO1. Explain the importance of financial management from a strategic perspective.
CO2. Apply concepts of time value of money to make financial choices.
CO3. Apply concepts of capital budgeting to make investment decisions.
CO4. Apply the methods of estimation of cost of capital for financial planning.
CO5. Explain the concepts of working capital, long term and short term sources of finance

Textbooks

1. Khan, M Y., Jain, P K., Basic Financial Management, Third Edition, McGraw Hill Education (India) Private Limited, 2012.
2. Chandra, P., Financial Management—Theory and Practice, Tenth Edition, McGraw Hill Education (India) Private Limited., 2019.

Reference book

1. Rustagi, R P., Taxmann's Fundamentals of Financial Management-With Excel Applications, 15th Edition, 2020.

Web links and Video Lectures (e-Resources):

- https://www.pdfdrive.com/financial-management-and-analysis-workbook-step-by-stepexercises-and-tests-tohelp-you-master-financial-management-and-analysis-e158595305.html
- https://www.pdfdrive.com/fundamentals-of-financial-management-concise-sixth-editione20229517.html
- https://www.youtube.com/watch?v=CCQwz_Gwo6o
- https://www.digimat.in/nptel/courses/video/110107144/L01.html

Alternate Assessment Tools (AATs) suggested:

I. Activity Based Learning (Suggested Activities in Class)/ Case Studies (Not limited to)

- Identifying the small or medium sized companies and understanding the Investment evaluation techniques used by them.
- Using the annual reports of selected companies, students can study the working capital management employed by them. Students can also compare the working capital management of companies in the same sector.
- Evaluate the NPV of an investment made in any one of the capital projects of a company for 5 years.
- Submit an analysed report on Capital structure in 5 different industries.
- Visit a business entity and estimate working capital requirement for the entity.
- Calculate Equated Instalment and prepare Loan Repayment schedule for the loan borrowed by your family / friend

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous

evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks

- The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

DATABASE MANAGEMENT SYSTEM (3:0:2) 4
(Effectivefrom the academic year 2025-26)

Course Code	**BCS403**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40 hours	Exam Hours	3

Course Objectives:

This course will enable students to:

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Understand the relational database design principles.
- Demonstrate the use of concurrency and transactions in database.
- Design and build database applications for real world problems.
- Become familiar with database storage structures and access techniques.

Preamble: A Database Management System (DBMS) is a software system that is designed to manage and organize data in a structured manner. It allows users to create, modify, and query a database, as well as manage the security and access controls for that database. DBMS provides an environment to store and retrieve the data in convenient and efficient manner.

Module – 1

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams, Specialization and Generalization.

Textbook 1: Chapter 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10

(8 Hours)

Module – 2

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

Textbook 1: Chapter 5.1 to 5.3, Chapter 8.1 to 8.5; Chapter 9.1 to 9.2,
Textbook 2: 3.5 **(8 Hours)**

Module – 3

SQL: SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL

SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL.

Textbook 1: , Chapter 6.1 to 6.5 Chapter 7.1 to 7.3 **(8 Hours)**

Module – 4

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Textbook 1: Chapter 14.1 to 14.7 **(8 Hours)**

Module – 5

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.
Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering
Database Recovery Techniques: Recovery concepts, Shadow Paging, The ARIES Recovery Algorithm
Textbook 1: Chapter 20.1 to 20.6, Chapter 21.1 to 21.3, Chapter 22.1,22.4,22.5

(08 Hours)

1.	**Practical Component:** Create a table called Employee & execute the following. Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION) 1. Create a user and grant all permissions to the user. 2. Insert the any three records in the employee table contains attributes EMPNO, ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback. Check the result. 3. Add primary key constraint and not null constraint to the employee table. 4. Insert null values to the employee table and verify the result.
2.	Create a table called Employee that contain attributes EMPNO, ENAME, JOB, MGR, SAL & execute the following. 1. Add a column commission with domain to the Employee table. 2. Insert any five records into the table. 3. Update the column details of job 4. Rename the column of Employ table using alter command. 5. Delete the employee whose Empno is 105.
3.	Queries using aggregate functions (COUNT,AVG,MIN,MAX,SUM),Group by ,Orderby. Employee(E_id, E_name, Age, Salary) 1. Create Employee table containing all Records E_id, E_name, Age, Salary. 2. Count number of employee names from employee table 3. Find the Maximum age from employee table. 4. Find the Minimum age from employee table. 5. Find salaries of employee in Ascending Order. 6. Find grouped salaries of employees.
4.	Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old & new Salary. CUSTOMERS(ID, NAME,AGE,ADDRESS,SALARY)
5.	Create cursor for Employee table & extract the values from the table. Declare the variables , Open the cursor & extract the values from the cursor. Close the cursor. Employee(E_id, E_name, Age, Salary)

Course Outcomes:

At the end of the course the student will be able to:

CO1: Describe the basic elements of a relational database management system

CO2: Design entity relationship for the given scenario.

CO3: Apply various Structured Query Language (SQL) and Relational Algebra Concepts for database manipulation.

CO4: Analyze various normalization forms for the given application.

CO5: Analyze and implement transaction processing and concurrency and database recovery protocols in databases

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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CIE for the practical component of the IPCC :

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC :

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scoredby the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Textbooks

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books

1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

Alternate Assessment Tools (AATs) suggested:

- **Online Certification Course on MongoDB/NoSQL**
- **Construction of ER Diagram using any relevant tool**
- **Mini Project/Project based learning**

Web links / e – resources:

1. **https://nptel.ac.in/courses/106/105/106105175/**
2. **https://nptel.ac.in/courses/106/106/106106093/**

B.E in COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

Analysis & Design of Algorithms Lab (0:0:2) 1
(Effective from the academic year 2025-26)

Course Code	**BCSL404**	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	28 hours	Exam Hours	3

Course Objectives:

This course will enable students to:

- To design and implement various algorithms in C/C++ programming using suitable development tools to address different computational challenges.
- To apply diverse design strategies for effective problem-solving.
- To Measure and compare the performance of different algorithms to determine their efficiency and suitability for specific tasks.

List of Experiments

1. Sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++, how the brute force method works along with its time complexity analysis: worst case, average case and best case.
2. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++ how the divide-and- conquer method works along with its time complexity analysis: worst case, average case and best case.
3. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++how the divide-and- conquer method works along with its time complexity analysis: worst case, average case and best case.
4. Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
5. Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
6. Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.
7. Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph.
8. Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.
9. Design and implement C/C++ Program to find a subset of a given set S = {sl , s2, ,sn} of n positive integers whose sum is equal to a given positive integer d.
10. Design and implement C/C++ Program for N Queen's problem using Backtracking.

Course Outcomes:

At the end of the course the student will be able to:

CO1: Develop programs to solve computational problems using suitable algorithm design strategy.

CO2: Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical).

