# CURRICULUM AND DETAILED SYLLABI

**FOR**

**B.TECH DEGREE (Computer Science and Business Systems) PROGRAMME**

**FOR THE STUDENTS ADMITTED FROM THE**

**ACADEMIC YEAR 2020 – 2021 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**

(A Government Aided ISO 9001-2008 Certified

Autonomous Institution affiliated to Anna University)

MADURAI – 625 015, TAMILNADU

Phone: 0452 – 2482240, 41

Fax: 0452 2483427

Web: www.tce.edu

Passed in Board of Studies Meeting on 06.07.2020

Approved in 60th Academic Council Meeting on 25.07.2020

## Department of Computer Science and Engineering

### Vision

Excellence in Computer Science and Engineering education and research.

### Mission

1. Strive for academic excellence in Computer Science and Engineering through a creative teaching learning process.
2. Transform students into technically competent, socially responsible and ethical Computer Science professionals.
3. Create Centres of Excellence in leading areas of Computer Science and Engineering.
4. Incubate, apply and spread innovative ideas by collaborating with relevant industries and R&D labs through focused research groups.
5. Attain these through continuous team work by a group of committed faculty, transforming the Computer Science and Engineering department as a leader in imparting Computer Science and Engineering education and research.

### Programme Educational Objectives for B.Tech Computer Science and Business Systems (CSBS)

PEO1 - Graduates will be able to establish themselves in various technical/managerial roles by solving real world problems using core topics in Computer Science with equal appreciation to IT Management

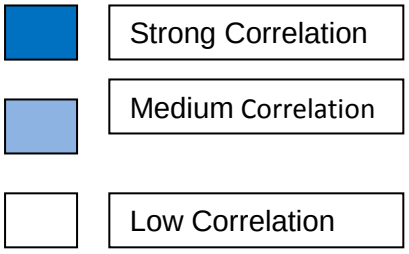
PEO2 - Graduates will be able to develop professional skills that equip them for employment and for higher education in contemporary areas in Computer Science and Business systems

PEO3 - Graduates will be able to demonstrate their innovative abilities by adapting to a rapidly changing environment applying their knowledge in technology abstraction and common business principles

PEO4 - Graduates will be able to declare themselves as productive citizens with high ethical and professional standards making sound engineering and managerial decisions

## PEO Vs Mission mapping

| Mission/PEO | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |




## Program Outcomes (POs) for B.Tech (CSBS) Programme

PO1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Graduate Attributes**

1. Engineering knowledge
2. Problem analysis
3. Design & Development of solutions
4. Investigation of Complex Problem
5. Modern tool usage
6. Engineer and society
7. Environment& sustainability
8. Ethics
9. Individual & team work
10. Communication
11. Project management & finance
12. Life-long learning

## PO Vs PEO mapping

| PEO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |

## PO Vs Graduate Attributes

| PO\GA | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |

## Program Specific Outcomes (PSOs) for B.Tech (CSBS) Programme

**PSO1**: **Cognitive Outcome**

Ability to solve contemporary problems in Computer Science by applying management principles including Machine Learning, Cloud Computing, Internet of Things and Business Analytics

**PSO2**: **Skill Outcome**

Ability to apply technical and business skills learnt through professional society events, certification programs, projects and/or lab exercise to provide sustainable solutions to Computer science and business systems related to society and environment

**PSO3**: **Attitudinal and Behavioral Outcome**

Ability to practice as an ethical software engineer/researcher in the evolving discipline of Computer Science and Business systems by employing management skills learnt through internships and collaborative projects with industry

## Thiagarajar College of Engineering, Madurai - 625015

### Credit Distribution for B.Tech (Computer Science and Business Systems) Programme – 2020 – 2021 Batch

| S.No | Category of Courses | Credits |
|---|---|---|
| **A** | **Foundation Courses** | |
| | Humanities and Social Sciences (HSS) | 11 |
| | Basic Sciences (BS) | 21 |
| | Engineering Sciences (ES) | 22 |
| **B** | **Professional Core Courses** | **55** |
| **C** | **Elective Courses** | **30** |
| | Program Specific Electives | |
| | Program Specific Electives for Expanded Scope | |
| | General Elective | **3** |
| | Foundation Elective | **3** |
| **D** | **Project work, Seminar, Internship** in Industry or at Higher Learning Institutions | **15** |
| **E** | Mandatory Courses – Environment Science, Induction Programme, Indian Constitution, Essence of Indian Tradition knowledge, Consumer Affairs (as per UGC guidelines) | |
| | **Total Credits** | **160** |
| | **Minimum credits to be earned for the award of the Degree** | **160** |

**Thiagarajar College of Engineering, Madurai-625015**
**Department of Computer science and Engineering**
**Scheduling of Courses – for B.Tech (Computer Science and Business Systems) Programme - join in the year 2020 – 2021**

| Semester | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mandatory Audit Course | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | 20CB110 Discrete Mathematics (4) | 20CB120 Introductory Topics in Statistics, Probability and Calculus (3) | 20CB130 Fundamentals of Computer Science (3) | 20CB140 Principles of Electrical Engineering (2) | 20CB150 Business Communication & Value Science - I (2) | 20CB160 Fundamentals of Physics (3) | 20CB170 Fundamentals of Computer Science Lab (2) | 20CB180 Principles of Electrical Engineering Lab (1) | | | Induction Program | 20 |
| II | 20CB210 Linear Algebra (4) | 20CB220 Statistical Methods (4) | 20CB230 Data Structures and Algorithms (4) | 20CB240 Principles of Electronics (2) | 20CB250 Fundamentals of Economics (2) | 20CB260 Business Communication & Value Science - II (2) | 20CB270 Data Structures and Algorithms Lab (2) | 20CB280 Principles of Electronics Lab (1) | 18ES290 Lateral Thinking (1) | | 18CHAA0 Environmental Sciences | 22 |
| III | 20CB310 Computer Organization and Architecture (3) | 20CB320 Object Oriented Programming (2) | 20CB330 Computational Statistics (3) | 20CB340 Software Engineering (3) | 20CB350 Formal Language and Automata Theory (3) | 20CB360 Computer Organization and Architecture Lab (2) | 20CB370 Object Oriented Programming Lab (2) | 20CB380 Computational Statistics Lab (1) | 20CB390 Software Engineering Lab (1) | | 18CHAB0 Constitution of India | 20 |
| IV | 20CB410 Operating Systems (3) | 20CB420 Database Management Systems (3) | 20CB430 Introduction to Innovation, IP Management & Entrepreneurship (3) | 20CB440 Marketing Research & Marketing Management (2) | 20YYFX0 *Foundation Elective (3)* | 20CB460 Software Design with UML (3) | 20CB470 Design Thinking (3) | 20CB480 Operating Systems Lab (1) | 20CB490 Database Management Systems Lab (1) | | Essence of Indian Traditional Knowledge | 22 |
| V | 20CB510 Design and Analysis of Algorithms (3) | 20CB520 Compiler Design (3) | 20CB530 Fundamentals of Management (2) | 20CB540 Business Strategy (2) | 20CB550 Business Communication & Value Science - III (2) | *20YYGX0 General Elective (3)* | *20CBPX0 Program Elective (4)* | 20CB570 Design and Analysis of Algorithms Lab (2) | 20CB580 Compiler Design Lab (1) | 20CB590 Mini Project (1) | | 23 |
| VI | 20B610 Computer Networks (3) | 20CB620 Information Security (3) | 20CB630 Artificial Intelligence (3) | 20CB640 Financial & Cost Accounting (2) | 20CB650 Business Communication & Value Science - IV (2) | *20CBPX0 Program Elective (3)* | *20CBPX0 Program Elective (4)* | 20CB660 Computer Networks Lab (2) | 20CB670 Information Security Lab (1) | 20CB680 Artificial Intelligence Lab (1) | | 24 |
| VII | 20CB710 Financial Management (2) | 20CB720 Human Resource Management (2) | 20CB730 IT Workshop Skylab / Matlab *(3)* | 20CB740 Services Science & Service Operational Management (3) | 20CB750 IT project Management (4) | 20CB760 Usability Design of Software Applications (3) | *20CBPX0 Program Elective (3)* | *20CBPX0 Program Elective (3)* | | | | 23 |
| VIII | 20CB810 Project Evaluation I (6) | | | | | | | | | | | 6 |
| | | | | | | | | | | | TOTAL | 160 |

BS | HSS | ES | Core | PE | Open Electives | Project | Audit Courses

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**THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI- 625 015**
(A Govt. Aided, ISO 9001:2008 certified Autonomous Institution affiliated to Anna University)

**B.Tech (Computer Science and Business Systems) Programme**

## Categorization of Courses

### List of Humanities and Social Science Courses (11)

20CB250 - Fundamentals of Economics (2)
20CB430 - Introduction to Innovation, IP management and Entrepreneurship (3)
20CB530 - Fundamentals of Management (2)
20CB540 - Business Strategy (2)
20CB640 - Financial & Cost Accounting (2)

### List of Basic Science Courses (21)

20CB110 **-** Discrete Mathematics (4)
20CB120 - Introductory Topics in Statistics, Probability and Calculus (3)
20CB160 - Fundamentals of Physics (3)
20CB210 - Linear Algebra (4)
20CB220 - Statistical Methods (4)
20CB740 - Services Science & Service Operational Management (3)

### List of Engineering Science Courses (22)

20CB130 - Fundamentals of Computer Science (3)
20CB140 - Principles of Electrical Engineering (2)
20CB170 - Fundamentals of Computer Science Lab (2)
20CB180 - Principles of Electrical Engineering Lab (1)
20CB240 - Principles of Electronics (2)
20CB280 - Principles of Electronics Lab (1)
18ES290 - Lateral Thinking (1)
20CB330 - Computational Statistics (3)
20CB380 - Computational Statistics Lab (1)
20CB470 - Design Thinking (3)
20CB730 - IT Workshop Skylab/Matlab (3)

### List of Professional Core Courses (55)

20CB230 - Data Structures and Algorithms (4)
20CB270 - Data Structures and Algorithms Lab (2)
20CB310 - Computer Organization and Architecture (3)
20CB320 - Object Oriented Programming (2)
20CB340 - Software Engineering (3)
20CB350 - Formal Language & Automata Theory (3)
20CB360 - Computer Organization and Architecture Lab (2)
20CB370 - Object Oriented Programming Lab (2)
20CB390 - Software Engineering Lab (1)
20CB410 - Operating Systems (3)
20CB420 - Database Management Systems (3)
20CB460 - Software Design with UML(3)
20CB480 - Operating Systems Lab (1)
20CB490 - Database Management Systems Lab(1)
20CB510 - Design and Analysis of Algorithms (3)
20CB520 - Compiler Design (3)

20CB570 - Design and Analysis of Algorithms Lab (2)
20CB580 - Compiler Design Lab (1)
20CB610 - Computer Networks (3)
20CB620 - Information Security (3)
20CB630 - Artificial Intelligence (3)
20CB660 - Computer Networks Lab (2)
20CB670 - Information Security Lab (1)
20CB680 - Artificial Intelligence Lab (1)

**Programme Electives: (30)**
20CB440 - Marketing Research & Marketing Management (2)
20CB710 - Financial Management (2)
20CB720 - Human Resource Management (2)
20CB750 - IT Project Management (4)
20CB760 - Usability Design of Software Applications (3)
Elective II (4)
Elective III (3)
Elective IV (4)
Elective V (3)
Elective VI (3)

**General Elective(Elective I) : (3)**
Conversational systems / Cloud, Microservices & application / Machine Learning

**Foundation Elective: (3)**
Operations Research (3)

**Project (15)**
20CB590 - Mini Project (1)
20CB810 - Project Evaluation I (6)
20CB150 - Business Communication & Value Science – I (2)
20CB260 - Business Communication & Value Science –II (2)
20CB550 - Business Communication & Value Science – III (2)
20CB650 - Business Communication & Value Science –IV (2)

# CURRICULUM AND DETAILED SYLLABI

# FOR

# B.Tech DEGREE (Computer Science and Business Systems) PROGRAMME

## FIRST SEMESTER

## FOR THE STUDENTS ADMITTED FROM THE

## ACADEMIC YEAR 2020 - 2021 ONWARDS

**THIAGARAJAR COLLEGE OF ENGINEERING**

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**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**
**B.Tech (Computer Science and Business systems) Programme**
**COURSES OF STUDY**
(For the candidates admitted from 2020 - 21 onwards)

**FIRST SEMESTER**

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | No.of Hours / Week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| **THEORY COURSES** | | | | | | | |
| 1 | 20CB110 | Discrete Mathematics | BS | 3 | 1 | 0 | 4 |
| 2 | 20CB120 | Introductory Topics in Statistics, Probability and Calculus | BS | 3 | 0 | 0 | 3 |
| 3 | 20CB130 | Fundamentals of Computer Science | ES | 3 | 0 | 0 | 3 |
| 4 | 20CB140 | Principles of Electrical Engineering | ES | 2 | 0 | 0 | 2 |
| 5 | 20CB150 | Business Communication & Value Science - I | Project | 2 | 0 | 0 | 2 |
| **THEORY CUM PRACTICAL COURSES** | | | | | | | |
| 6 | 20CB160 | Fundamentals of Physics | BS | 2 | 0 | 2 | 3 |
| **PRACTICAL COURSES** | | | | | | | |
| 7 | 20CB170 | Fundamentals of Computer Science Lab | ES | 0 | 0 | 4 | 2 |
| 8 | 20CB180 | Principles of Electrical Engineering Lab | ES | 0 | 0 | 2 | 1 |
| Induction Program (Non Credit) | | | | | | | |
| **TOTAL** | | | | **15** | **1** | **8** | **20** |

BS : Basic Science
HSS : Humanities and Social Science
ES : Engineering Science
PC : Program Core
PE : Program Elective
OE : Open Elective

L : Lecture
T : Tutorial
P : Practical

**Note**:

1 Hour Lecture is equivalent to 1 credit
1 Hour Tutorial is equivalent to 1 credit
2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**
**B.Tech (Computer Science and Business systems) Programme**

**SCHEME OF EXAMINATIONS**
(For the candidates admitted from 2020 - 21 onwards)

**FIRST SEMESTER**

| S.No. | Course Code | Name of the Course | Duration of Terminal Exam. in Hrs. | Marks | | | Minimum Marks for Pass | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment | Terminal Exam * | Max. Marks | Terminal Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 20CB110 | Discrete Mathematics | 3 | 50 | 50 | 100 | 25 | 50 |
| 2 | 20CB120 | Introductory Topics in Statistics, Probability and Calculus | 3 | 50 | 50 | 100 | 25 | 50 |
| 3 | 20CB130 | Fundamentals of Computer Science | 3 | 50 | 50 | 100 | 25 | 50 |
| 4 | 20CB140 | Principles of Electrical Engineering | 3 | 50 | 50 | 100 | 25 | 50 |
| 5 | 20CB150 | Business Communication & Value Science - I | - | 100 | - | 100 | - | 50 |
| **THEORY CUM PRACTICAL** | | | | | | | | |
| 6 | 20CB160 | Fundamentals of Physics | 3 | 50 | 50 | 100 | 25 | 50 |
| **PRACTICAL** | | | | | | | | |
| 7 | 20CB170 | Fundamentals of Computer Science Lab | 3 | 50 | 50 | 100 | 25 | 50 |
| 8 | 20CB180 | Principles of Electrical Engineering Lab | 3 | 50 | 50 | 100 | 25 | 50 |

* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

| 20CB110 | DISCRETE MATHEMATICS | CATEGORY | L | T | P | CREDIT |
|---|---|---|---|---|---|---|
| | | BS | 3 | 1 | 0 | 4 |

## Preamble

Discrete Mathematics is the branch of mathematics that provides mathematical framework on discrete objects. Computer Science and Engineering rely mainly on the working principle of discrete objects. This course introduces four modules **Boolean Algebra** which provides techniques for the minimization of digital circuits, **Abstract Algebra** which takes vital role in application part of computer science such as cryptography, coding theory etc and also introduces **Counting principles** such as basic counting, pigeonhole principle & **Generating functions**, **Recurrence relations** which are used to determine the complexity of algorithms and to solve counting problems. Combinatorial arguments are made a little easier by the use of pictures of the graphs. The concept of Graph Theory has wide range of applications in Networks, computer architecture, compiling techniques, model checking, artificial intelligence, software engineering, expert systems, software/hardware correctness problem, DBMS, designing concepts, storage methods etc.

## Prerequisite

Higher Secondary Level Mathematics

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Demonstrate the given Boolean expression by means of truth table, logic gates and also simplify it into minimum number of literals | 15 |
| CO2 | Simplify the given Boolean expression/function using Karnaugh maps | 10 |
| CO3 | Verify the given set with the operations for relations, groups, rings and fields using elementary properties if necessary | 15 |
| CO4 | Use the principle of basic counting and Pigeonhole on problems related to counting | 10 |
| CO5 | Solve recurrence relations using generating functions | 10 |
| CO6 | Illustrate the types of graphs, digraphs and its properties | 20 |
| CO7 | Obtain PCNF and PDNF of given logical expression | 10 |
| CO8 | Rephrase real world statements as logical propositions and demonstrate whether the proposition is satisfiable, tautology or a contradiction. | 10 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |
| CO2 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |
| CO3 | TPS3 | Apply | Value | - | 1.1.1 , 1.2.7, 2.1.1 |
| CO4 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |
| CO5 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |
| CO6 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |
| CO7 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |
| CO8 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | M | M | M | | | | | | | | | M | | |
| CO 2 | S | S | S | S | | | | | | | | | S | | |
| CO 3 | S | S | S | S | | | | | | | | | S | | |
| CO 4 | S | S | S | S | | | | | | | | | S | | |
| CO 5 | S | S | S | S | | | | | | | | | S | | |
| CO 6 | S | S | S | S | | | | | | | | | S | | |
| CO 7 | S | S | S | S | | | | | | | | | S | | |
| CO 8 | S | S | S | S | | | | | | | | | S | | |

S- Strong; M-Medium; L-Low

## Assessment Pattern: Cognitive Domain

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | 1 | 2 | 3 | |
| Remember | 10 | 10 | 10 | - | - | - | - |
| Understand | 30 | 30 | 30 | - | - | - | 30 |
| Apply | 60 | 60 | 60 | 100 | 100 | 100 | 70 |
| Analyze | | | | | | | |
| Evaluate | | | | | | | |
| Create | | | | | | | |

## Sample Questions for Course Outcome Assessment

**Course Outcome 1(CO1)**

1. Demonstrate by means of truth tables the validity of the following identities.
   i) De Morgan's law for 3 variables: $(xyz)' = x' + y' + z'$
   ii) Second distributive law: $(x + yz) = (x + y)(x + z)$
2. Simplify the following Boolean expression to a minimum number of literals.
   $x'y' + xy + x'y$
3. Given the following Boolean function $F = xy'z + x'y'z + w'xy + wxy$
   i) Obtain the truth table of the function
   ii) Draw the logic diagram using the original Boolean expression
   iii) Simplify the function to minimum number of literals
   iv) Obtain the truth table of the function from the simplified expression and show that it is the same as the one in subdivision i).

**Course Outcome 2(CO2)**

1. Simplify the following Boolean functions using three variable maps $F(x, y, z) = \sum(1, 2, 3, 6, 7)$
2. Simplify the following Boolean expression using 3-variable maps $xy + x'y'z' + x'yz'$

3. Simplify the following Boolean functions in product of sums $F(w,x,y,z)=\sum(0,2,5,6,7,8,10)$

**Course Outcome 3(CO3)**

1. Given A = {1,2,3,4} and R ={(1,2),(1,1),(1,3),(2,4)}, S={(1,4),(1,3),(2,3), (3, 1),(4,1)} are relations on A. Find $S\circ R, R\circ S, M_R, M_S, M_{(R\circ S)^{-1}}$ and graph of R & S.
2. Prove that the set of all real numbers of the form $a+b\sqrt{3}$ where $a \& b \in Q$ under usual addition and multiplication is a ring.
3. Verify whether $(Z,+,.)$ is a field or not under usual addition and multiplication.

**Course Outcome 4 (CO4)**

1. How many different license plates can be made if each plate contains a sequence of 3 upper case English letters followed by 3 digits?
2. How many students must be in a class to guarantee that at least 2 students receive the same score on the final exam, if the exam is graded on a scale from 0 to 100 points?
3. Let $a_1, a_2, ....a_n$ be positive real numbers. The arithmetic mean of these numbers is defined by $A=\frac{a_1+a_2+.....+a_n}{n}$ and the geometric mean of these numbers is defined by $G=(a_1a_2.....a_n)^{1/n}$. Use mathematical induction to prove that $A\geq G$

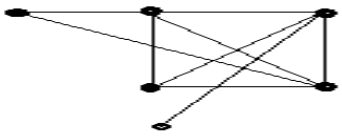
**Course Outcome 5(CO5)**

1. Find the generating functions of $(1+x)^{-n}$ & $(1-x)^{-n}$ where n is a positive integer.
2. Solve the recurrence relation $a_k=3a_{k-1}$ *for* $k=1,2,.....$and initial condition $a_0=2$
3. Determine the generating function of a numeric function $a_r$ , where

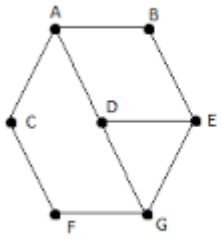
$$a_r=\begin{cases}2^r \ \ if\ r\ is\ even\\ -2^r\ if\ r\ is\ odd\end{cases}$$

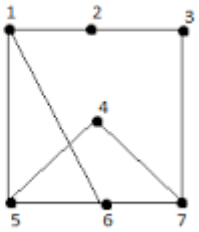
**Course Outcome 6(CO6)**

1. Verify whether the following graphs are Eulerian or Hamiltonian graphs



2. Determine whether the following graphs are isomorphic or not.




3. What is the procedure to find the chromatic polynomial for the given graph

**Course Outcome 7(CO7)**

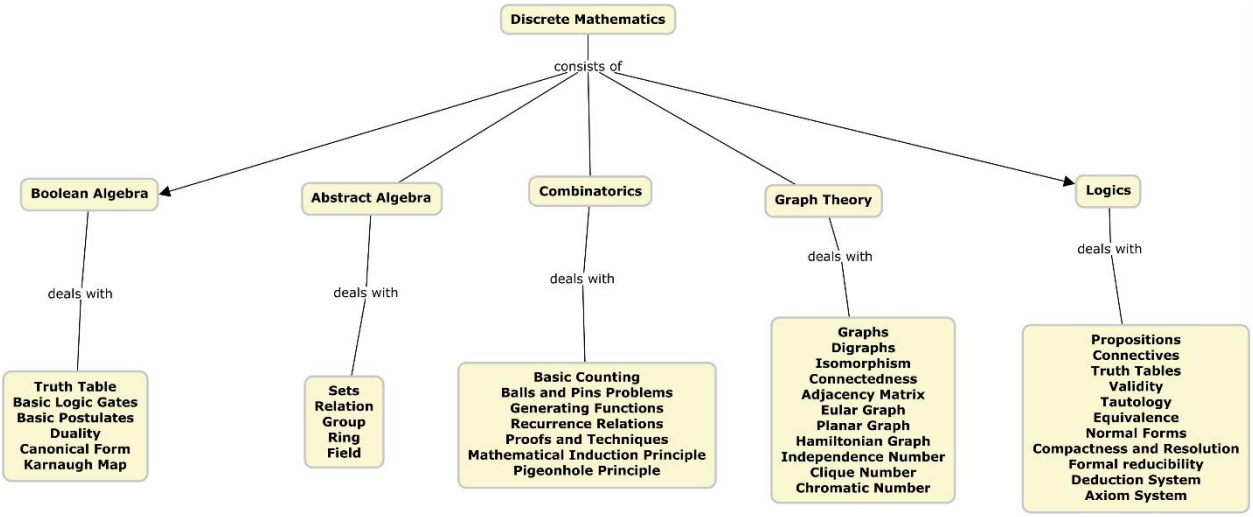
1. Estimate the PCNF and PDNF of the given formula

2. Construct the Truth table of the formula $(7P \vee Q) \wedge (7Q \vee P)$
3. Obtain principal disjunctive normal form of P $\rightarrow$ ((P $\rightarrow$Q) $\wedge$ 7(7Q $\vee$ 7P)) and hence obtain principal conjunctive normal form.

**Course Outcome 8(CO8)**

1. Prove p $\rightarrow$ (p $\vee$ q) is a Tautology.
2. Check if the following arguments is sound.
   a. All rabbits are mammals.
   b. Bugs Bunny is a rabbit.
   c. Therefore, Bugs Bunny is a mammal.
3. Show that the following set of premises is inconsistent**.**
   If the contract is valid, then john is liable for penalty. If john is liable for penalty, he will go bankrupt. If the bank will loan him money, he will not go bankrupt. As a matter of fact, the contract is valid and the bank will loan him money

## Concept Map




## Syllabus

**Boolean algebra**: Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

**Abstract algebra**: Set, relation, group, ring, field.

**Combinatorics**: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

**Graph Theory**: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

**Logic**: Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

## Learning Resources


1. Topics in Algebra, I. N. Herstein, John Wiley and Sons.
2. Digital Logic & Computer Design, M. Morris Mano, Pearson.
3. Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw Hill, New Delhi.
4. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
5. Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore.
6. Introduction to linear algebra. Gilbert Strang.
7. Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.
8. Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.
9. Introduction to Mathematical Logic, (Second Edition), E. Mendelsohn, Van-Nostrand, London.


## Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| **1.** | **BOOLEAN ALGEBRA** | | |
| 1.1 | Introduction | 1 | CO1 |
| 1.2 | Truth Table | 1 | CO1 |
| 1.3 | Basic Logic Gates | 1 | CO1 |
| | Tutorial | 1 | |
| 1.4 | Basic Postulates of Boolean Algebra | 1 | CO1 |
| 1.5 | Principle of Duality | 1 | CO1 |
| 1.6 | Canonical Forms | 1 | CO1 |
| | Tutorial | 1 | |
| 1.7 | Karnaugh Map | 2 | CO2 |
| **2.** | **ABSTRACT ALGEBRA** | | |
| 2.1 | Sets | 1 | CO3 |
| 2.2 | Relations | 1 | CO3 |
| 2.3 | Group | 1 | CO3 |
| | Tutorial | 1 | |
| 2.4 | Ring | 1 | CO3 |
| 2.5 | Field | 1 | CO3 |
| | Tutorial | 1 | |
| **3.** | **COMBINATORICS** | | |
| 3.1 | Mathematical Induction | 1 | CO4 |
| 3.2 | Balls and Bins Problem | 1 | CO4 |
| 3.3 | Pigeonhole Principle | 1 | CO4 |
| | Tutorial | 1 | |
| 3.4 | Generating Functions | 2 | CO5 |
| 3.5 | Recurrence Relations | 2 | CO5 |
| | Tutorial | 1 | |
| **4.** | **GRAPH THEORY** | | |
| 4.1 | Graphs and digraphs | 1 | CO6 |
| 4.2 | Complement, Isomorphism | 1 | CO6 |
| 4.3 | Connectedness and Reachability | 1 | CO6 |
| | Tutorial | 1 | |
| 4.4 | Adjacency matrix | 1 | CO6 |
| 4.5 | Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs | 1 | CO6 |

| | | | |
|---|---|---|---|
| 4.6 | Tournaments, Trees | 1 | CO6 |
| | Tutorial | 1 | |
| 4.7 | Planar graphs, Euler's formula, dual of a planer graph | 1 | CO6 |
| 4.8 | Independence number and clique number | 1 | CO6 |
| 4.9 | Chromatic number, statement of Four-color theorem. | 1 | CO6 |
| | Tutorial | 1 | |
| **5.** | **LOGIC** | | |
| 5.1 | Propositional calculus - propositions and connectives, syntax | 1 | CO7 |
| 5.2 | Semantics - truth assignments and truth tables, validity and satisfiability, tautology | 1 | CO8 |
| 5.3 | Adequate set of connectives | 1 | CO7 |
| | Tutorial | 1 | |
| 5.4 | Equivalence and normal forms | 2 | CO7 |
| 5.5 | Compactness and resolution | 1 | CO8 |
| | Tutorial | 1 | |
| 5.6 | Formal reducibility - natural deduction system and axiom system | 1 | CO8 |
| 5.7 | Soundness and completeness | 1 | CO8 |
| | Total | 48 | |

**Course Designers:**

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2. Dr. A.P. Pushpalatha appmat@tce.edu
3. Miss. H. Sri Vinodhini srivinodhini@tce.edu

| 20CB120 | INTRODUCTORY TOPICS IN STATISTICS, PROBABILITY AND CALCULUS |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| BS | 3 | 0 | 0 | 3 |

## Preamble

Statistics as a subject is a science of learning from data and provides tools for making decisions when conditions of uncertainty prevail. Statistical techniques are an important tool in these activities because they provide the engineer with both descriptive and analytical methods for dealing with the variability in observed data. The main objective of this course is to provide students with the foundations of statistical and probabilistic analysis mostly used in various applications in engineering and science. It introduces students to cognitive learning in statistics, calculus and develops skills on analyzing the different types of data.