CO3: Make use of suitable integrated development tools to develop programs

Assessment Details (both CIE and SEE)

Lab Evaluation Scheme

1. Ten marks for every experiment (10 X 10 = 100 marks), round it off to 30 marks.
2. Ten marks for every experiment will be evaluated for write-up, program execution, the procedure followed while execution and viva voce after each exercise.
3. Internal practical test for 100 marks to be given and the marks scored will be scaled down to 20 marks.
4. A Minimum of 20 mark is to be scored in CIE.
5. SEE examination for the Lab is to be conducted for 100 marks and reduced to 50 marks.
6. A Minimum of 18 marks is to be scored in SEE.

Note: Open Ended experiment will be done by the students in the Lab session. A total mark of 40 is to be scored by the student from both CIE and SEE together out of 100.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- **Virtual Labs (CSE): http://cse01-iiith.vlabs.ac.in/**

ENGINEERING SCIENCE COURSE/ EMERGING TECHNOLOGY COURSE/ PROGRAMING LANGUAGE COURSE

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

Discrete Mathematical Structures (2:2:0:0) 3
(Effective from the academic year 2025-26)

Course Code	**BCS405A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0:0	SEE Marks	50
Total Number of Contact Hours	50	Exam Hours	3

Course Objectives:
This course will enable students to:

- Understand an intense foundational introduction to fundamental concepts in discrete mathematics.
- Interpret and solve the language associated with logical reasoning, relations, and functions.

Preamble: Discrete Mathematics course introduces students to the mathematics of discrete structures which build the mathematical foundation of Information Technology. Discrete mathematics has wide variety of application in problem analysis, decision making and provides adequate basics for the IT students who will be taking advanced courses like Security, Machine Learning and the Theory of Computing. The concepts of counting, mathematical induction, functions, relations, and graph theory provides an applied introduction to model mathematical concepts to the real word applications.

Module – 1

Fundamentals of Logic: Basic connectives and Truth tables, Tautologies, Logical Equivalence: The laws of logic, Logical implications, Rules of inference.
Applications: Quantifiers and proofs of Theorems.

(08 Hours)

Module – 2

Relations: Properties of relations, Equivalence relations, Partitions, Partial orders and Extremal elements in posets.
Applications: Hassediagrams

(8 Hours)

Module – 3

Functions: Types of function, Properties of functions, Compositionof functions, Inverse functions and Invertible Functions
Applications: The pigeonhole principle

(08 Hours)

Module – 4

Mathematical Induction, Recursive Definitions and Recurrence Relations:
Method of mathematical induction, Recursive definition, First order linear recurrence relation-Formulation problems and examples. Second order linear homogeneous recurrence relations with constant coefficients.
Applications: Statement problems on recurrence relations (applicable to real life)

(08 Hours)

Module – 5

Fundamental Principles of Counting: Overview, The rule of sum and product, Permutations, Combinations and Combinations with repetition.

Applications: **The Principles of Inclusion and Exclusion:** Generalization of the principle, Derangements- Nothing is in its right place.

(08 Hours)

Course Outcomes:

The students will be able to:

- **CO1:** Apply mathematical logic in the analysis of logical statements and simplification of switching circuits.
- **CO2:** Use properties of relations and functions in theoretical algorithms.
- **CO3:** Apply mathematical induction to analyzes recursive and non-recursive concepts.
- **CO4:** Apply the ideas of Permutations and Combinations, principle of inclusion and exclusion in different fields of computer science.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

Text Books:

1. Ralph P. Grimaldi and B V Ramana, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, Asia, Fifth edition – 2007. ISBN 978-81-7758- 424-0

2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata – McGraw Hill, 35TH reprint 2008. ISBN 13:978-0-07-463113-3.

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata – McGraw Hill, Sixth Edition, Sixth reprint 2008. ISBN-(13):978-0-07-064824-1.

2. C. L. Liu and D P Mohapatra, Elementary Discrete Mathematics, Tata- McGraw Hill, Sixth Edition, ISBN: 10:0-07-066913-9.

Alternate Assessment Tools (AATs) suggested:

- Quizzes
- Model Presentation
- Group Discussions

Web links / e – resources:

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.
- http://www.themathpage.com/
- http://www.abstractmath.org/ http://www.ocw.mit.edu/courses/mathematics/

B.E in COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

Graph Theory (2:2:0:0) 3
(Effective from the academic year 2025-26)

Course Code	**BCS405B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0:0	SEE Marks	50
Total Number of Contact Hours	40 hours	Exam Hours	3

Course Objectives:
This course will enable students to:

- To understand discrete and continuous mathematical structures.
- To impart basics of relations and functions.
- To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.
- To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.

Preamble: This course had its beginning in recreational math problems but it has grown into a significant area of mathematical research. It enables to learn the basic elementary concepts and resulting graphs about open problems. It helps learners to learn proof, techniques and algorithms to improve proof writing skills. It plays an important role in solving technology driven and research oriented problems.

Module – 1

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

(08 hours)

Module – 2

Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions.
Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition.

(08 hours)

Module – 3

Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.
Properties of Relations: Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.

(08 hours)

Module – 4

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.
Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. **(08 Hours)**

Module – 5

Introduction to Groups Theory: Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo n, Multiplicative group of Integers modulo-p and permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem.

(08 Hours)

Course Outcomes:

At the end of the course the student will be able to:

CO1: Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements.

CO2: Demonstrate the application of discrete structures in different fields of computer science.

CO3: Apply the basic concepts of relations, functions and partially ordered sets for computer representations.

CO4: Solve problems involving recurrence relations and generating functions.

CO5: Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

4. The question paper will have ten questions. Each question is set for 20 marks.
5. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

Textbooks

1. Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied Introduction", 5 th Edition, Pearson Education
2. Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education.

Reference Books

1. Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics – A Conceptbased approach", Universities Press, 2016
2. Kenneth H. Rosen: "Discrete Mathematics and its Applications", 6th Edition, McGraw Hill, 2007.
3. Jayant Ganguly: "A Treatise on Discrete Mathematical Structures", SanguinePearson, 2010.
4. D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications, Latest Edition, Thomson, 2004.
5. Thomas Koshy: "Discrete Mathematics with Applications", Elsevier, 2005, Reprint 2008.

Alternate Assessment Tools (AATs) suggested:

- MOOC/Certification Courses(Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.
- http://www.themathpage.com/
- http://www.abstractmath.org/
- http://www.ocw.mit.edu/courses/mathematics/

B.E in COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

OPTIMIZATION TECHNIQUE (2:2:0:0) 3
(Effective from the academic year 2025-26)

Course Code	**BCS405C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0:0	SEE Marks	50
Total Number of Contact Hours	40 hours	Exam Hours	3

Course Objectives:
This course will enable students to:

- To understand the methodology of OR problem solving and formulate linear programming problem.
- To develop formulation skills in transportation models and assignment problems hence find solutions.
- To understand the basics in the field of game theory.

Preamble: Optimization Technique is a discipline to aid decision making and improving efficiency of the system by applying advanced analytical methods. Today, it has become a professional discipline that deals with the application of scientific methods for decision-making, and especially to the allocation of scare resources. This course offers a unique blend of traditional coursework, practical skills, and real world problem solving experience designed to position students for success in today's competitive world.

Module – 1

Introduction to LPP and Solution to LPP: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).

(08 hours)

Module – 2

Simplex method and Big-M method: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method, Degeneracy in LPP.

(08 hours)

Module – 3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Unbalanced T.P, Finding optimal solution by MODI method, Maximization T.P. Degeneracy in transportation problems.

(08 hours)

Module – 4

Assignment Problem: Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems. Travelling Salesman Problem (TSP).

(08 Hours)

Module – 5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn and mX2 games by graphical method. Formulation of games.

(08 Hours)

Course Outcomes:

At the end of the course the student will be able to:

CO1: Formulate, Solve and Optimize linear programming problems using appropriate techniques theoretically as well as graphically and interpret the results obtained.

CO2: Interpret the transportation models' solutions and infer solutions to the real-world problems.

CO3: Interpret the assignment models' solutions and infer solutions to the real-world problems.

CO4: Model competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

Textbooks

1. Operations Research - S.D.Sharma, Kedarnath Ramnath & Co, 2020.
2. Operations Research - Theory and Applications, J.K Sharma,5th edition, Macmillan Publications India Ltd, 2013.
3. Kanti swaroop, P.K.Guptha and Man Mohan: Operation Research. Sultan Chand

Reference Books

1. Operations Research - H.A.Taha, Pearson, 7th Edition, June 2002.
2. Introduction to Operations Research - Hiller and Liberman, MGH, 7th Edition, 2002.
3. S.K Sinha: Reliability and life testing. Wiley Eastern.

Alternate Assessment Tools (AATs) suggested:

- **MOOC/Certification Courses(Infosys Springboard,Geek for Geeks,IBM,Hacker earth,Math works)**
- **Model presentation**
- **Video**

Web links / e – resources:

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.html

B.E in COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

LINEAR ALGEBRA (2:2:0:0) 3
(Effective from the academic year 2025-26)

Course Code	**BCS405D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0:0	SEE Marks	50
Total Number of Contact Hours	40 hours	Exam Hours	3

Course Objectives:
This course will enable students to:

- To equip the students with standard concepts and tools in Linear algebra which will find them useful in their disciplines.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Preamble: This course introduces the concept of a vector space which is a unifying abstract frame work for studying linear operations involving diverse mathematical objects such as ntuples, polynomials, matrices and functions. Students learn to operate within a vector and between vector spaces using the concepts of basis and linear transformations. The concept of inner product enables them to do approximations and orthogonal projects and with them solve various mathematical problems more efficiently.

Module – 1

VECTOR SPACES: Introduction, Vector spaces, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Coordinates.

(08 hours)

Module – 2

LINEAR TRANSFORMATIONS: Introduction, Linear Mappings, Geometric linear transformation of i2, Kernel and Image of a linear transformations, Rank-Nullity Theorem (No proof), Matrix representation of linear transformations, Singular and Non-singular linear transformations, Invertible linear transformations

(08 hours)

Module – 3

EIGENVALUES AND EIGENVECTORS: Introduction, Polynomials of Matrices, Applications of Cayley-Hamilton Theorem, Eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.

(08 hours)

Module – 4

INNER PRODUCT SPACES: Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error.

(08 Hours)

Module – 5

OPTIMIZATION TECHNIQUES IN LINEAR ALGEBRA: Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction – Principal component analysis.

(08 Hours)

Course Outcomes:

At the end of the course the student will be able to:

CO1: Explain the concepts of vector spaces, subspaces, bases, dimension and their properties.

CO2: Use matrices and linear transformations to solve the given problem.

CO3: Compute Eigenvalues and Eigenvectors for the linear transformations

CO4: Determine orthogonality of inner product spaces.

CO5: Apply the optimization techniques to solve the problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

3. The question paper will have ten questions. Each question is set for 20 marks.
4. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

Textbooks

1. David C. Lay, Steven R. Lay, Judi J Mc. Donald: "Linear Algebra and its applications", Pearson Education, 6th Edition, 2021
2. Gilbert Strang: "Linear Algebra and its applications", Brooks Cole, 4th edition, 2005.

Reference Books

1. Richard Bronson & Gabriel B. Costa: "Linear Algebra: An Introduction", 2nd edition. Academic Press, 2014.
2. Seymour Lipschutz, Marc Lipso: "Theory and problems of linear algebra", Schaum's outline series - 6th edition, 2017, McGraw-Hill Education.
3. Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong: "Mathematics for Machine learning", Cambridge University Press, 2020.

Alternate Assessment Tools (AATs) suggested:

- MOOC/Certification Courses(Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

- https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
- https://www.math.ucdavis.edu/~linear/linear.pdf
- https://www.coursera.org/learn/linear-algebra-machine-learning
- https://nptel.ac.in/syllabus/111106051/
- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

Ability Enhancement Course/ Skill Enhancement Course

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

Green IT and Sustainability (1:0:0) 1
COMMON TO ALL INFORMATION TECHNOLOGY BRANCHES (CSE/ISE/AIML)
(Effective from the academic year 2025-26)

Course Code	**BCS456A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	16	Exam Hours	3

Course Objectives:

This course will enable students to:

- Understand challenges for Green ICT and the environmental impact
- Learn different aspects of ICT metrics and Sustainable Cloud Computing.
- Explore effects of software design on sustainability.

Preamble: In this Course the students learn how Green IT strives to optimize resource efficiency, minimize energy consumption, and mitigate electronic waste while maintaining or improving overall operational performance.

Module – 1

Green ICT -History, Agenda, and Challenges Ahead: Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead. (**3 Hours)**

Module – 2

Emerging Technologies and Their Environmental Impact: Introduction, Number of Connected Devices , Increased , Functionality, Increased Number of Separate Functions , Increased Demand for Speed and Reliability , Obsolescence—The Problem of Backward Compatibility, The Other Side of the Balance Sheet, Video conference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Intelligent Energy Metering , Building Management Systems, Saving IT.
(**3 Hours)**

Module – 3

Measurements and Sustainability: Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures.
(**3 Hours)**

Module – 4

Sustainable Cloud Computing: Introduction, Challenges in the Use of Cloud Computing As Green Technology, Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated With Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing, Reflections on Sustainable Cloud Computing Applications.
(**3 Hours)**

Module – 5

Sustainable Software Design: Overview and Scope, Evaluating Sustainability Effects , Sustainability and the Product Life Cycle , Direct Effects: Sustainability During Use, Runtime Energy Consumption Basics , Analyzing the Energy Consumption of an Application , Energy Consumption Reduction Using Physical Properties of Semiconductors, Optimizing the Energy Consumption of an Application: Compiler Techniques, Optimizing the Energy Consumption of an Application: Runtime Approaches. **(2 Hours)**