## Prerequisite

- Higher secondary level -probability concepts

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Understand the types of data by graphical representation and Frequency curves, central tendency and dispersion, Scatter diagram | 15 |
| CO2 | Apply the concept of correlation analysis and least square method in fitting regression curves to engineering problems | 20 |
| CO3 | Apply Bayes theorem to invert conditional probabilities | 20 |
| CO4 | Determine mass and density functions for discrete and continuous distributions | 15 |
| CO5 | Identify expected values, moments and moment generating functions | 10 |
| CO6 | Find areas enclosed between two curves and volumes enclosed between surfaces using integrals of multivariable | 20 |

*** Weightage depends on Bloom's Level, number of contact hours,

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS2 | Understand | Respond | - | 1.1.1, 2.1.1 |
| CO2 | TPS3 | Apply | Value | - | 1.1.1,2.1.1.1, 2.1.4 |
| CO3 | TPS3 | Apply | Value | - | 1.1.1, 2.1.4 |
| CO4 | TPS3 | Apply | Value | - | 1.1.1, 2.1.4 |
| CO5 | TPS2 | Understand | Respond | - | 1.1.1, 2.1.4 |
| CO6 | TPS3 | Apply | Value | - | 1.1.1, 1.2.7, 2.1.1 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | S | M | M | | | | | | | | | S | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 2 | S | M | S | M | | | | | | | | | S | | |
| CO 3 | S | S | S | M | | | | | | | | | S | | |
| CO 4 | M | S | L | M | | | | | | | | | M | | |
| CO 5 | M | S | L | M | | | | | | | | | M | | |
| CO 6 | S | S | S | S | | | | | | | | | S | | |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| **Cognitive Levels** | **Continuous Assessment Tests** | | | **Assignment** | | | **Terminal Examination** |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | 1 | 2 | 3 | |
| Remember | 10 | 10 | 10 | - | - | - | - |
| Understand | 30 | 30 | 30 | - | - | - | 30 |
| Apply | 60 | 60 | 60 | 100 | 100 | 100 | 70 |
| Analyse | | | | | | | |
| Evaluate | | | | | | | |
| Create | | | | | | | |

**Assessment Pattern: Psychomotor**

| **Psychomotor Skill** | **Mini project /Assignment/Practical Component** |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

**Sample Questions for Course Outcome Assessment****

**Course Outcome 1(CO1):**

1. Define Statistics and state it's objective
2. The following are the number of transistors failing a quality check per hour during 72 observed hours of production:
   2 4 6 8 1 2 1 8 5 4 6 1
   0 1 8 2 3 4 1 2 5 1 1 8
   2 1 9 1 4 2 5 6 8 1 7 1
   4 9 1 8 2 4 1 1 8 5 5 3
   0 9 1 9 7 1 8 8 7 7 7 2
   7 1 2 7 3 5 8 8 5 9 9 0
   Group these data into a frequency distribution showing how often each of the values occurs and draw a bar chart.
3. Find the mean and the standard deviation of the following miles per gallon (mpg) obtained in 20 test runs performed on urban roads with an intermediate-size car:

19.7 21.5 22.5 22.2 22.6
21.9 20.5 19.3 19.9 21.7
22.8 23.2 21.4 20.8 19.4
22.0 23.0 21.1 20.9 21.3

**Course Outcome 2(CO2):**

1. Suppose we have a linear equation through the origin. Estimate the regression line passing through the origin for the following data. Suppose it is not known whether the true regression should pass through the origin. Estimate the regression line.

| x | 0.5 | 1.5 | 3.2 | 4.2 | 5.1 | 6.5 |
|---|---|---|---|---|---|---|
| y | 1.3 | 3.4 | 6.7 | 8.0 | 10.0 | 13.2 |

2. A study was done on a diesel-powered light-duty pickup truck to see if humidity, air temperature, and barometric pressure influence emission of nitrous oxide (in ppm). Emission measurements were taken at different times, with varying experimental conditions. The data are given in Table 12.2. The model is $yi = \beta 0 + \beta 1x1i + \beta 2x2i + \beta 3x3i + \_i, i = 1, 2, \ldots, 20$. Fit this multiple linear regression model to the given data and then estimate the amount of nitrous oxide emitted for the conditions where humidity is 50%, temperature is 76◦F, and barometric pressure is 29.30.

| Nitrous Oxide y | Humidity $x_1$ | Temp., $x_2$ | Pressure $x_3$ | Nitrous Oxide y | Humidity $x_1$ | Temp., $x_2$ | Pressure $x_3$ |
|---|---|---|---|---|---|---|---|
| 0.90 | 72.4 | 76.3 | 29.18 | 1.07 | 23.3 | 76.8 | 29.38 |
| 0.91 | 41.6 | 70.3 | 29.35 | 0.94 | 47.4 | 86.6 | 28.35 |
| 0.96 | 34.3 | 77.1 | 29.24 | 1.10 | 31.5 | 76.9 | 29.63 |
| 0.89 | 35.1 | 68.0 | 29.27 | 1.10 | 10.6 | 86.3 | 29.56 |
| 1.00 | 10.7 | 79.0 | 29.78 | 1.10 | 11.2 | 86.0 | 29.48 |
| 1.10 | 12.9 | 67.4 | 29.39 | 0.91 | 73.3 | 76.3 | 29.40 |
| 1.15 | 8.3 | 66.8 | 29.69 | 0.87 | 75.4 | 77.9 | 29.28 |
| 1.03 | 20.1 | 76.9 | 29.48 | 0.78 | 96.6 | 78.7 | 29.29 |
| 0.77 | 72.2 | 77.7 | 29.09 | 0.82 | 107.4 | 86.8 | 29.03 |
| 1.07 | 24.0 | 67.7 | 29.60 | 0.95 | 54.9 | 70.9 | 29.37 |

**Course Outcome 3(CO3):**

1. A system may become infected by some spyware through the internet or e-mail. Seventy percent of the time the spyware arrives via the internet, thirty percent of the time via email. If it enters via the internet, the system detects it immediately with probability 0.6. If via e-mail, it is detected with probability0.8. What percentage of times is this spyware detected?
2. One box contains six red balls and four green balls, and a second box contains seven red balls and three green balls. A ball is randomly chosen from the first box and placed in the second box. Then a ball is randomly selected from the second box and placed in the first box.
   a. What is the probability that a red ball is selected from the first box and a red ball is selected from the second box?

   b**.** At the conclusion of the selection process, what is the probability that the numbers of red and green balls in the first box are identical to the numbers at the beginning?

3. In a certain city, sports bikes are being targeted by thieves. Assume that the probability of a sports bike being stolen is 0.09 while the probability is only 0.5 for a regular bike. Taking, as an approximation for all bikes in that area, the nationwide proportion 0.19 of sports bikes, find (a) the probability that a bike will be stolen. (b) the probability that a stolen bike is a sports bike.

**Course Outcome 4 (CO4):**

1. If the probability is 0.05 that a certain wide-flange column will fail under a given axial load, what are the probabilities that among 16 such columns
   (a) at most two will fail;
   (b) at least four will fail?
2. The substrate concentration of influent to a reactor is normally distributed with $\mu$ =0.30 and $\sigma = 2.8$

   a. Identify the probability that the concentration exceeds 0.25?
   b. Identify the probability that the concentration is at most0 .10?
   c. Characterize the largest 5% of all concentration values?

3 . Let X denote the distance (m) that an animal moves from its birth site to the first territorial vacancy it encounters. Suppose that for banner-tailed kangaroo rats, X has an exponential distribution with parameter $\lambda = 0.01386$ (i).Compute the probability that the distance is between 100 and 200 m? (ii). Identify the probability that distance exceeds the mean distance by more than 2 standard deviations? (iii). Calculate the value of the median distance?

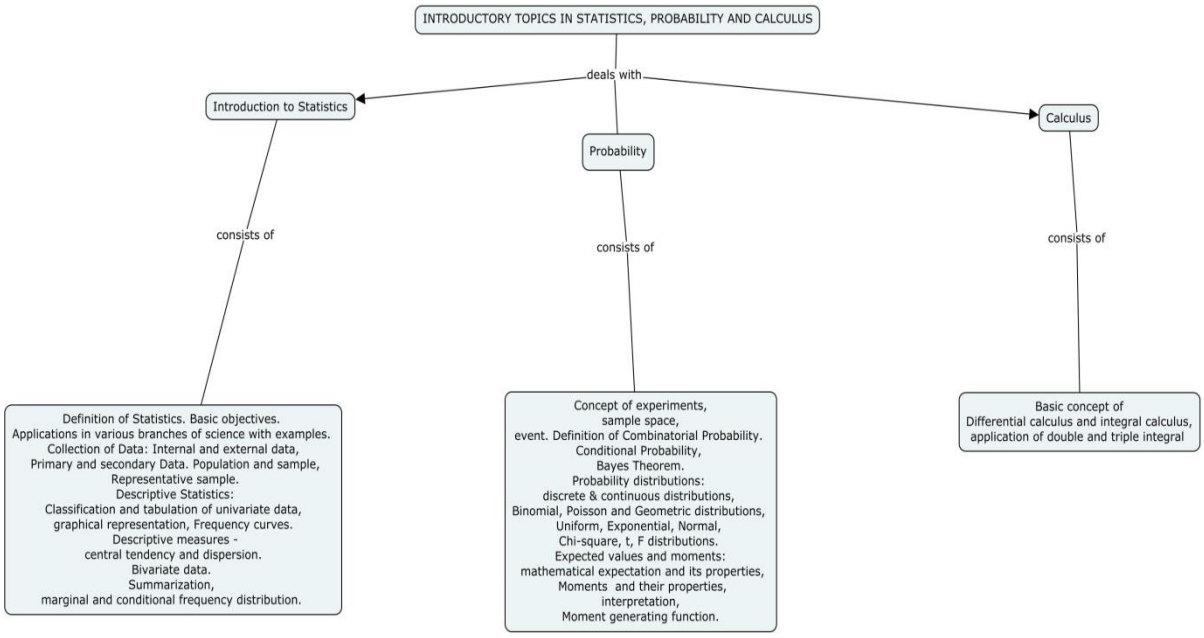
**Course Outcome 5 (CO5):**

1. If $X_1$ has mean 8 and variance 2 while $X_2$ has mean −12.5 and variance 2.25, and the two are independent, find
   (a) $E(X_1 - X_2)$;
   (b) $Var(X_1 - X_2)$.
2. Let $f(x) = 0.2$ for $x = 0, 1, 2, 3, 4$.
   (a) Find the moment generating function
   (b) Obtain $E(X)$ and $E(X^2)$ by differentiating the moment generating function.
3. Let $f(x) = 0.40\binom{4}{x}$ for x = 0, 1, 2, 3, 4
   (a) Find the moment generating function and hence obtain $E(X)$ and $E(X^2)$

**Course Outcome 6(CO6):**

1. Evaluate the integral $\int_0^1 \int_x^1 e^{\frac{x}{y}} dydx$ by reversing the order of integration
2. Estimate the area enclosed by the curves $y = x^2$ $x + y = 2$
3. Use triple integral to find the volume of the tetrahedron by the planes $x + 2y + z = 2$; $x = 2y$; $x = 0$ & $z = 0$.

## Concept Map




## Syllabus

**Introduction to Statistics**: Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample. Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution.

**Probability**: Concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem. Probability distributions: discrete & continuous distributions, Binomial, Poisson and Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions. Expected values and moments: mathematical expectation and its properties, Moments (including variance) and their properties, interpretation, Moment generating function.

**Calculus**: Basic concept of Differential calculus and integral calculus, application of double and triple integral.

## Learning Resources

1. Introduction of Probability Models, S. M. Ross, Academic Press, N.Y.
2. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.
4. A first course in Probability, S. M. Ross, Prentice Hall.
5. Probability and Statistics for Engineers, (Fourth Edition), I. R. Miller, J.E. Freund and R. Johnson, PHI.
6. Introduction to the Theory of Statistics, A. M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education.
7. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Learning.

8. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg, Pearson Education.
9. Applied Mathematics, Vol. I & II, P. N. Wartikar and J. N. Wartikar, Vidyarthi Prakashan.

**Course Contents and Lecture Schedule**

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1. | **Introduction to Statistics** | | |
| 1.1 | Definition of Statistics , its objectives and applications | 2 | CO1 |
| 1.2 | Collection of Data: Internal and external data, Primary and secondary Data | 2 | CO1 |
| 1.3 | Population and sample, Representative sample | 1 | CO1 |
| 1.4 | Classification and tabulation of univariate data, graphical representation, Frequency curves. | 2 | CO1 |
| 1.5 | central tendency and dispersion | 1 | CO1 |
| 1.6 | Summarization, marginal and conditional frequency distribution. Scatter diagram. | 2 | CO1 |
| 1.7 | Linear correlation, Rank correlation | 2 | CO2 |
| 1.8 | Linear regression- Least squares method | 2 | CO2 |
| | Case studies in correlation and data analysis – Assignment I | 1 | |
| 2. | **Probability** | | |
| 2.1 | Concept of experiments, sample space, event | 1 | CO3 |
| 2.2 | Combinatorial Probability and Conditional Probability | 1 | CO3 |
| 2.3 | Bayes Theorem | 2 | CO3 |
| 2.4 | Discrete distributions- Binomial, Poisson and Geometric | 2 | CO4 |
| 2.5 | Continuous Distributions- Uniform, Exponential, Normal | 2 | CO4 |
| 2.6 | Continuous Distributions - Chi-square, t, F | 2 | CO4 |
| 2.7 | Expected values, variance, covariance, moments, mathematical expectation and its properties | 2 | CO5 |
| 2.8 | Moment generating function | 1 | CO5 |
| | Case studies in Bayesian Application – Assignment II | 1 | |
| 3. | **Calculus** | | |
| 3.1 | Basic Concepts of Differential Calculus | 2 | CO6 |
| 3.2 | Integral Calculus | 1 | CO6 |
| 3.3 | Applications of Double Integral | 2 | CO6 |
| 3.4 | Applications of Triple Integral | 2 | CO6 |
| | Assignment III | | |
| | Total hours | 36 | |

**Course Designers:**

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| 20CB130 | FUNDAMENTALS OF COMPUTER SCIENCE |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| ES | 3 | 0 | 0 | 3 |

## Preamble

This course aims to provide exposure to problem solving through programming. It also aims to train the students with basic programming skills. This course enables the students to solve real world computational problems using C-programming language.