Course outcomes

At the end of the course the student will be able to:

CO1: Classify the challenges for Green ICT
CO2: Relate the environmental impact due to emerging technologies
CO3: Demonstrate different aspects of ICT metrics
CO4: Compare the various parameters related to Sustainable Cloud Computing
CO5: Interpret the effects of software design on the sustainability.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

Textbooks

1. Green Information Technology – A Sustainable Approach, Mohammad Dastbaz Colin Pattinson, Babak Akhgar, Elsevier, 2015 Inc.
2. San Murugesan; G. R. Gangadharan, Harnessing Green IT: Principles and Practices, Wiley-IEEE Press

Alternate Assessment Tools (AATs) suggested:

- Group Discussion of Case studies
- Model Making

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=kvn_-mJ2tSo
- https://www.youtube.com/watch?v=kxngsYn5N3Y
- https://www.youtube.com/watch?v=EgdFi3sCgzU
- https://www.brightest.io/sustainability-measurement
- https://www.youtube.com/watch?v=S2m49Op25Zw

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

MongoDB (0:0:2) 1
(Effective from the academic year 2025-26)

Course Code	**BAI456B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	14	Exam Hours	1

Course Objectives:

This course will enable students to:

- Understand basic MongoDB functions, operators and types of operations in MongoDB.
- Demonstrate the use of Indexing, Advanced Indexing in MongoDB.
- Apply the aggregation and Map Reduction in MongoDB.
- Demonstrate text searching on collections in MongoDB.

Sl.NO	Experiments
1	a. Illustration of Where Clause, AND,OR operations in MongoDB. b. Execute the Commands of MongoDB and operations in MongoDB : Insert, Query, Update, Delete and Projection. (Note: use any collection) **[Refer: Book 1 chapter 4].**
2	a. Develop a MongoDB query to select certain fields and ignore some fields of the documents from any collection. b. Develop a MongoDB query to display the first 5 documents from the results obtained in a. [use of limit and find] **[Refer: Book1 Chapter 4, book 2: chapter 5]**
3	a. Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection b. Execute query selectors (Geospatial selectors, Bitwise selectors) and list out the results on any collection **[Refer: Book 3 Chapter 13]**
4	Create and demonstrate how projection operators ($, $elematch and $slice) would be used in the MondoDB. **[Refer: Book 3 Chapter 14]**
5	Execute Aggregation operations ($avg, $min,$max, $push, $addToSet etc.). students encourage to execute several queries to demonstrate various aggregation operators) **[Refer: Book 3 Chapter 15]**
6	Execute Aggregation Pipeline and its operations (pipeline must contain $match, $group, $sort, $project,$skip etc. students encourage to execute several queries to demonstrate various aggregation operators) **[Refer book 2: chapter 6]**
7	a. Find all listings with listing_url, name, address, host_picture_url in the listings And Reviews collection that have a host with a picture url Using E-commerce collection write a query to display reviews summary. **[refer Book2: chapter 6]**
8	a. Demonstrate creation of different types of indexes on collection (unique, sparse, compound and multikey indexes)

	b. Demonstrate optimization of queries using indexes. **[Refer: Book 2: Chapter 8 and Book 3: Chapter 12]**
9	a. Develop a query to demonstrate Text search using catalog data collection for a given word Develop queries to illustrate excluding documents with certain words and phrases **[Refer: Book 2: Chapter 9]**
10	Develop an aggregation pipeline to illustrate Text search on Catalog data collection. **[Refer: Book 2 :Chapter 9]**

Course outcomes:

At the end of the course the student will be able to:

CO1: Make use of MangoDB commands and queries.

CO2: Illustrate the role of aggregate pipelines to extract data.

CO3 Demonstrate optimization of queries by creating indexes.

CO4: Develop aggregate pipelines for text search in collections.

Suggested Learning Resources:

- **BOOK 1: "**MongoDB: The Definitive Guide", Kristina chodorow, 2nd ed O'REILLY, 2013.
- **BOOK 2: "***MongoDB in Action*" by KYLE BANKER et. al. 2nd ed, Manning publication, 2016
- **BOOK 3:** "MongoDB Complete Guide" by Manu Sharma 1st ed, bpb publication, 2023.
- **instaIlation of MongoDB Video:** https://www.youtube.com/watch?v=dEm2AS5amyA
- **video on Aggregation:** https://www.youtube.com/watch?v=vx1C8EyTa7Y
- **MongoDB in action book Code downIoad URL: h**ttps://www.manning.com/downloads/529
- **MongoDB Exercise UR**

Assessment Details (both CIE and SEE)

Lab Evaluation Scheme

1. Ten marks for every experiment (10 X 10 = 100 marks), round it off to ***30 marks***.
2. Ten marks for every experiment will be evaluated for write-up, program execution, the procedure followed while execution and viva voce after each exercise.
3. Internal practical test for 100 marks to be given and the marks scored will be scaled down to ***20 marks***.
4. A Minimum of ***20 mark*** is to be scored in CIE.
5. SEE examination for the Lab is to be conducted for 100 marks and reduced to ***50 marks***.
6. A Minimum of ***18 marks*** is to be scored in SEE.

Note: Open Ended experiment will be done by the students in the Lab session. A total mark of 40 is to be scored by the student from both CIE and SEE together out of 100.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for

100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 03 hours

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
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SEMESTER – IV

UI/UX Laboratory (0:0:2) 1
(Effective from the academic year 2025-26)

Course Code	**BCS456C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	28	Exam Hours	2

Course Objectives:

This course will enable students to:

- Understand the importance of the User Interface Design process.
- To make the learners familiar with the importance of requirement, user analysis and different
- levels of design for a particular project and the techniques to be used.
- To introduce them to Figma tool- a tool for prototyping

Preamble: This Course introduces various topics such as research, prototyping, Wireframing, user testing where UX focuses on creating a seamless and meaningful user experience by understanding user needs, conducting research, and designing intuitive interfaces, while UI design focuses on the visual, interactive elements of a product to create aesthetically pleasing interfaces.

Sl. No.	Experiments
1.	Design a Logo for an E-Commerce app
2.	Design an email that showcases a promotional offer of the e-commerce app.
3.	3 Design brochure that showcases different features of the e-commerce app
4.	Create sketches and low-fidelity wire frames and experiment the user testing
5.	Create High-Fidelity Mockups & Prototypes from the wireframes.
6.	Figma basics: Creating basic responsive elements like buttons, input elements, etc. to understand frames, groups, layout, constraints, texts, vector, color palette,etc.
7.	Basic Clickable Prototyping using figma
8.	Create a Design System for an e-commerce app using Grid and Spacing, Typography, Color System, and UI elements like icons, images, buttons, Inputs, Cards, Search Bar, Lists, etc.
9.	Reusing the above Design System, compose the Home page, Product Page, and Checkout Page of the e-commerce app
	Open ended Experiment
1.	Create a generic prototype of any application both in Web vs. App
2.	Test your sitemap using Treejack

Course outcomes

At the end of the course the student will be able to:

CO1: Experiment with various visual design aspects.
CO2: Theme the visual look and feel of the user experiences using figma
CO3: Create effective and compelling screen-based experiences.