## Prerequisite

NIL

## Course Outcomes

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

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Explain the algorithms and draw flowcharts for solving Mathematical and Engineering problems. (Understand) | 15 |
| CO2 | Develop Computer programs using different types of Operator and Expressions in C (Apply) | 20 |
| CO3 | Identify the appropriate control structure and interpret modularization, recursion-using functions to solve real time problems. (Apply) | 20 |
| CO4 | Implement Programs with pointers and arrays.(Apply) | 15 |
| CO5 | Write programs using Structures ,Unions and files.(Apply) | 15 |
| CO6 | Illustrate the Unix system Interface using C programs. (Understand) | 15 |

*** Weightage depends on Bloom's Level, number of contact hours

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS2 | Understand | Respond | Guided Response | 1.2,2.1.2,2.4.6,2.5.2,3.2.3,4.4.3 |
| CO2 | TPS3 | Apply | Value | - | 1.2,2.1.5,3.2.3 |
| CO3 | TPS3 | Apply | Value | - | 1.2,2.1.5, 3.2.3,4.3.2 |
| CO4 | TPS3 | Apply | Value | - | 1.2,2.1.5, 3.2.3,4.5.1 |
| CO5 | TPS3 | Apply | Value | - | 1.2, 2.1.5,3.2.3,4.5.3 |
| CO6 | TPS2 | Understand | Respond | Guided Response | 1.2,2.1.2,2.4.6,4.4.3 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | M | - | - | - | - | - | - | | - | - | - | - | L | | |
| CO 2 | S | L | - | - | - | L | - | L | - | - | L | L | L | L | L |
| CO 3 | S | L | - | - | - | L | - | L | - | - | L | L | L | L | L |
| CO | S | L | - | - | - | L | - | L | - | - | L | L | L | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | | | | | | | | | | | | | | |
| CO 5 | S | L | - | - | - | L | - | L | - | - | L | L | L | L | L |
| CO 6 | M | - | - | - | - | L | - | L | - | - | L | L | L | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | |
| Remember | 30 | 15 | 15 | - | - | - | 20 |
| Understand | 40 | 30 | 35 | 50 | 50 | 50 | 35 |
| Apply | 30 | 55 | 50 | 50 | 50 | 50 | 45 |
| Analyse | - | - | - | - | - | - | - |
| Evaluate | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Assignment |
|---|---|
| Perception | - |
| Set | - |
| Guided Response | 100 |
| Mechanism | - |
| Complex Overt Responses | - |
| Adaptation | - |
| Origination | - |

**Sample Questions for Course Outcome Assessment****

**Course Outcome 1 (CO1):**

1. Explain the symbols of Flowchart
2. Write the pseudo code to count the digits of an integer
3. Illustrate the flow chart to exchange the values of variables

**Course Outcome 2 (CO2):**

1. Explain about the simple data types in C.
2. Determine the values of c and d.
   int a=18,b=26,c;
   float d;
   c=(++a)-(b++);d=(c+b)*a+c+b*a;

3. Write a C Program to convert temperature in degrees Celsius to degrees Fahrenheit.

**Course Outcome 3 (CO3):**

1. Explain the conversion of 'while loop' into 'for loop' with the help of flow charts.
2. Draw the flowchart for finding factorial without wit out recursion
3. Construct a C program to read a positive integer, determine the number of digits in it and perform either summation of digits of an integer or reversing the integer value or squaring the value or testing whether it is odd or even based on the number of digits.

Assume that the entered value has a maximum of 4 digits. Use Relevant Control Structure

**Course Outcome 4 (CO4):**

1. Write the importance of pointers? Assume q=20 which is stored in location R=100 and find *R,(q).. Explain call by value and call by reference.
2. Write the algorithm to determine the first two largest elements from the given array. Use pointer notation to access the elements.
3. Develop a C program to multiply two nxn matrices using arrays and pointers.

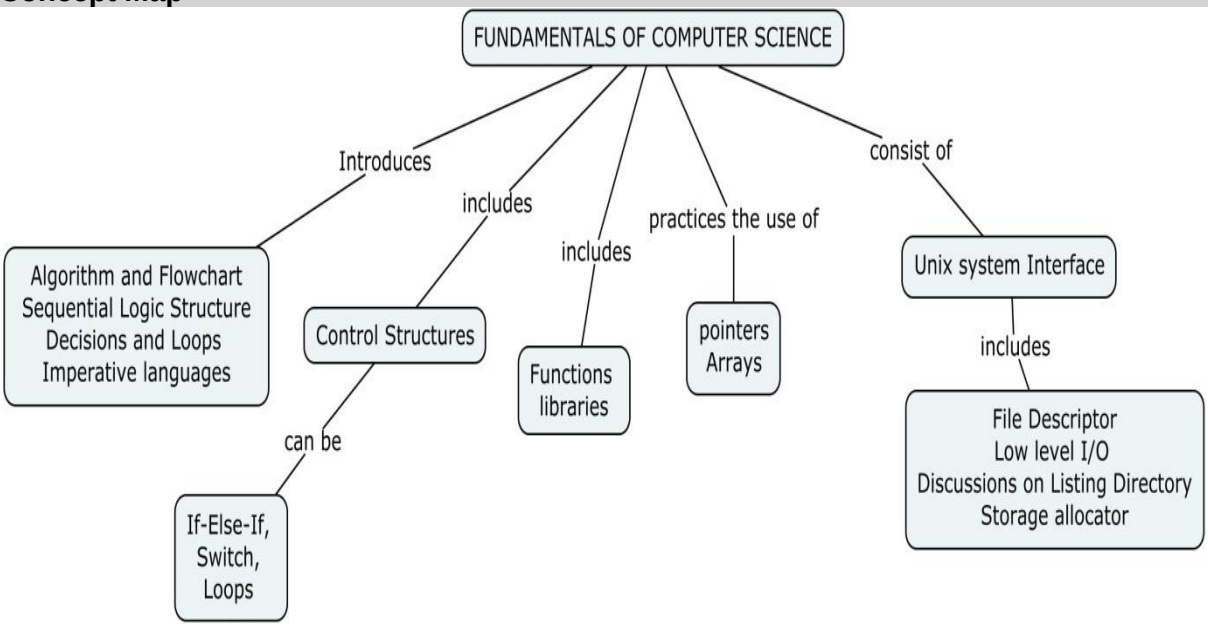
**Course Outcome 5 (CO5):**

1. Write the syntax for structure type variable within another structure
2. Construct a C program to print the following message:[Use string manipulation functions]
   "Whatsapp or Gmail for communication is preferable.
   St1: I am using Gmail for communication
   St2: People are using Whatsapp or Gmail.
   St3: Any mode of communication is preferable
3. Develop a C program to create a text file to store records of addresses of N persons and retrieve and display the records with status="covid positive".

**Course Outcome 6 (CO6):**

1. What are the responsibilities of a shell?
2. Specify the difference between absolute path and related path?
3. Describe links and symbolic links in UNIX?

## Concept Map




## Syllabus

**General problem Solving concepts**: Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops- **Problem Solving using Fundamental Algorithms:** Exchanging the values of two variables, counting

**Imperative languages**: **Introduction to imperative language;** syntax and constructs of a specific language (ANSI C) -**Types Operator and Expressions with discussion of variable naming and Hungarian Notation:** Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators,

Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation

**Control Flow and Functions - Control Flow with discussion on structured and unstructured programming:** Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, Go to Labels, structured and un- structured programming - **Functions and Program Structure with discussion on standard library:** Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Pre-processor, Standard Library Functions and return types- Summation of a set of numbers- Reversing Digits of an Integer- Factoring Methods for smallest divisor and prime number - Modularization and recursion –string handling functions

**Pointers and Arrays:** Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations – Evaluation - Array order reversal, Array Counting, Finding maximum and the minimum value in a set- Sorting – Searching

**Structures:** Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions, Bit-fields -**Input and Output:** Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions

**Unix system Interface:** File Descriptor, Low level I/O – read and write, Open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator, **Programming Method:** Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility.

## Learning Resources


1. "C: The Complete Reference", Herbert Schildt, Fourth Edition, , McGraw Hill, 2017
2. "Let Us C", YashavantKanetkar , Sixteenth edition, BPB Publication, 2017
3. "Programming in C",B. Gottfried, Third Edition, Schaum Outline Series, 2017
4. "The C Programming Language", B. W. Kernighan and D. M. Ritchi, Second Edition, PHI,1988.
5. "How to solve it by Computer", R.G Dromey, Pearson education, Delhi, 2008.
6. "Simple Program Design", A Step-by-Step Approach, Lesley Anne Robertson, 5th Edition, Thomson, 2007


## Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1 | **General problem Solving concepts** | | |
| 1.1 | Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops | 3 | CO1 |
| 1.2 | **Problem Solving using Fundamental Algorithms:** Exchanging the values of two variables, counting | 2 | CO1 |
| 2 | **Imperative languages** | | |
| 2.1 | **Introduction to imperative language-** syntax and constructs of a specific language (ANSI C) | 1 | CO2 |
| 2.2 | **Types Operator and Expressions with discussion of variable naming and Hungarian Notation:** Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations | 2 | CO2 |

| | | | |
|---|---|---|---|
| 2.3 | Arithmetic Operators, Relational Operators, Logical Operators | 1 | CO2 |
| 2.4 | Type Conversion, Increment Decrement Operators, Bitwise Operators | 1 | CO2 |
| 2.5 | Assignment Operators and Expressions, Precedence and Order of Evaluation | 1 | CO2 |
| 2.6 | Proper variable naming and Hungarian Notation | 1 | CO2 |
| 3 | **Control Flow and Functions** | | |
| 3.1 | **Control Flow with discussion on structured and unstructured programming:** Statements and Blocks, If-Else-If | 1 | CO3 |
| 3.2 | Switch , Loops – while, do, for, break and continue, Go-to Labels, structured and un- structured programming | 2 | CO3 |
| 3.3 | **Functions and Program Structure with discussion on standard library:** Basics of functions, parameter passing and returning type | 1 | CO3 |
| 3.4 | C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation | 1 | CO3 |
| 3.5 | Recursion, Pre-processor, Standard Library Functions and return types-Summation of a set of numbers- Reversing Digits of an Integer | 1 | CO3 |
| 3.6 | Factoring Methods for smallest divisor and prime number -Modularization and recursion –string handling functions | 1 | |
| 4 | **Pointers and Arrays** | | |
| 4.1 | Pointers and address, Pointers and Function Arguments ,Pointers and Arrays, Address Arithmetic | 1 | CO4 |
| 4.2 | character Pointers and Functions, Pointer Arrays, Pointer to Pointer | 1 | CO4 |
| 4.3 | Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays | 1 | CO4 |
| 4.4 | Command line arguments, Pointer to functions | 1 | CO4 |
| 4.5 | Complicated declarations –Evaluation - Array order reversal | 1 | CO4 |
| 4.6 | Array Counting, Finding maximum and the minimum value in a set- Sorting - Searching | 1 | CO4 |
| 5 | **Structures** | | |
| 5.1 | Basic Structures, Structures and Functions, Array of structures | 1 | CO5 |
| 5.2 | Pointer of structures, Self-referral Structures, Table look up, Type def, Unions, Bit-fields | 2 | CO5 |
| 5.3 | **Input and Output:** Standard I/O, Formatted Output – printf, Formated Input – scanf | 1 | CO5 |
| 5.4 | Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, | 1 | CO5 |
| 5.5 | Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions | 1 | CO5 |
| 6 | **Unix system Interface** | | |
| 6.1 | File Descriptor, Low level I/O – read and write, Open, create, close and unlink | 2 | CO6 |

| | | | |
|---|---|---|---|
| 6.2 | Random access – lseek, Discussions on Listing Directory, Storage allocator | 1 | CO6 |
| 6.3 | **Programming Method:** Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility. | 2 | CO6 |
| | **Total Hours** | **36** | |

**Course Designers:**

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| 20CB140 | PRINCIPLES OF ELECTRICAL ENGINEERING |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| ES | 2 | 0 | 0 | 2 |

## Preamble

Principles of electrical engineering are a fundamental course for all the circuit branches in engineering. This course covers the various network theorems to study the behavior of the electrical circuits. In order to find the behavior of AC circuits, the steady state and transient responses are discussed. By applying basic circuit laws, the performance of Electric and Magnetic field is determined in free space and in material space. Students will get an idea about transformer, various measuring instruments and sensors, electrical wiring, earthing and illumination system with some practical applications.

## Prerequisite

Nil

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Apply various network theorems and laws to interpret the behavior of the given DC circuits. | 20 |
| CO2 | Find the steady and transient response of the given AC circuits. | 20 |
| CO3 | Apply basic circuit laws to find the behavior of Electric and Magnetic field in free space and in material space. | 20 |
| CO4 | Explain the construction, working principle and applications of transformer. | 10 |
| CO5 | Explain the construction, working principle and applications of various measuring Instruments and sensors. | 15 |
| CO6 | Demonstrate the concept of Electrical Wiring, role of earthing, safety devices and system in practical applications. | 15 |

*** Weightage depends on Bloom's Level, number of contact hours,

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | | 1.2.4 , 2.3.1 |
| CO2 | TPS3 | Apply | Value | | 1.2.4 , 2.3.1 |
| CO3 | TPS3 | Apply | Value | | 1.2.2, 2.3.1 |
| CO4 | TPS2 | Understand | Respond | | 1.2.2 |
| CO5 | TPS2 | Understand | Respond | | 1.2.2 |
| CO6 | TPS3 | Apply | Value | | 1.2.1 , 2.3.1, 3.2.6 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | L | S | | | M | M | | | | M | L | L |
| CO2 | S | M | M | L | S | | | M | M | | | | M | L | L |
| CO3 | S | M | M | L | S | | | M | M | | | | M | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | M | L | L | | | | | M | M | | | | L | L | L |
| CO5 | M | L | L | | | | | M | M | | | | L | L | L |
| CO6 | S | M | M | L | S | | | M | M | | | | M | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | |
| Remember | 20 | 20 | 20 | - | - | - | 20 |
| Understand | 40 | 40 | 40 | - | - | - | 40 |
| Apply | 40 | 40 | 40 | 100 | 100 | 100 | 40 |
| Analyse | | | | | | | |
| Evaluate | | | | | | | |
| Create | | | | | | | |

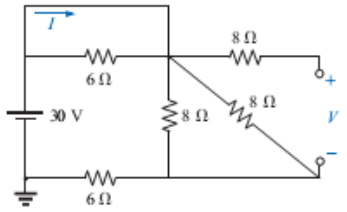
**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Miniproject /Assignment/Practical Component |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

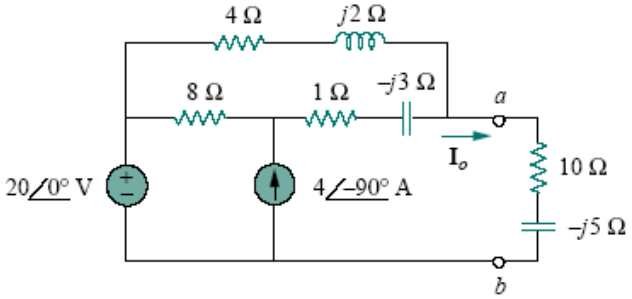
**Sample Questions for Course Outcome Assessment**

**Course Outcome 1(CO1):**

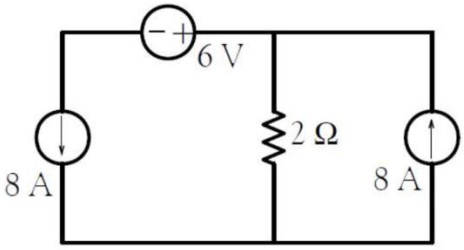
1. Determine the voltage V and current I for the network in figure below using Thevenin's theorem




2. Determine the Norton equivalent of the circuit in Fig. Given as seen from terminals a-b. Use the equivalent to find $I_o$.