Assessment Details (both CIE and SEE)

Lab Evaluation Scheme

1. Ten marks for every experiment (10 X 10 = 100 marks), round it off to ***30 marks***.
2. Ten marks for every experiment will be evaluated for write-up, program execution, the procedure followed while execution and viva voce after each exercise.
3. Internal practical test for 100 marks to be given and the marks scored will be scaled down to ***20 marks***.
4. A Minimum of ***20 mark*** is to be scored in CIE.
5. SEE examination for the Lab is to be conducted for 100 marks and reduced to ***50 marks***.
6. A Minimum of ***18 marks*** is to be scored in SEE.

Note: Open Ended experiment will be done by the students in the Lab session. A total mark of

40 is to be scored by the student from both CIE and SEE together out of 100.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 03 hours

Alternate Assessment Tools (AATs) suggested:

- Designing of user interface
- Building a Prototype

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=JGLfyTDgfDc
- **https://nptel.ac.in/courses/124107008**
- **https://www.classcentral.com/course/swayam-user-interface-design-12889**

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

BUSINESS COMMUNICATION (1:0:0) 1
(Effective from the academic year 2025-26)

Course Code	**BCB456D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	16	Exam Hours	1

Course Objectives:

This course will enable students to: (List as per the requirement of your course)

1. Enhance proficiency and competencies in verbal and non- verbal communication skills with a holistic long-term perspective
2. Develop technical communication skills
3. Guide the participants to manage cross cultural communication
4. Address contemporary skills, issues and concepts

Preamble: This course introduces the fundamental principles of business communication and provides the opportunity to distinguish between business communication and personal/social communication. The course is designed to impart a basic understanding of written business communication, including letters, reports, presentations and email and valuable insights into listening and non -verbal communication. Every skill gained from this course will aid the learners in developing complete confidence to communicate professionally with different audiences

Module – 1

Aspects of technical communication, forms, importance, skills, linguistic ability, style in technical communication. **(8 Hours)**

Module – 2

Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. **(8 Hours)**

Module – 3

Introduction to Corporate Communication in Brand Promotion, Financial Communication, Crises Communication. **(8 Hours)**

Module – 4

Project proposals, collection of data, tables constitution, charts, writing the report, documenting the sources, proof reading. **(8 Hours)**

Module – 5

Career planning, preparing Resume, job applications, preparation for a job interview, employment interviews, follow-up.. **(8 Hours)**

Course outcomes

At the end of the course the student will be able to:

CO1: Communicate with more clarity that would facilitate the organizational work process.
CO2: Break the barriers and help in the process of earning greater commitment among stakeholders to goal achievement.
CO3: Handle all sorts of organizational communications, within and beyond.
CO4: Demonstrate cross - cultural skills in a trans-national business environment

Assessment Details (both CIE and SEE)

Lab Evaluation Scheme

1. Ten marks for every experiment (10 X 10 = 100 marks), round it off to ***30 marks***.
2. Ten marks for every experiment will be evaluated for write-up, program execution, the procedure followed while execution and viva voce after each exercise.
3. Internal practical test for 100 marks to be given and the marks scored will be scaled down to ***20 marks***.
4. A Minimum of ***20 mark*** is to be scored in CIE.
5. SEE examination for the Lab is to be conducted for 100 marks and reduced to ***50 marks***.
6. A Minimum of ***18 marks*** is to be scored in SEE.

Note: Open Ended experiment will be done by the students in the Lab session. A total mark of 40 is to be scored by the student from both CIE and SEE together out of 100.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 03 hours

Textbooks

1. Scot Ober, Contemporary business communication, Biztantra, 2014, ISBN-10: 9780198061847

Reference Books:

1. Lesiler &Flat lay, Basic Business communication, Tata Mc Graw Hill, 2010, ISBN-10: 9780072537536

Alternate Assessment Tools (AATs) suggested:

- Corporate Email Writing
- Group Discussion
- Report Writing

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=kvn_-mJ2tSo
- https://www.youtube.com/watch?v=kxngsYn5N3Y
- https://www.youtube.com/watch?v=EgdFi3sCgzU
- https://www.brightest.io/sustainability-measurement
- https://www.youtube.com/watch?v=S2m49Op25Zw

B.E COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

BIOLOGY FOR INFORMATION TECHNOLOGY (2:0:0) 2
COMMON TO ALL INFORMATION TECHNOLOGY BRANCHES (CSE/ISE/AIML)
(Effective from the academic year 2025-26)

Course Code	**BBOC407**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	3

Course Objectives:

This course will enable students to:

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of bio-design principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

Preamble: Exploring "Biology for Engineers" isn't just a scientific pursuit; it's a strategic investment in nation-building and economic growth. By bridging biology with engineering, we unlock pathways to sustainable development, innovative industries, and improved healthcare solutions. This interdisciplinary approach not only enriches our understanding of living systems but also propels us towards a future where technological advancements drive societal progress and economic prosperity. Let's harness the power of biology to engineer a brighter tomorrow for our nation and the world.

Module – 1

CELL BASIC UNIT OF LIFE

Introduction. Structure and functions of a cell. Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins and hormones.

05 Hours

Module – 2

APPLICATION OF BIOMOLECULES

Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, lipids in biodiesel and detergents production, Enzymes in biosensors fabrication, food processing, detergent formulation and textile processing.

05 Hours

Module – 3

ADAPTATION OF ANATOMICAL PRINCIPLES FOR BIOENGINEERING DESIGN

Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system.

Kidney as a filtration system.

05 Hours

Module – 4

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS:

Echolocation, Photosynthesis. Bird flying, Lotus leaf effect, Plant burrs, Shark skin, Kingfisher beak. Human Blood substitutes - haemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).

05 Hours

Module – 5

Backtracking: General method, solution using back tracking to N-Queens problem, Sum of subsets problem, Graph **TRENDS IN BIOENGINEERING:**
Muscular and Skeletal Systems as scaffolds, scaffolds and tissue engineering, Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete. Bioremediation. Biomining.
05 Hours

Course outcomes

At the end of the course the student will be able to:

CO1: Elucidate the basic biological concepts via relevant industrial applications and case studies.

CO2: Evaluate the principles of design and development, for exploring novel bioengineering projects.

Textbooks

1. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022.
3. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.

Activity Based Learning

- Group Discussion of Case studies
- Model Making and seminar/poster presentations
- Design of novel device/equipment like Cellulose-based water filters, Filtration system

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-designspring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring 2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

B.E in COMPUTER SCIENCE AND BUSINESS SYSTEM
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SEMESTER – IV

Universal Human Values (UHV) (1:0:0) 1
(Effective from the academic year 2025-26)

Course Code	**BUHK408**	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15-hour	Exam Hours	3

Course Objectives:

This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Preamble: Given the increasing conflict and violence in the world today, much of which is attributable to religious and ethnic divisions, the Course recognizes the paramount importance of fostering understanding and harmonious coexistence among different peoples. It expresses a determination to address the root causes of violence and conflict, and points out the need to address the spiritual aspect of human existence in order to achieve the purposes for which the United Nations was formed, including universal human rights as set out in the Universal Declaration of Human Rights as well as the objectives of the Millennium Declaration.

Module – 1

Introduction to Value Education:

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

03 Hours

Module – 2

Harmony in the Human Being:

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health**.** **03 Hours**

Module – 3

Harmony in the Family and Society:

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

03 Hours

Module – 4

Harmony in the Nature/Existence:

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

03 Hours

Module – 5

Implications of the Holistic Understanding – a Look at Professional Ethics:

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

03 Hours

Course outcomes

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature):

1. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability.
2. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
3. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

- Ethical human conduct
- Socially responsible behaviour
- Holistic vision of life
- Environmentally responsible work
- Having Competence and Capabilities for Maintaining Health and Hygiene
- Appreciation and aspiration for excellence (merit) and gratitude for all

Textbooks

1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 97893-87034- 47-1.
2. The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G.

References

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3. The Story of Stuff (Book).
4. SThe Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa.
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

- Value Education websites
- https://www.uhv.org.in/uhv-ii
- http://uhv.ac.in
- http://www.uptu.ac.in
- Story of Stuff
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)
SEMESTER – IV

English Communications Skill II
(Common to all Branches, for Lateral Entry Diploma students)
(Effective from the academic year 2025-2026)

Course Code	BENGDIP2	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2-NCMC	SEE Marks	-
Total Number of Lecture Hours	26	Total marks	100

Course objectives:

This course will enable students to

1. Identify the Common Errors in Writing and Speaking of English.
2. Achieve better technical writing and Presentation skills for employment.
3. Acquire Employment and Workplace communication skills.
4. Enhance their conversation and public speaking skills.

Module – 1: Advanced Vocabulary

Introduction, learning through speeches, Descriptions, Word formation, Synonyms, Antonyms, learning words through situations, Homonyms and Homophones, Words often confused, One word substitution, Phrasal verbs, Idiomatic expressions, Developing technical vocabulary, Eponyms, Jumbled sentences: Introduction, Steps to approach jumbled sentences, Unscrambling a paragraph **4 Hours**

Module – 2: Technical Reports and Proposals

Reports and Proposals: Introduction, Definition, Salient Features, Significance, Types, Use of Graphic Aids/Illustrations, Preparation and Planning, Data Collection, Analyzing and Organizing the Data, Writing and Revising, Preparing an Outline, Structure of Formal Reports, Styles of Reports, Preparing a Checklist, Sample Reports, Technical Proposals - Purpose, Importance, Types and Structure. **4 Hours**

Module – 3: Technical Writing Skills

Email and Other Writings: Introduction, Email Writing- Reasons for Popularity, Some Common Pitfalls, Guiding Principles for Composition, Maintaining Common Etiquette.

Itinerary Writing, Inter-office Memorandum (Memos), Circulars, Notice, Agenda, and Minutes, Writing Instructions, Advertising.

Blogs and Reviews: Introduction, Movie Review, Book Review, Blog Writing **6 Hours**

Module – 4: Professional Speaking Practices

Conversations, Dialogues and Debates: Introduction, Purpose of General Conversations, Features of a Good Conversation, Tips for Improving Conversations, Short Conversations, Telephonic Skills, Debate, Situational Dialogues and Role Plays.

The Art of Negotiation: Introduction, Definition, Different Types of Negotiation Styles, Tips for Win-Win Negotiation. **6 Hours**

Module – 5: Communication in Workplace.

Public Speaking: Introduction, choosing an appropriate pattern, selecting an appropriate method, Art of Persuasion, making speeches interesting, Delivering different types of speeches.

Group Discussion: Introduction, Definition, Difference between GD and debate, Number and duration, Personality traits to be evaluated, Dynamics of Group Behaviors/Group Etiquette and mannerisms, Type, opening of a GD, summarizing a discussion, Some tips for GD

Job Interviews: Introduction, Definition, Process, Stages of Interview, Types, Desirable Qualities, Preparation, Using Proper Verbal and Non-verbal Clues, Exhibiting Confidence, Tips for Success.

6 Hours

Course Outcomes: The students will be able to:

1. Understand and identify the Common Errors in Writing and Speaking.
2. Enhance Technical Writing and Presentation skills.
3. Exhibit Employment and Workplace communication skills.
4. Analyze and apply various Techniques of Information Transfer through presentation in different levels

Textbooks

1. "Professional Writing Skills in English" published by Fillip Learning – Education (ILS), Bangalore – 2022.
2. "Functional English" (As per AICTE 2018 Model Curriculum) (ISBN-978-93-5350-047-4) Cengage learning India Pvt Limited [Latest Edition 2019]

References

1. Gajendra Singh Chauhan, Technical Communication, Cengage Learning India Pvt Limited, Latest Revised Edition, 2019
2. N.P. Sudharshana and C. Savitha, English for Engineers, Cambridge University Press ,2018. Meenakshi Raman and Sangeetha Sharma, Technical Communication – Principles and Practice, Oxford University Press, Third Edition 2017.

B.E in COMPUTER SCIENCE AND BUSINESS SYSTEM
Choice Based Credit System (CBCS) applicable for 2022 Scheme
SEMESTER – IV

NSS
(Common to all branches)
(Effective from the academic year 2025-2026)

Course Code	**BNSK359/459/559/659**	CIE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

Course Objectives: National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Preamble: The National Service Scheme (NSS) is a government-sponsored program in India that aims to develop students' personalities and character through voluntary community service. The NSS's motto is "NOT ME, BUT YOU", which reflects the need for selfless service and consideration for others.

Module – 1

Introduction to NSS

History and growth of NSS, Philosophy of NSS, Objectives of NSS, Meaning of NSS Logo, NSS Programs and activities, administrative structure of NSS, Planning of programs / activities, implementation of NSS programs / activities, National & State Awards for NSS College / Program Officer / Volunteers.

04 Hours

Module – 2

Overview of NSS Programs

Objectives, special camping Environment enrichment and conservation, Health, Family, Welfare and Nutrition program. Awareness for improvement of the status of women, Social Service program, production-oriented programs, Relief & Rehabilitation work during natural calamities, education and recreations, Selection of the problem to be addressed.