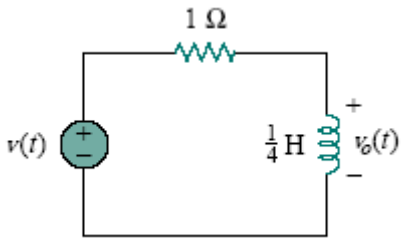

3. The voltage across the 2Ω resistor is equal to




(A) 3V
(B) -3V
(C) 8V
(D) None of the above

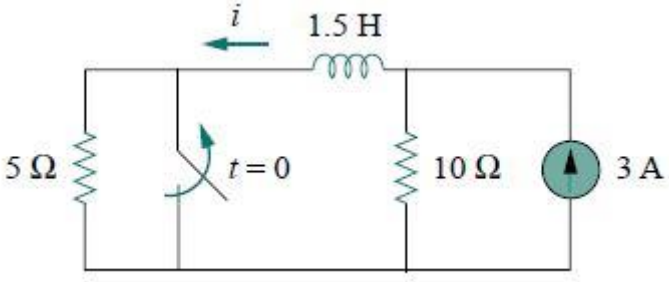
**Course Outcome 2(CO2):**

1. At what frequency will the output voltage $V_o(t)$ in Fig. below be equal to the input voltage $V(t)$?

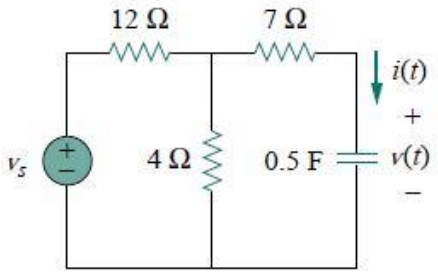



(a) 0 rad/s (b) 1 rad/s (c) 4 rad/s (d) ∞ rad/s (e) none of the above

2. The switch in figure has been closed for a long time. It opens at t = 0. Find $i(t)$ for $t$ >0.




3. Find the step responses $v(t)$ and $i(t)$ to $v_s$ = 5u(t) V in the circuit of figure




**Course Outcome 3(CO3):**

1. Two point charges - 4 μC and 5 μC are located at (2, - 1, 3) and (0, 4, - 2 ), respectively. If a third point charge of 3 μC is located at the origin. Find the potential at ( -1 , 5, 2) assuming V(∞) = 0
2. Derive the Maxwell's equation for static fields.
3. Given points P(l, - 3 , 5), *Q(2,* 4, 6), and *R(0,* 3, 8), find: (a) the position vectors of *P* and *R,* (b) the distance vector $r_{qr}$*(c)* the distance between *Q* and *R.*

**Course Outcome 4 (CO4):**

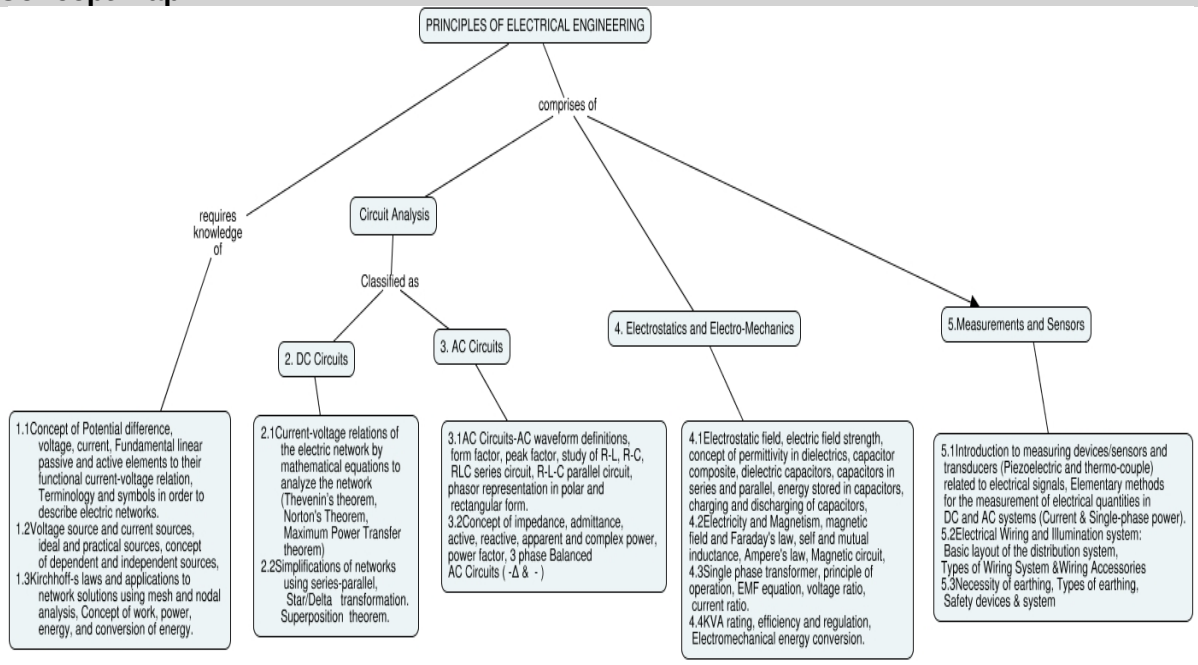
1. Derive the EMF equation of single phase transformer.
2. Define the term transformation ratio in Transformer.

3. Mention the advantages of shell type transformer over core type transformer.

**Course Outcome 5 (CO5):**
1. Describe the various forces/torques required in the measuring instruments.
2. Name the few static performance characteristics of a measuring instrument.
3. Discuss various methods for the measurement of electrical quantities in AC and DC system.

**Course Outcome 6(CO6):**
1. Design a lighting layout for a seminar hall having a dimension of 10 meter X 15 meter for an illumination level of 400 Lux. The recommended lamp is 36 watts fluorescent lamp. The depreciation factor is 1.2 and Utilization factor is 0.7. The lumens output of the 36watts fluorescent lamp is 3250 lumens. Also Calculate the number of fittings required.
2. Compare the luminous efficiency of various lamps.
3. Discuss the various earthing techniques used in a house.
4. List the electrical accessories used in a house wiring.

## Concept Map




## Syllabus

**Introduction:** Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

**DC Circuits:** Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.

**AC Circuits:** AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (λ-Δ & λ-λ).

**Electrostatics and Electro-Mechanics:** Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and

parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.

**Measurements and Sensors:** Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.

**For Further Reading -** Principle of batteries, types, construction and application, Magnetic material and B-H Curve, Basic concept of indicating and integrating instruments.

**Learning Resources**


1. Electric Machinery, (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2. A Textbook of Electrical Technology, (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.
5. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press.
6. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
7. Engineering Circuit Analysis, William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
8. Fundamentals of Electrical and Electronics Engineering, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.


**Course Contents and Lecture Schedule**

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1. | **Introduction** | | |
| 1.1 | Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks. | 1 | CO1 |
| 1.2 | Voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, | 1 | CO1 |
| 1.3 | Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy. | 2 | CO1 |
| 2. | **DC Circuits** | | |
| 2.1 | Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) | 2 | CO1 |
| 2.2 | Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem. | 2 | CO1 |
| 3. | **AC Circuits** | | |
| 3.1 | AC Circuits-AC waveform definitions, form factor, peak factor, study of R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form. | 2 | CO2 |

| | | | |
|---|---|---|---|
| 3.2 | Concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (ʎ-Δ & ʎ-ʎ) | 2 | CO2 |
| 4. | **Electrostatics and Electro-Mechanics** | | |
| 4.1 | Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, | 2 | CO3 |
| 4.2 | Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, | 2 | CO3 |
| 4.3 | Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio. | 2 | CO4 |
| 4.4 | KVA rating, efficiency and regulation, Electromechanical energy conversion. | 1 | CO4 |
| 5. | **Measurements and Sensors** | | |
| 5.1 | Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). | 2 | CO5 |
| 5.2 | Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System &Wiring Accessories | 2 | CO6 |
| 5.3 | Necessity of earthing, Types of earthing, Safety devices & system | 1 | CO6 |
| | **Total** | 24 | |

**Course Designers:**

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| 20CB150 | BUSINESS COMMUNICATION & VALUE SCIENCE – I |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| Project | 2 | - | - | 2 |

## Preamble

This course aims at building up the behavioral performance of the learners. It makes learners Understand what life skills are and their importance in leading a happy and well-adjusted life that motivate students to look within and create a better version of self by introducing them to key concepts of values, life skills and business communication

## Prerequisite

Basic Knowledge of high school English

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Recognize the need for life skills and values | 10 |
| CO2 | Recognize own strengths and opportunities | 10 |
| CO3 | Apply the life skills to different situations | 20 |
| CO4 | Explain the basic tenets of communication | 20 |
| CO5 | Apply the basic communication practices in different types of communication | 20 |
| CO6 | Design a project based on field work (Community services) | 20 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS2 | Understand | Value | Perception | 2.4, 2.5, 3.1 |
| CO2 | TPS2 | Understand | Respond | Perception | 2.4, 2.5, 3.2.6 |
| CO3 | TPS3 | Apply | Value | Perception | 3.1, 3.1.6 |
| CO4 | TPS2 | Understand | Receive | Perception | 3.1.6, 3.2 |
| CO5 | TPS3 | Apply | Respond | Guided response | 3.2.1, 3.2.3, 3.3.1 |
| CO6 | TPS6 | Create | Characterize | Origination | 4.3.4, 4.7.7, 4.7.8 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | | | M | | M | S | S | | M | L | M | M |
| CO2 | M | | | | | M | | M | M | S | | | L | L | L |
| CO3 | S | | | | | | | | | S | | S | L | L | L |
| CO4 | M | | | | | | | | | S | | S | L | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO5 | S | | | | | M | | | S | S | | S | L | M | L |
| CO6 | S | | | | | M | | | S | S | | S | L | M | L |

S- Strong; M-Medium; L-Low

## AssessmentPattern: Cognitive Domain

No CAT will be conducted.
Summative - Activity Based Evaluation ( No External Examination)

Evaluation is done in classroom activities as given below:

| | | | |
|---|---|---|---|
| Essential Grammar | CO4 | APPLY | 10 |
| Business Communication | CO5 | APPLY | 10 |
| Listening Comprehension | CO1 | UNDERSTAND | 10 |
| Group Assignment | CO3 | APPLY | 10 |
| Self Introduction | CO2 | APPLY | 10 |

| | | |
|---|---|---|
| Project submission (20) + interview (15) CO6 | | 35 |
| GD (15) CO1 | | 15 |
| | Total | 100 |

## Assessment Pattern: Psychomotor

| Psychomotor Skill | Miniproject/Assignment/Practical Component |
|---|---|
| Perception | |
| Set | |
| Guided Response | Micro project |
| Mechanism | |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

## Sample Questions for Course Outcome Assessment**

** (2 to 3 at the cognitive level of course outcome)

**Course Outcome 1(CO1): (15 marks)**

1. Corona virus Pandemic and its Impact
2. FDI in Retail Sector a Boon or Curse?
3. Digital Education vs Traditional Education

**Course Outcome 2(CO2): (10 marks)**

Project: Submission and Presentation.

**Course Outcome 3 (CO3): :** (10 Marks – Time Max 20 mints)
**Type of Exercise**: Listen to the MP3n/ or MP4 (You Tube Videos) and answer the given MCQs/ Gap -Filling / True or False Exercises

**Course Outcome 4 (CO4): Do as Directed ( 15 Marks)**

1.**Choose the correct alternative to fill in the blanks: (3 Marks )**

a. Food prices ---------- again this month.
(i) have raised (ii) have been raising (C) have been rising (D) have arose

b. The team lead, as well as the other members , ---------- present on the occasion.
(A) were (B) was (C) has (D) have

c. Despite the new medicine's ---------- in treating diabetes, it is not ---------- widely.
(A) effectiveness – prescribed (B) availability – used
(C) prescription – available (D) acceptance – proscribed

2. **Do as directed (3 Marks**)

a. Rewrite the following sentence with standard grammatical accuracy.
Epic, the country's first browser, uses very less memory than Google chrome.

b. Which of the above underlined parts of the sentence is not appropriate?
All engineering students (I)/should learn business systems, (II)/ mathematics and (III) how to do computation. (IV).

c. Which of the following options is the closest in meaning to the sentence below?
She enjoyed herself immensely at party

(A) She had a terrible time at the party (B) She had a horrible time at the party
(C) She had a terrific time at the party (D) She had a terrifying time at the party

3. **Do as directed (3 Marks)**

a. Write down the verbs of the following words: i) standard ii) responsive
b. Frame adjectives from the following words: i) news ii) operation
c. Construct a passive using the following prompt, given in brackets.
(It/feel) There is a lack of communication in sales .

4. **Do as directed (3 Marks)**

a. Rearrange the following words to make formal business expressions.
look / meeting / forward / to/ you.

b. Complete the sentence with the correct relative pronoun.
The merger raises a number of HR issues ---------- need to be addressed soon.

c. Complete the sentence with a suitable preposition.
I am working ------- TCS ------- the domain of Business Analytics.

5. **Do as directed (3 Marks)**

a. Frame a sentence in the future perfect, using the prompt given.
network / half our suppliers by / end of this year.
b. Complete the following sentence, using the correct form of the passive.
To asses past performance, and review pay all employees -------- (assess) once a year.
c. Complete the sentence using the correct alternative given in brackets.
d. The number of training organizations ------- ( has / have ) increasing rapidly.

**Course Outcome 5 (CO5): (**15 Marks : Time: 20 Minutes)

**TCS E Mail Writing**: As a recent buyer of their car, write an E-mail to the Manager of XYZ automotive company, Mr Kishore, regarding the poor quality of service facility available in the city. Sign the E-mail as Anil. (Max: 50 words in two Paragraphs)
very few - service centers - complaints - pending problems - maintenance - cost - time - delivery - increase - customer satisfaction

**(OR)**

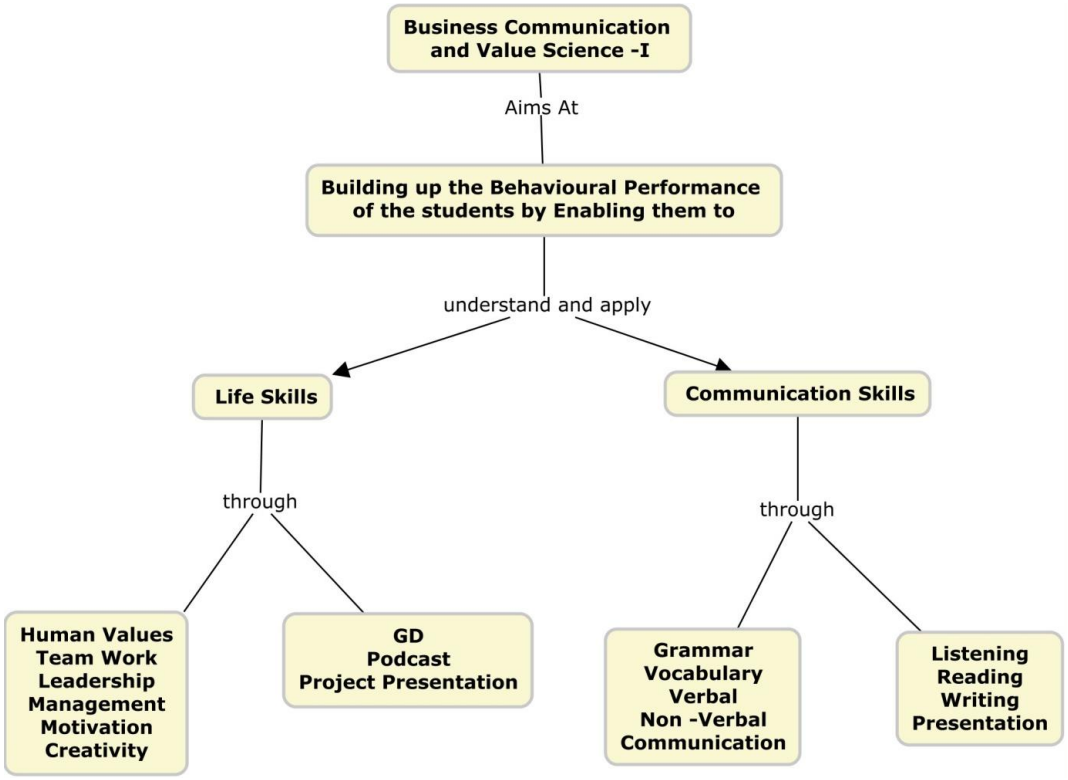
**BEC Vantage- Email Writing - Task 1**: Your office printer has broken down and you decide to replace it. Write an email to the Head of Purchasing including the following content points: (Words: 40- 50)

- Describing the reason for not repairing the old printer
- Explaining what you need from a new one (colour printing, paper size, etc.)
- Suggesting where to buy a new one

**Course Outcome 6 (CO6): (35 Marks – 20+15)**

**Project Submission and interview**.

## Concept Map




## Syllabus

Overview of LOL (include activity on introducing self), Introduction to critical life skills - Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation; Understanding Life Skills: Movie based learning, Self-awareness - identity, body awareness, stress management; Importance of listening skills, Difference between listening and hearing, Types of listening

.

Essential Grammar – Parts of Speech, Applications of tenses in Functional Grammar, Sentence formation, Common errors, Voices; Overview of Business Communication Skills, Barriers of communication, Effective communication, Types of communication- verbal and non–verbal – Role-play based learning, Importance of Questioning, Written Communication: Summary writing, story writing

Business Communication : Formal and informal emails, Verbal communication: Pronunciation, Clarity of speech, Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, formal business vocabulary.

## Learning Resources

| | |
|---|---|
| **Text Books:** | |
| There are no prescribed texts for Semester 1 – there will be handouts and reference links shared. | |
| **Reference Books:** | |
| 1 | English vocabulary in use – Alan Mc'carthy and O'dell |
| 2 | APAART: Speak Well 1 (English Language and Communication) |
| 3 | APAART: Speak Well 2 (Soft Skills) |
| 4 | Business Communication – Dr.SarojHiremath |
| **Web References:** | |
| 1 | Train your mind to perform under pressure- Simon sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/ |
| 2 | Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html |
| 3 | Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0 |
| **Online Resources:** | |
| 1 | https://www.coursera.org/learn/learning-how-to-learn |
| 2 | https://www.coursera.org/specializations/effective-business-communication |

## Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1.1 | Overview of LOL (include activity on introducing self) | 1 | CO1 |
| 1.2 | Self-awareness – identity, body awareness, stress management | 1 | CO1 |
| 1.3 | Discussion in classroom (Movie based learning – Pursuit of Happiness) | 2 1 | CO2 |
| 1.4 | Verbal and non – verbal – Role-play based learning – Activity | 1 | CO2 |
| 1.5 | Importance of listening skills - Listen to recording and answer | 1 (lab) | CO3 |
| 1.6 | Writing a newspaper report – Activity | 2 | CO5 |
| 1.7 | Presentation on a favourite topic | 2 | CO5 |
| 2.1 | Overview - Barriers of communication, Effective communication | 1 | CO1 |
| 2.2 | Parts of Speech–Listening to an audio clip and noting down the difference | 1 (lab) | CO3 |
| 2.3 | Sharing words and framing sentence with various parts of speech | 1 | CO4 |
| 2.4 | Tenses: Applications of tenses in Functional Grammar | 2 | CO4 |
| 2.5 | Sentence formation (general & Technical), | 1 | CO4 |
| 2.6 | Common errors, Voices | 1 | CO4 |
| 2.7 | Summary writing, story writing | 2 | CO5 |
| 3.1 | Overview of business communication | 1 | CO4 |
| 3.2 | Formal and informal emails | 2 | CO5 |
| 3.3 | Pronunciation, clarity of speech | 2 (lab) | CO4 |
| 3.4 | Reading Economic Times, Reader's Digest and discuss | 2 | CO4 |

| | | | |
|---|---|---|---|
| | vocabulary | | |
| 3.5 | Exposure to words from General Service List (GSL) by West | 1 | CO2 |
| 3.6 | Group discussion using words learnt - Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, significant abbreviations formal business vocabulary | 2 | CO1 |
| 3.7 | Toastmaster style speech with evaluation | 2 | CO5 |
| 3.8 | Creating a podcast on a topic that will interest college students | 2 | CO5 |
| 3.9 | Project Preparation - Community Service | 2 | CO6 |

**Course Designers:**

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| 20CB160 | FUNDAMENTALS OF PHYSICS |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| BS | 2 | 0 | 2 | 3 |

## Preamble

The course work aims in imparting fundamental knowledge of oscillations, optics, quantum mechanics ,crystal structures and laws of thermodynamics which are essential in understanding and explaining engineering devices

## Prerequisite

Basic course (No prerequisite)

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Analyze the behavior of a damped harmonic oscillator | 15 |
| CO2 | Explain the phenomenon of interference, diffraction and polarization and utilize it for engineering applications | 20 |
| CO3 | Describe and make use of the Maxwells equation of electromagnetism | 10 |
| CO4 | Use the basic principles of Quantum mechanics to identify the wave function & understand different crystal structures | 25 |
| CO5 | Understand the different types of laser ,fiber optic and their applications | 15 |
| CO6 | Compute the entropy of a given thermodynamic process using the laws of thermodynamics. | 15 |

*** Weightage depends on Bloom's Level, number of contact hours,

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | | 1.1 |
| CO2 | TPS3 | Apply | Value | | 1.1 |
| CO3 | TPS2 | Understand | Respond | | 1.1 |
| CO4 | TPS3 | Apply | Value | | 1.1 |
| CO5 | TPS2 | Understand | Respond | | 1.1 |
| CO6 | TPS3 | Apply | Value | | 1.1 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | M | L | L | | | | | L | L | | | M | L | |
| CO 2 | M | L | L | - | | | | | L | L | | | L | L | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 3 | M | L | L | L | | | | | L | L | | | L | L | |
| CO 4 | S | M | L | L | | | | | L | L | | | M | L | |
| CO 5 | M | L | L | - | | | | | L | L | | | L | L | |
| CO 6 | S | M | L | L | | | | | L | L | | | M | L | |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination Theory |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 Practical | 1 | 2 | 3 | |
| Remember | 20 | 20 | | | | | 20 |
| Understand | 30 | 30 | | | | | 30 |
| Apply | 50 | 50 | 100 | 100 | 100 | 100 | 50 |
| Analyse | | | | | | | |
| Evaluate | | | | | | | |
| Create | | | | | | | |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Miniproject /Assignment/Practical Component |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

**Sample Questions for Course Outcome Assessment****

** (2 to 3 at the cognitive level of course outcome)

**Course Outcome 1(CO1):**

1. Write any two necessary conditions for body to execute S.H.M
2. Construct the differential equation of a damped harmonic oscillator and deduce the conditions of heavy damping.
3. Explain the different types of damping with suitable displacement-time graph.

**Course Outcome 2(CO2):**

1. In Newton's ring experiment, the diameter of the fifth ring was 0.3 cm and diameter of twenty fifth ring was 0.8 cm.If the radius of curvature of plano convex lens is 1m, compute the wavelength of light used.

2 Calculate the angles at which the first dark band and next bright band are formed in

Fraunhoffer diffraction pattern of slit width 0.3mm wide if wavelength of light used is 5890 A.

3 The critical angle for a clear crystal for green light is 24.4·Identify the angle of Polarisation.

**Course Outcome 3(CO3):**

1. Briefly explain the Hertz experiment for production of electromagnetic waves
2. Make use of the Maxwells equation to develop the wave equation for a transverse electric field in free space.
3. Recall the maxwells equation in differential form.

**Course Outcome 4 (CO4):**

1. If the uncertainity in position of electron is $4x10^{-10}$ m,calculate the uncertainity in velocity of electron
2. Calculate the first two energy levels for electron confined to a one dimensional box of $10^{-10}$ m width.
3. Calculate the interplanar spacing for a (321) plane in a simple cubic lattice where lattice constant is $4.2x10^{-10}$ m

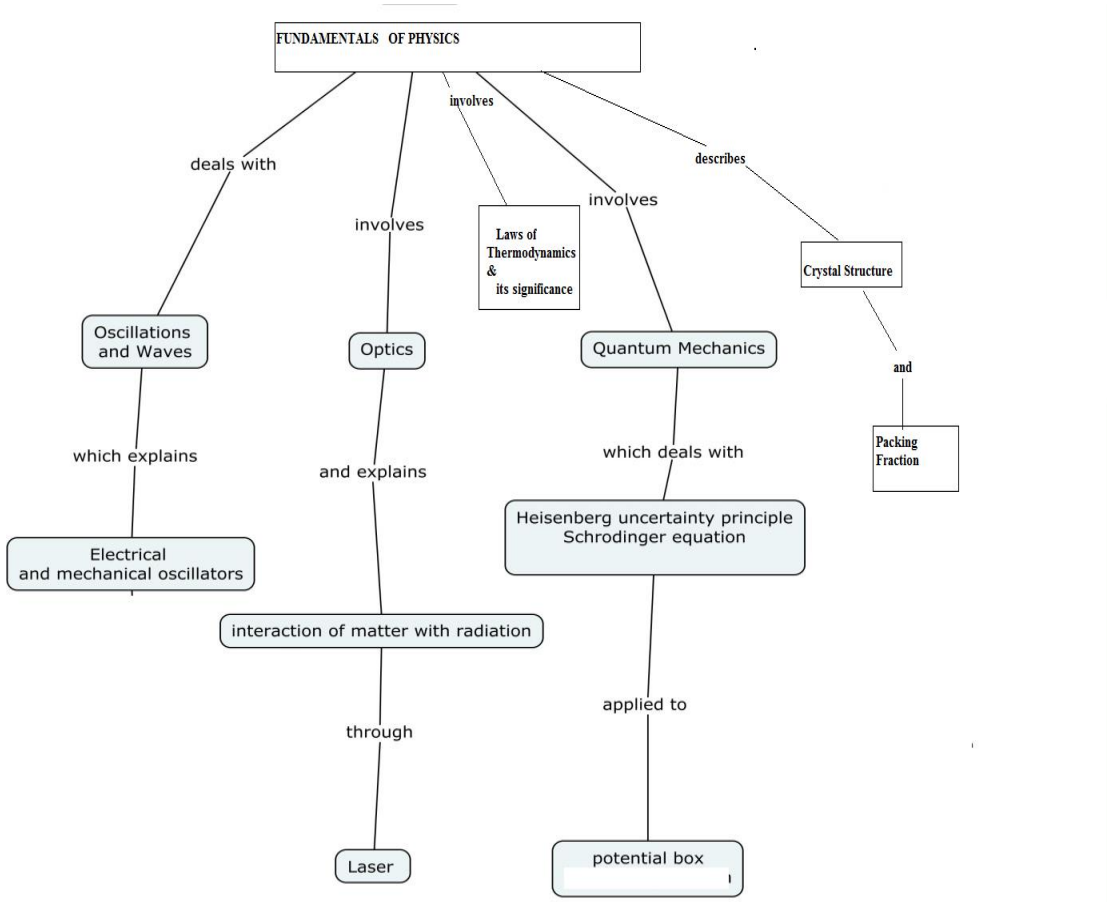
**Course Outcome 5 (CO5):**

1. Find the ratio of population of two energy states in a Laser the transition between which is responsible for the emission of photons of wavelength6893A at a temperature of 300K.Comment on the type of emission based on the ratio of population.
2. Analyze the role of mixture of gases for a $CO_2$ laser and predict the working of the laser without Helium gas in the mixture.
3. Differentiate between $CO_2$ laser and Nd-YAG Laser with respect to their construction and energy level diagram.

**Course Outcome 6(CO6):**

1. Recall the first law of thermodynamics and its significance.
2. Calculate the change in entropy when 1 g of ice is converted into 1 g of water at 0C.Given that latent heat of fusion is 80 cal/g
3. Cite two examples for irreversible process and prove that entropy increases in irreversible process.

## Concept Map




## Syllabus

**Oscillations**

Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple springs mass system. Resonance-definition, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

**Interference**

principle of superposition-Young's experiment,Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction- Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

**Polarisation of Light**

Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

**Basic Idea of Electromagnetisms, Maxwell's Equations**

Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium

**Quantum Mechanics**

Introduction- Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box

**Crystallography**

Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures, X-ray diffraction

**Semiconductor Physics**
Conductor, semiconductor and Insulator; Basic concept of Band theory
**Laser and Fiber optics:**
Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, $CO_2$ and Nd-YAG (Neodymium-doped Yttrium Aluminium Garnet) Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering.
Fiber optics and Applications, Types of optical fibers
**Thermodynamics**
Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

**Laboratory**

1) Magnetic field along the axis of current carrying coil – Stewart and Gee
2) Determination of Hall coefficient of semi conductor
3) Determination of Plank constant
4) Determination of wave length of light by Laser diffraction method
5) Determination of wave length of light by Newton's Ring method
6) Determination of laser and optical fiber parameters
7) Determination of Stefan's Constant.