04 Hours

Module – 3

NSS Activities - Group Contributions to Society / community (Activity based Learning)

Organic Farming, Indian agriculture (Past, Present, Future) Connectivity for marketing, Waste management role of different stakeholders implementation, preparing an actionable business proposal for enhancing the village income and approach for implementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

06 Hours

Module – 4

National Level Activities for Society / Community at large (Activity based Learning)

Developing Sustainable Water management system for rural areas and implementation approaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.

06 Hours

Module – 5

Individual Activities for Local Voice (Activity based learning)

Govt. school Rejuvenation and helping them to achieve good infrastructure, Plantation and adoption of plants. Know your plants. Spreading public awareness under rural outreach programs, National integration and social harmony events.

06 Hours

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Alternate Assessment Tools suggested:

Weightage	CIE 100%
Presentation -1 Selection of topic, PHASE-1	20 Marks
Commencement of activity and its progress PHASE 2	20 Marks
Case Study based Assessment Individual performance	20 Marks
Sector wise study and its consolidation	20 Marks
Video based seminar for 10 minutes by each student at the end of the course with Report	20 Marks

Text Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

Department of Humanities and Social Sciences

B.E. Computer Science and Business Systems

Choice Based Credit System (CBCS)

SEMESTER III to VI

Sports

(Common to all branches)

(Effective from the academic year 2025-2026)

Course Code	**BPEK359/459/559/659**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	--
Total Number of Contact Hours	26	Exam Hours	--

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

Course Objectives: The course will enable students to

1. Develop a healthy life style.
2. Acquire Knowledge about various stages of sports and games.
3. Focus on modern technology in sports.

Module 1

Introduction of the game: Aim of sports and games, Brief history of the game, Nature of the game, Terminology & Modern trends of the game, Fitness & Skill tests along with Game Performance.

(06 Hours)

Module 2

Offensive and Defensive Techno Tactical Abilities: Fitness, Fundamentals & Techniques of the game with the implementation of Biomechanics, Tactics- Drills for the Techno Tactical abilities, Individual and Group, Miner games- to implement the Techniques, Tactics and Motor abilities.

(05 Hours)

Module 3

Team tactics and Rules of the Game: Rules and Regulations of the Game: Game rules as well as sequence of officiating, Team tactics: Offensive and Defensive team strategies and scrimmages, Practice Matches: among the group, Analysis of Techno Tactical abilities: Correction and implementation of skills and Sports Injuries and rehabilitation: First aid, PRICE treatment,

(05 Hours)

Module 4

Sports Training: Introduction of Sports Training, Principles of Sports performance, how to increase and sustain the sports performance, Training Load & Recovery- How to increase the training load (volume/Intensity) and means and methods for Recovery, Periodization: Shorts, Medium and Long term.

Physiological changes: Changes in Lung capacity, heart beats etc…

(05 Hours)

Module 5

Organization of Sports Event: Tournament system, Planning and preparation for the competition, Ground

preparation and Equipment's, Organizing an event among the group

(05 Hours)

The above 5 modules are common to all the sports events / games, we are offering the following games: **1. Baseball, 2. Kabaddi, 3. Table Tennis, and 4. Volleyball.**

Course outcomes:

The students will be able to:

1. Understand the importance of sports and games, inculcate healthy habits of daily exercise & fitness, Self-hygiene, good food habits, Create awareness of Self-assessment of fitness.
2. Develops individual and group techno tactical abilities of the game.
3. Increases the team combination and plan the strategies to play against opponents.
4. Outline the concept of sports training and how to adopt technology to attain high level performance.
5. Summarize the basic principles of organising sports events and concept of technology implemented to organise competitions in an unbiased manner.

Teaching Practice:

Classroom teaching (Chalk and Talk)
ICT Power Point Presentation and video analysing.
Practical classes in outdoor and indoor as per requirement.

CIE: 100 Marks

- CIE 1 for 40 marks A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks A practical test conducted at the end of the semester in which the student has to give fitness and skill tests and his performance in game will be assessed.

Textbooks

1. Barbara Bushman, "ACSM's complete guide to Fitness & Health", 2011, Human Kinetics USA
2. Pankaj Vinayak Pathak, Sports and Games - Rules and Regulation, 2019, Khel Sahitya Kendra.
3. Hardayal Singh, "Sports Training, General Theory & Methods", 1984 "Netaji Subhas, National Institute of Sports".
4. Keith A. Brown, "International Handbook of Physical Education and Sports Science", 2018, (5 Volumes) Hardcover.

References

1. Tudor O Bompa, " Periodization Training for Sports", 1999, Human Kinetics, USA.
2. Michael Boyle, New Functional Training for Sports 2016, Human Kinetics USA.
3. Michael Kjaer, Michael Rogsgaard, peter Magnusson, Lars Engebretsen & 3 more, "Textbook of Sports Medicine: Basic Science and Clinical Aspects of Sports Injury and Physical Activity",2002, Wiley Blackwell.
4. Scott L. Delp and Thomas K. Uchida, ics of Movement: The Science of Sports, Robotics, and Rehabilitation", 2021, The MIT Press.
5. MCARDLE W.D. "Exercise Physiology Nutrition Energy And Human Performance" 2015, LWW IE (50).

Department of Humanities and Social Sciences

B.E. Computer Science and Business Systems

Choice Based Credit System (CBCS)

SEMESTER III to VI

Yoga

(Common to all branches)

(Effective from the academic year 2025-2026)

Course Code	**BYOK359/459/559/659**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Course Objectives:

This course will enable students to:

1. Understand the importance of practicing yoga in day-to-day life.
2. Be aware of therapeutic and preventive value of Yoga.
3. Have a focussed, joyful and peaceful life.
4. Maintain physical, mental and spiritual fitness.
5. Develop self-confidence to take up initiatives in their lives.

Module – 1

Introduction to Yoga: Introduction to Yoga: Introduction, classical and scientific aspects of yoga, Importance, Types, Healthy Lifestyle, Food Habits, Brief Rules, Sithalikarana Practical classes.

04 Hours

Module – 2

Physical Health: Introduction, Pre-requisites, Asana-Standing, Sitting, Supine and Prone, Practical classes. **06 Hours**

Module – 3

Psychological Health: Introduction Thought Forms, Kriya (Kapalabhati), Preparation to Meditation, Practical classes. **06 Hours**

Module – 4

Therapeutic Yoga: Mudra Forms, Acupressure therapy, Relaxation techniques Practical classes

06 Hours

Module – 5

Spirituality & Universal Mantra: Introduction, Being Human, Universal Mantra, Universal LOVE, Benefits of practice of Spirituality in day-to-day life, practical classes. **04 Hours**

Course Outcomes:

Students will be able to:

CO1: Understand the requirement of practicing yoga in their day-to-day life.

CO2: Apply the yogic postures in therapy of psychosomatic diseases

CO3: Train themselves to have a focussed, joyful and peaceful life.