## Learning Resources

**Text Books:**

1. Beiser A, "Concepts of Modern Physics", Fifth Edition, McGraw Hill International.
2. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics",Seventh Edition Wiley plus

**Reference Books:**

1. AjoyGhatak, "Optics" Fifth Edition, Tata McGraw Hill.
2. Sears & Zemansky, "University Physics",Eleveth Edition, Addison-Wesley.
3. Jenkins and White, "Fundamentals of Optics", Third Edition, McGraw-Hill

## Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1. | **Oscillations** | | |
| 1.1 | Periodic motion-simple harmonic motion-characteristics of simple harmonic motion- vibration of simple springs mass system. Resonance-definition. | 1 | CO1 |
| 1.2 | Damped harmonic oscillator – heavy, critical and light damping, | 1 | CO1 |
| 1.3 | Energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators. | 1 | CO1 |
| 2. | **Interference &Polarization of Light** | | |
| 2.1 | Principle of superposition-Young's double slit experiment:Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, | 2 | CO2 |
| 2.2 | Diffraction-Two kinds of diffraction-Difference between | 2 | CO2 |

| | | | |
|---|---|---|---|
| | interference and diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence. | | |
| 2.3 | Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction. | 1 | CO2 |
| 3. | **Basic Idea of Electromagnetisms, Maxwell's Equations** | | |
| 3.1 | Continuity equation for current densities. . | 1 | CO3 |
| 3.2 | Maxwell's equation in vacuum and non-conducting medium | 1 | CO3 |
| 4. | **Quantum Mechanics and Crystallography:** | | |
| 4.1 | Introduction- Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, | 1 | CO4 |
| 4.2 | Time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box, | 2 | CO4 |
| 4.3 | Crystallography- Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, | 1 | CO4 |
| 4.4 | Atomic packing factor for SC, BCC, FCC and HCP structures. | 1 | CO4 |
| 4.5 | X-ray Diffraction | 1 | CO4 |
| 4.6 | Semiconductor Physics – conductor, semiconductor and Insulator; Basic concept of Band theory | 1 | CO4 |
| 5. | **Laser and Fiber optics:** | | |
| 5.1 | Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, | 1 | CO5 |
| 5.2 | different types of lasers: Ruby Laser, CO2 and Nd-YAG Laser(Neodymium-doped Yttrium Aluminium Garnet) | 1 | CO5 |
| 5.3 | Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering. | 1 | CO5 |
| 5.4 | Fiber optics and Applications, Types of optical fibers | 1 | CO5 |
| 6. | **Thermodynamics** | | |
| 6.1 | Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st | 1 | CO6 |

| | | | |
|---|---|---|---|
| | law. | | |
| 6.2 | Second law of thermodynamics and concept of Engine. | 1 | CO6 |
| 6.3 | Change in entropy in reversible and irreversible processes. | 1 | CO6 |
| | Theory class | **24hrs** | |
| | | | |
| 7 | Practicals | | |
| 7.1 | Introduction to Laboratory Class –Brief Theory of Experiments | 3 | |
| 7.1 | Determination of Plank constant. | 2 | CO4 |
| 7.2 | Determination of wave length of light by Laser diffraction method | 2 | CO5 |
| 7.3 | Determination of wave length of light by Newton's Ring method | 3 | CO2 |
| 7.4 | Determination of laser and optical fiber parameters | 2 | CO5 |
| 7.5 | Determination of Stefan's Constant | 3 | CO6 |
| 7.6 | Magnetic field along the axis of current carrying coil – Stewart and Gee | 3 | CO3 |
| 7.7 | Determination of Hall coefficient of semi conductor | 2 | CO4 |
| 7.8 | Additional Practical class (Absentees , Students Joining Late, Repeat Experiments) | 2 | |
| 7.8 | Practical –Continoius Assesment Test 3 | 2 | |
| | Total Practical Hours | 24 | |
| | **Total hours** (Theory 24+Practical 24) | **48** | |

**Course Designers:**

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| 20CB170 | FUNDAMENTALS OF COMPUTER SCIENCE LAB |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| ES | 0 | 0 | 4 | 2 |

## Preamble

This course aims to provide exposure to problem solving through C programming. It aims to train the student to design, implement and test the Mathematical and Engineering problems using C-programming language

## Prerequisite

NIL

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Design the algorithms and draw flowcharts for the given Mathematical and Engineering problems | 15 |
| CO2 | Write Computer programs for the given algorithm. | 20 |
| CO3 | Implement programs with the relevant control structure and parameter passing using functions. | 20 |
| CO4 | Develop C programs using derived data types. | 15 |
| CO5 | Create and use header files and C pre-processor directive as utility. | 15 |
| CO6 | Use Pattern searching and parsing strategies in problem solving | 15 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | - | 1.2, 2.1.2 , 2.1.5, 2.4.6, 3.2.4, 3.2.5, 4.4.3 |
| CO2 | TPS3 | Apply | Value | - | 1.2, 2.1.2 , 2.1.5, 2.4.6, 3.2.3, 3.2.4, 4.5.3 |
| CO3 | TPS3 | Apply | Value | - | 1.2, 2.1.2 , 2.1.5, 2.4.6, 3.2.3, 3.2.4, 4.5.3 |
| CO4 | TPS3 | Apply | Value | - | 1.2, 2.1.2 , 2.1.5, 2.4.6, 3.2.3, 3.2.4, 4.5.3 |
| CO5 | TPS3 | Apply | Value | - | 1.2, 2.1.2 , 2.1.5 ,2.4.6, 3.2.3, 3.2.4, 4.5.3 |
| CO6 | TPS3 | Apply | Value | - | 1.2, 2.1.2 , 2.1.5, 2.4.6, 3.2.3, 3.2.4, 4.5.3 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | M | L | - | - | L | - | L | - | - | L | L | M | L | L |
| CO 2 | S | M | L | - | - | L | - | L | - | - | L | L | M | L | L |
| CO | S | M | L | - | - | L | - | L | - | - | L | L | M | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | | | | | | | | | | | | | | |
| CO 4 | S | M | L | - | - | L | - | L | - | - | L | L | M | L | L |
| CO 5 | S | M | L | - | - | L | - | L | - | - | L | L | M | L | L |
| CO 6 | S | M | L | - | - | L | - | L | - | - | L | L | M | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Model Examination | Terminal Examination |
|---|---|---|
| Remember | - | - |
| Understand | - | - |
| Apply | 100 | 100 |
| Analyse | - | - |
| Evaluate | - | - |
| Create | - | - |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Observation |
|---|---|
| Perception | - |
| Set | - |
| Guided Response | 100 |
| Mechanism | - |
| Complex Overt Responses | - |
| Adaptation | - |
| Origination | - |

**List of Experiments/Activities with CO Mapping**

| Ex.No | List of Experiments | CO |
|---|---|---|
| 1. | Algorithm and flowcharts of small problems like GCD | CO1 |
| | **Structured code writing with:** | |
| 2. | Small but tricky codes | CO2 |
| 3. | Proper parameter passing | CO3 |
| 4. | Command line Arguments | CO3 |
| 5. | Variable parameter | CO3 |
| 6. | Pointer to functions | CO4 |
| 7. | User defined header | CO5 |
| 8. | Make file utility | CO5 |

| | | |
|---|---|---|
| 9. | Multi file program and user defined libraries | CO5 |
| 10. | Interesting substring matching / searching programs | CO6 |
| 11. | Parsing related assignments | CO6 |

**Learning Resources**


1. "C: The Complete Reference", Herbert Schildt, Fourth Edition, , McGraw Hill, 2017
2. "Let Us C", Yashavant Kanetkar , Sixteenth edition, BPB Publication, 2017
3. "Programming in C",B. Gottfried, Third Edition, Schaum Outline Series, 2017
4. "The C Programming Language", B. W. Kernighan and D. M. Ritchi, Second Edition, PHI,1988.
5. "How to solve it by Computer", R.G Dromey, Pearson education, Delhi, 2008.
6. "Simple Program Design", A Step-by-Step Approach, Lesley Anne Robertson, 5th Edition, Thomson, 2007


**Course Designers:**


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| 20CB180 | PRINCIPLES OF ELECTRICAL ENGINEERING LAB |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| ES | 0 | 0 | 2 | 1 |

## Preamble

The course is designed to provide students a widespread knowledge and understanding of the basic Electrical Systems Components and theorems. The indispensable and pervasive knowledge of various types of circuits and its behavior, two types of connections in AC system and quantities associated in both DC and AC will enhance the practical knowledge about the electrical engineering system.

## Prerequisite

Nil

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Practice the use of electrical Elements, sources, measuring devices and transducers related to electrical circuits experimentally. | 10 |
| CO2 | Determine the resistance temperature coefficient experimentally. | 10 |
| CO3 | Verify the network theorems for the electric circuit using hardware and simulation software experimentally. | 30 |
| CO4 | Verify series resonance phenomena in a RLC circuit experimentally. | 10 |
| CO5 | Analyze the transient behavior of the given RC circuit experimentally. | 10 |
| CO6 | Verify the relationship between voltage and current in three phase balanced star and delta connected loads experimentally. | 20 |
| CO7 | Practice electrical quantities measurement in DC and AC systems experimentally. | 10 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| | | | | | |
| CO1 | TPS3 | Apply | Value | Mechanism | 1.2.1 ,2.2.3 |
| CO2 | TPS3 | Apply | Value | Mechanism | 1.2.1 ,2.2.3 |
| CO3 | TPS3 | Apply | Value | Mechanism | 1.2.1 ,2.2.3 |
| CO4 | TPS3 | Apply | Value | Mechanism | 1.2.1 ,2.2.3 |
| CO5 | TPS4 | Analyze | Organize | Complex Overt Responses | 1.2.1 ,2.2.3 |
| CO6 | TPS3 | Apply | Value | Mechanism | 1.2.1 ,2.2.3 |
| CO7 | TPS3 | Apply | Value | Mechanism | 1.2.1 ,2.2.3 |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | L | M | | | M | M | M | | | M | M | L |
| CO2 | S | M | L | L | M | | | M | M | M | | | M | M | L |
| CO3 | S | M | L | L | S | | | M | M | M | | | M | M | L |
| CO4 | S | M | L | L | S | | | M | M | M | | | M | M | L |
| CO5 | S | M | L | L | S | | | M | M | M | | | M | M | L |
| CO6 | S | M | L | L | S | | | M | M | M | | | M | M | L |
| CO7 | S | M | L | L | L | | | M | M | M | | | M | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Model Examination | Terminal Examination |
|---|---|---|
| Remember | | |
| Understand | | |
| Apply | 50 | 50 |
| Analyse | 20 | 20 |
| Evaluate | | |
| Create | | |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Miniproject /Practical Component/Observation |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | 30 |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

**List of Experiments/Activities with CO Mapping**

| Experiment List | CO |
|---|---|
| Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits | CO1 |
| Determination of resistance temperature coefficient | CO2 |
| Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power Transfer theorem) | CO3 |
| Simulation of R-L-C series circuits for XL> XC , XL< XC & XL= XC | CO4 |
| Simulation of Time response of RC circuit | CO5 |

| | |
|---|---|
| Verification of relation in between voltage and current in three phase balanced star and delta connected loads. | CO6 |
| Demonstration of measurement of electrical quantities in DC and AC systems. | CO7 |

## Learning Resources


1. Electric Machinery, (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2. A Textbook of Electrical Technology, (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.
5. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press.
6. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
7. Engineering Circuit Analysis, William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
8. Fundamentals of Electrical and Electronics Engineering, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.


## Course Designers:


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# CURRICULUM AND DETAILED SYLLABI

# FOR

## B.Tech DEGREE (Computer Science and Business Systems) PROGRAMME

## SECOND SEMESTER

## FOR THE STUDENTS ADMITTED FROM THE

## ACADEMIC YEAR 2020 - 2021 ONWARDS

**THIAGARAJAR COLLEGE OF ENGINEERING**

(A Government Aided ISO 9001-2008 certified
Autonomous Institution affiliated to Anna University)

MADURAI – 625 015, TAMILNADU

Phone: 0452 – 2482240, 41

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Passed in Board of Studies Meeting on 06.07.2020 Approved in 60th Academic Council Meeting on 25.07.2020

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**
**B.Tech (Computer Science and Business systems) Programme**

**COURSES OF STUDY**
(For the candidates admitted from 2020 - 21 onwards)

**SECOND SEMESTER**

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | No.of Hours / Week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| **THEORY COURSES** | | | | | | | |
| 1 | 20CB210 | Linear Algebra | BS | 3 | 1 | 0 | 4 |
| 2 | 20CB220 | Statistical Methods | BS | 3 | 1 | 0 | 4 |
| 3 | 20CB230 | Data Structures and Algorithms | PC | 3 | 1 | 0 | 4 |
| 4 | 20CB240 | Principles of Electronics | ES | 2 | 0 | 0 | 2 |
| 5 | 20CB250 | Fundamentals of Economics | HSS | 2 | 0 | 0 | 2 |
| 6 | 20CB260 | Business Communication & Value Science - II | Project | 2 | 0 | 0 | 2 |
| **PRACTICAL COURSES** | | | | | | | |
| 7 | 20CB270 | Data Structures and Algorithms Lab | PC | 0 | 0 | 4 | 2 |
| 8 | 20CB280 | Principles of Electronics Lab | ES | 0 | 0 | 2 | 1 |
| 9 | 18ES290 | Lateral Thinking | ES | 0 | 0 | 2 | 1 |
| 10 | 18CHAA0 | Environmental Sciences | AC | 1 | 0 | 1 | - |
| | | | | | | | |
| **Total** | | | | **16** | **3** | **9** | **22** |

BS : Basic Science
HSS : Humanities and Social Science
ES : Engineering Science
PC : Program Core
PE : Program Elective
OE : Open Elective
AC : Audit Course

L : Lecture
T : Tutorial
P : Practical

**Note**:
1 Hour Lecture is equivalent to 1 credit
1 Hour Tutorial is equivalent to 1 credit
2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**
**B.Tech (Computer Science and Business systems) Programme**

**SCHEME OF EXAMINATIONS**
(For the candidates admitted from 2020 - 21 onwards)

**SECOND SEMESTER**

| S.No. | Course Code | Name of the Course | Duration of Terminal Exam. in Hrs. | Marks | | | Minimum Marks for Pass | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment | Terminal Exam * | Max. Marks | Terminal Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 20CB210 | Linear Algebra | 3 | 50 | 50 | 100 | 25 | 50 |
| 2 | 20CB220 | Statistical Methods | 3 | 50 | 50 | 100 | 25 | 50 |
| 3 | 20CB230 | Data Structures and Algorithms | 3 | 50 | 50 | 100 | 25 | 50 |
| 4 | 20CB240 | Principles of Electronics | 3 | 50 | 50 | 100 | 25 | 50 |
| 5 | 20CB250 | Fundamentals of Economics | 3 | 50 | 50 | 100 | 25 | 50 |
| 6 | 20CB260 | Business Communication & Value Science - II | - | 100 | - | 100 | - | 50 |
| **PRACTICAL** | | | | | | | | |
| 7 | 20CB270 | Data Structures and Algorithms Lab | 3 | 50 | 50 | 100 | 25 | 50 |
| 8 | 20CB280 | Principles of Electronics Lab | 3 | 50 | 50 | 100 | 25 | 50 |
| 9 | 18ES290 | Lateral Thinking | - | 50 | 50 | 100 | 25 | 50 |
| 10 | 18CHAA0 | Environmental Sciences | - | 50 | 50 | 100 | 25 | 50 |

* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

| 20CB210 | LINEAR ALGEBRA |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| BS | 3 | 1 | 0 | 4 |

## Preamble

A general theory of Mathematical systems involving addition and scalar multiplication of vectors has applications in all Engineering field. Mathematical systems of this form are called Vector spaces or linear spaces. Linear systems of equations are associated with many problems in Engineering and Sciences, as well as with applications of mathematics to social sciences, quantitative study of business and economic problems. The modules II and III of this subject deal with the concepts on Vector spaces and orthogonality. SVD & PCA are the two important techniques used for dimensionality reduction in unsupervised learning of machine learning.