CO4: Demonstrate the fitness of Physical, Mental and Spiritual practices.

CO5: Develops self-confidence to take up initiatives in their lives.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT Power Point Presentation
- Audio & Video Visualization Tools

CIE: 100 Marks

- CIE 1 for 40 marks A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks A practical test conducted at the end of the semester in which the student have to perform asanas.

Textbooks

1. George Feuerstein: The yoga Tradition (Its history, literature, philosophy and practice.)
2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind. (Orient paper Backs: vision Books Pvt.Ltd., 1982.
3. B.K.S Iyenkar: Light on the Yoga sutras of patanjali (Haper Collins Publications India Pvt.,Ltd., New Delhi.)
4. Science of Divinity and Realization of Self Vethathiri Publication, (6-11) WCSC, Erode

References

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited, ISBN: 9781909141209, 9781909141209
2. Basavaraddi I V: Yoga in School Health, MDNIY New Delhi, 2009
3. Dr. HR. Nagendra: Yoga Research and applications (Vivekanda Kendra Yoga Prakashana Bangalore)
4. Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga Prakashana Bangalore)

Web resources

Web links and Video Lectures (e-Resources): Refer links

1. https://youtu.be/KB-TYlgd1wE
2. https://youtu.be/aa-TG0Wg1Ls

Department of Humanities and Social Sciences

B.E. Computer Science and Business Systems

Choice Based Credit System (CBCS)

SEMESTER III to VI

Music

(Common to all branches)

(Effective from the academic year 2025-2026)

Course Code	**BMUK359/459/559/659**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of the Degree)

Course Objectives:

The course will enable the students to:

1. Identify the major traditions of Indian music, both through notations and aurally.
2. Analyze the compositions with respect to musical and lyrical content.
3. Demonstrate an ability to use music technology appropriately in a variety ofsettings.

Module 1

Preamble: Contents of the curriculum intend to promote music as a language to develop an analytical, creative, and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition.

Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada Swara, Laya, Raga, Tala, Mela. **(03 Hours)**

Module 2

Compositions: Introduction to the types of compositions in Carnatic Music - Geethe, JathiSwara, Swarajathi, Varna, Krithi, and Thillana, Notation system. **(03 Hours)**

Module 3

Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysore Vasudevacharya. **(03 Hours)**

Module 4

Music Instruments: Classification and construction of string instruments, wind instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments **(03 Hours)**

Module 5

Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Notation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethein Malahari, and one Jathi Swara, One Nottu Swara OR One krithi in a Mela raga, a patriotic song. **(14 Hours)**

Course Outcomes (COs):

The students will be able to:

CO1: Discuss the Indian system of music and relate it to other genres (Cognitive Domain)

CO2: Experience the emotions of the composer and develop empathy (AffectiveDomain)

CO3: Respond to queries on various patterns in a composition (Psycho-Motor Domain)

Teaching Practice:

- Classroom teaching
- ICT - PowerPoint Presentation Audio & Video
- Visualization Tools

CIE: 100 Marks

- **CIE 1** for 40 marks - A theory paper which is MCQ / Descriptive conducted during the semester
- **CIE 2** for 60 marks - A practical test conducted at the end of the semester in which the student has to recite one Sarale Varase mentioned by the examiner in three speeds. Sing / Play the Geethe in Malahari. Singing / Playing Jathi Swara / Krithi.

Textbooks

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana - Vol. 1 (English), Shreenivaasa Prakaashana, 2018.

References

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: APractical Guide", Tranquebar 2018.
2. R. Rangaramanuja Ayyangar,"History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "TheStory of Indian Music and Its Instruments: A Study of the Present and a Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, National Institute of Open Schooling, 2019.

Department of Humanities and Social Sciences

B.E. Computer Science and Business Systems

Choice Based Credit System (CBCS)

SEMESTER III to VI

NCC

(Common to all branches)

(Effective from the academic year 2025-2026)

Course Code	**BNCK359/459/559/659**	CIE Marks	100
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

Course Objectives:

This course will enable students to:

- Understand the vision of NCC and its functioning.
- Understand the security set up and management of Border/Coastal areas.
- Acquire knowledge about the Armed forces and general awareness.

Module 1

Introduction to National Cadet Corp: What is NCC, who can join NCC, benefits, Establishment, history, 3 wings, motto, core values, Aims, flag, song, pledge, cardinals, Organization, Director General NCC, Directorates, Uniform and Cadet ranks, Camps, Certificate exams, Basic aspects of drill.
National Integration: Importance of national integration, Factors affecting national integration, Unity in diversity, Role of NCC in nation building.
Disaster Management: What is a Disaster, Natural and Man-made disasters, Earthquake, Floods.

(04 Hours)

Module 2

Indian Army: Introduction to Indian Army, Command and control, Fighting & supporting arms, Rank structure, Major Regiments of the Army, Major Wars and Battles, Entry to the Indian Army, Renowned leaders and Gallantry Awardees.

(02 Hours)

Module 3

Indian Air Force: Introduction to Indian Air Force, Command and control, Rank structure, Major Aircrafts, Entry to the Indian Air Force, Renowned leaders.

Indian Navy: Introduction to Indian Navy, Command and control, Rank structure, Major Ships and Submarines, Entry to the Indian Navy, Renowned leaders. **(02 Hours)**

Module 4

Health and Hygiene: First Aid Protocols - CPR, Understanding Types of Bandages, Fire Fighting

Field & Battle Crafts: Field Signals using hands, Judging distance -Types of Judging Distance, Section formations-types of Section Formation **(10 Hours)**

Module 5

Drill Practicals: Savdhan, Vishram, Salute, Turning, Marching**.** **(08 Hours)**

Course outcomes:

The students will be able to:

CO1: Develop qualities like character, comradeship, discipline, leadership, secular outlook, spirit of adventure, ethics and ideals of selfless service.

CO2: Get motivated and trained to exhibit leadership qualities in all walks of life and be always available for the service of the nation.
CO3: Familiarize on the issues related to social & community development and disaster management and equip themselves to provide solutions.
CO4: Get an insight of the defense forces and further motivate them to join the defense forces.

Teaching Practice:

- Blackboard/Multimedia Assisted Teaching.
- Class Room Discussions, Brainstorming Sessions, Debates.
- Activity: Organizing/Participation in Social Service Programs.
- On Ground: Drill training.

CIE: 100 Marks

- CIE 1 for 40 marks - A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks- A practical test conducted at the end of the semester.

Textbooks:

1. NCC Cadets Handbook Common Directorate General of NCC, New Delhi.
2. NCC Cadets Handbook Special(A), Directorate General of NCC, New Delhi.

References:

- Chandra B. Khanduri, "Field Marshal KM Cariappa: a biographical sketch", Dev Publications, 2000.
- Gautam Sharma, "Valour and Sacrifice: Famous Regiments of the Indian Army", Publishers, 1990.