## Prerequisite

Matrices and Determinants

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Solve the system of linear equations | 20 |
| CO2 | Verify whether the given set is vector space or not and determine its dimension | 15 |
| CO3 | Predict an orthonormal basis and decompose a given matrix using QR decomposition | 15 |
| CO4 | Compute eigen values and eigen vectors for a given matrix | 20 |
| CO5 | Decompose a matrix using Singular Value Decomposition (SVD) | 15 |
| CO6 | Perform dimensionality reduction on the given data using SVD and Principal Component Analysis(PCA) | 15 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | - | 1.1, 2.1,2.2,2.5.1,4.1.2 |
| CO2 | TPS3 | Apply | Value | - | 1.1, 2.1,2.2,2.5.1,4.1.2 |
| CO3 | TPS3 | Apply | Value | - | 1.1, 2.1,2.2,2.5.1,4.1.2 |
| CO4 | TPS3 | Apply | Value | - | 1.1, 2.1,2.2,2.5.1,4.1.2 |
| CO5 | TPS3 | Apply | Value | - | 1.1, 2.1,2.2,2.5.1,4.1.2 |
| CO6 | TPS3 | Apply | Value | - | 1.1, 2.1,2.2,2.5.1,4.1.2 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 2 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 3 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 4 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 5 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 6 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | 1 | 2 | 3 | |
| Remember | 10 | 10 | 10 | - | - | - | - |
| Understand | 30 | 30 | 30 | - | - | - | 30 |
| Apply | 60 | 60 | 60 | 100 | 100 | 100 | 70 |
| Analyse | | | | | | | |
| Evaluate | | | | | | | |
| Create | | | | | | | |

**Sample Questions for Course Outcome Assessment****

**Course Outcome 1(CO1)**

1. Compute the rank of the matrix $\begin{pmatrix} 4 & 2 & 1 \\ 2 & 0 & 1 \\ 2 & 0 & -1 \\ 1 & 2 & 1 \end{pmatrix}$
2. Solve by Gauss elimination method: $x+y+z=3:\ 2x-y+3z=16;\ 3x+y-z=-3$
3. Obtain LU decomposition: $\begin{pmatrix} 2 & 4 & 5 \\ 4 & 10 & 0 \\ 5 & 0 & 7 \end{pmatrix}$

**Course Outcome 2(CO2)**

1. Verify that $M_3(R)$ is a vector space and identify its dimension.
2. Given the basis $\{1,\ x,\ x^2\}$ for C[-1, 1], construct an orthonormal basis for C[-1, 1].
3. Obtain QR decomposition for the matrix $\begin{pmatrix} 2 & 2 & 0 \\ 1 & 0 & 3 \\ 2 & 0 & 1 \\ 4 & 3 & 1 \end{pmatrix}$

**Course Outcome 3(CO3)**

1. Show that $\left\{\frac{(1,1,1)^T}{\sqrt{3}}, \frac{(2,1,-3)^T}{\sqrt{14}}, \frac{(4,-5,1)^T}{\sqrt{42}}\right\}$ is an orthonormal set in $R^3$

2. Construct a QR decomposition for the matrix $\square = \begin{pmatrix} 4 & 2 & 1 \\ 2 & 0 & 1 \\ 2 & 0 & -1 \\ 1 & 2 & 1 \end{pmatrix}$
3. Construct a QR decomposition for the matrix $\begin{bmatrix} -4 & 2 & 2 \\ 3 & -3 & 3 \\ 6 & 6 & 0 \end{bmatrix}$

**Course Outcome 4 (CO4)**

1. Find the eigen values and eigen vectors for the matrix adj A where A= $\begin{pmatrix} 2 & 4 & 5 \\ 4 & 10 & 0 \\ 5 & 0 & 7 \end{pmatrix}$
2. Let L:$R^3 \rightarrow R^3$ be defined by $L(x, y, z) = (x,\ x + y,\ x + y + z)$. Verify whether L is a linear transformation and if so identify its matrix representation.
3. State and prove any two properties of Hermitian and Unitary matrices.

**Course Outcome 5 (CO5)**

1. Obtain SVD for the matrix i) $\begin{pmatrix} 1 & 1 \\ 1 & 1 \\ 0 & 0 \end{pmatrix}$ ii) $\begin{pmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{pmatrix}$
2. Compute pseudo inverse of the matrix $\begin{pmatrix} 1 & 1 \\ 1 & 1 \\ 0 & 0 \end{pmatrix}$

**Course Outcome 6(CO6)**

1. Calculate PCA for the following data

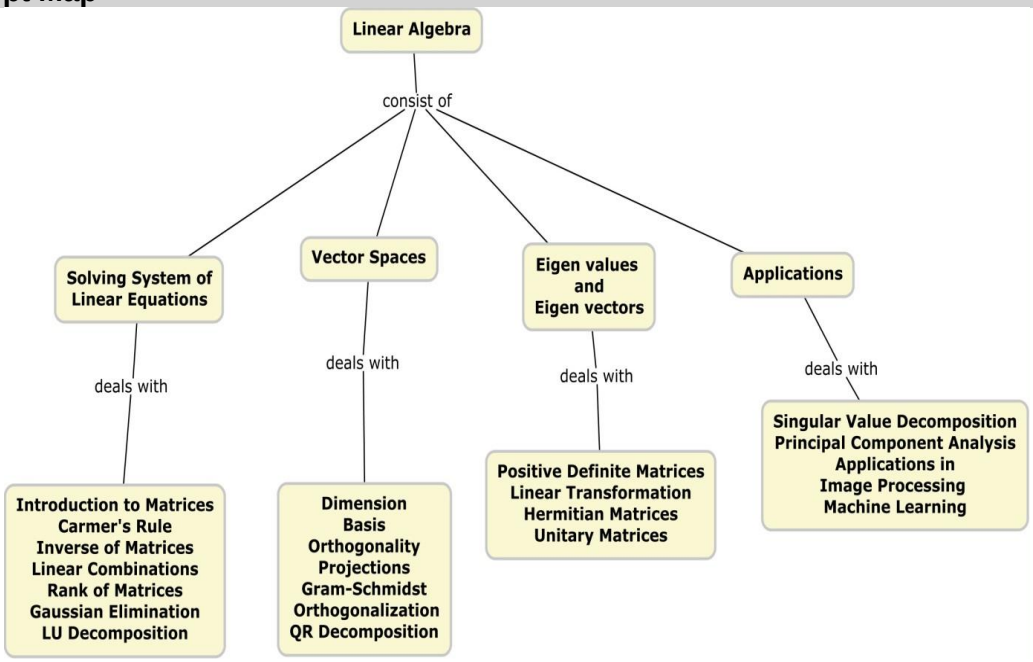
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X: | 2.5 | 0.5 | 2.2 | 1.9 | 3.1 | 2.3 | 2.0 | 1.0 |
| Y: | 2.4 | 0.7 | 2.9 | 2.2 | 3.0 | 2.7 | 1.6 | 1.1 |

2. Calculate PCA for the following trivariate data

| | | | | | |
|---|---|---|---|---|---|
| X: | 60 | 90 | 50 | 30 | 60 |
| Y: | 90 | 30 | 50 | 45 | 60 |
| Z: | 90 | 90 | 50 | 45 | 90 |

3. Apply PCA to i) $\begin{pmatrix} 1 & -1 \\ 0 & 1 \\ -1 & 0 \end{pmatrix}$ ii) $\begin{pmatrix} -1 & -2 & 4 \\ 1 & 3 & 0 \\ 2 & 1 & 3 \end{pmatrix}$

## Concept Map




## Syllabus

**Introduction to Matrices and Determinants** Introduction to Matrices and Determinants; Solution of Linear Equations; Cramer's rule; Inverse of a Matrix.

**Vectors and linear combinations** Rank of a matrix; Gaussian elimination; LU Decomposition; Solving Systems of Linear Equations using the tools of Matrices.

**Vector Space** Vector space; Dimension; Basis; Orthogonality; Projections; Gram-Schmidt orthogonalization and QR decomposition.

**Eigen Values and Eigen Vectors** Eigenvalues and Eigenvectors; Positive definite matrices; Linear transformations; Hermitian and unitary matrices;

**Singular Value Decomposition and Principal component analysis** Introduction to their applications in Image Processing and Machine Learning.

## Learning Resources

1. Higher Engineering Mathematics, B. S. Grewal.
2. Advanced Engineering Mathematics, 7th Edition, Peter V. O'Neil.
3. Advanced Engineering Mathematics, 2nd Edition, Michael. D. Greenberg.
4. Introduction to linear algebra, 5th Edition, Gilbert Strang.
5. Applied Mathematics (Vol. I & II) , by P. N. Wartikar& J. N. Wartikar.
6. Digital Image Processing, R C Gonzalez and R E Woods
7. https://medium.com/@jonathan_hui/machine-learning-singular-value-decomposition-svd-principal-component-analysis-pca-1d45e885e491
8. https://machinelearningmastery.com/introduction-matrices-machine-learning/

**Online course**

https://www.coursera.org/lecture/machine-learning/principal-component-analysis-algorithm-ZYIPa

## Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| **1.** | **Solving System of Linear Equations** | | |
| 1.1 | Introduction to Matrices and Determinants | 1 | CO1 |
| 1.2 | Solution of Linear Equations | 1 | CO1 |

| | | | |
|---|---|---|---|
| 1.3. | Cramer's Rule and Inverse of a Matrix | 1 | CO1 |
| | Tutorial | 1 | CO1 |
| 1.4 | Vectors and Linear Combinations | 1 | CO1 |
| 1.5 | Rank of a Matrix | 1 | CO1 |
| | Tutorial | 1 | CO1 |
| 1.6 | Gaussian Elimination | 1 | CO1 |
| 1.7 | LU Decomposition | 1 | CO1 |
| | Tutorial | 1 | CO1 |
| 1.9 | Solving systems of the linear equations using the tools of the matrices(Iterative Methods) | 1 | CO1 |
| | Tutorial | 1 | |
| **2.** | **Vector Space** | | |
| 2.1 | Vector Space | 2 | CO2 |
| 2.2 | Basis and Dimension | 2 | CO2 |
| | Tutorial | 1 | CO2 |
| 2.3 | Orthogonality | 1 | CO3 |
| 2.4 | Projections | 1 | CO3 |
| | Tutorial | 1 | CO3 |
| 2.5 | Gram-Schmidth Orthogonalisation | 2 | CO3 |
| 2.6 | QR Decomposition | 1 | CO3 |
| | Tutorial | 1 | CO3 |
| **3.** | **Eigen Values and Eigen Vectors** | | |
| 3.1 | Eigen values and Eigen vectors | 3 | CO4 |
| 3.2 | Positive Definite Matrices | 2 | CO4 |
| | Tutorial | 1 | CO4 |
| 3.3 | Linear Transformation and Matrix Representation | 2 | CO4 |
| | Tutorial | 1 | CO4 |
| 3.4 | Hermitian and Unitary Matrices | 2 | CO4 |
| | Tutorial | 1 | CO4 |
| **4.** | **Applications** | | |
| 4.1 | Singular Value Decomposition(SVD) | 3 | CO5 |
| 4.2 | Pseudo inverse | 1 | CO5 |
| | Tutorial | 1 | CO5 |
| 4.3 | Principal Component Analysis(PCA) | 3 | CO6 |
| 4.4 | Applications in Machine Learning | 3 | CO6 |
| | Tutorial | 1 | |

- Assignment : Google Page Rank Algorithm related to matrices and vector(Case Study)

**Course Designers:**

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| 20CB220 | STATISTICAL METHODS |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| BS | 3 | 1 | 0 | 4 |

## Preamble

Statistics as a subject is a science of learning from data and provides tools for making decisions when conditions of uncertainty prevail. Statistical techniques are an important tool in these activities because they provide the engineer with both descriptive and analytical methods for dealing with the variability in observed data. The main objective of this course is to provide students with the foundations of statistical and probabilistic analysis mostly used in various applications in engineering and science as well as which a basic essential mathematics for machine learning. It introduces students to cognitive learning in statistics and develops skills in writing programme language using R.

## Prerequisite

- Nil.

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Use several statistical method for the given data to infer the relation among the given variables. | 20 |
| CO2 | Estimate the population parameters and sufficient statistic. | 15 |
| CO3 | Identify the right test statistic to test the hypothesis formulated from the given data. | 15 |
| CO4 | Use the appropriate non parametric hypothesis testing procedures based on inferences | 15 |
| CO5 | Develop the model for the given time series and estimate the required forecasting. | 15 |
| CO6 | Explore the features of R language to implement statistical tests for the given data. | 20 |

*** Weightage depends on Bloom's Level, number of contact hours.

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | - | 1.1.1, 2.1.4 |
| CO2 | TPS3 | Apply | Value | - | 1.1.1, 2.1.1 |
| CO3 | TPS3 | Apply | Value | - | 1.1.1, 2.1.5, 2.2.1 |
| CO4 | TPS3 | Apply | Value | - | 1.1.1, 2.1.5, 2.2.4 |
| CO5 | TPS3 | Apply | Value | - | 1.1.1, 2.1.1, 2.1.3 |
| CO6 | TPS2 | Understand | Respond | - | 1.1.1, 2.1.1, 4.6.2 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | M | L | L | L | L | L | L | | | L | L | M | L | L |
| CO | S | M | L | L | L | L | L | L | | | L | L | M | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | | | | | | | | | | | | | | |
| CO 3 | S | M | L | L | L | L | L | L | | | L | L | M | L | L |
| CO 4 | S | M | L | L | L | L | L | L | | | L | L | M | L | L |
| CO 5 | S | M | L | L | L | L | L | L | | | L | L | M | L | L |
| CO 6 | M | L | | L | | L | | L | | | L | L | L | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | 1 | 2 | 3 | |
| Remember | 10 | 10 | 10 | - | - | - | - |
| Understand | 30 | 30 | 30 | - | - | - | 30 |
| Apply | 60 | 60 | 60 | 100 | 100 | 100 | 70 |
| Analyse | | | | | | | |
| Evaluate | | | | | | | |
| Create | | | | | | | |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Miniproject /Assignment/Practical Component |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

**Sample Questions for Course Outcome Assessment****

**Course Outcome 1(CO1):**

1. Suppose we have a linear equation through the origin. Estimate the regression line passing through the origin for the following data. Suppose it is not known whether the true regression should pass through the origin. Estimate the regression line.

| x | 0.5 | 1.5 | 3.2 | 4.2 | 5.1 | 6.5 |
|---|---|---|---|---|---|---|
| y | 1.3 | 3.4 | 6.7 | 8.0 | 10.0 | 13.2 |

2. A study was done on a diesel-powered light-duty pickup truck to see if humidity, air temperature, and barometric pressure influence emission of nitrous oxide (in ppm). Emission measurements were taken at different times, with varying experimental conditions. The data are given in Table 12.2. The model is $yi = \beta 0 + \beta 1x1i + \beta 2x2i + \beta 3x3i + \_i, i = 1, 2, \ldots, 20.$ Fit this multiple linear regression model to the given data and then estimate the amount of nitrous oxide emitted for the conditions where humidity is 50%, temperature is 76◦F, and barometric pressure is 29.30.

| Nitrous Oxide y | Humidity $x_1$ | Temp., $x_2$ | Pressure $x_3$ | Nitrous Oxide y | Humidity $x_1$ | Temp., $x_2$ | Pressure $x_3$ |
|---|---|---|---|---|---|---|---|
| 0.90 | 72.4 | 76.3 | 29.18 | 1.07 | 23.3 | 76.8 | 29.38 |
| 0.91 | 41.6 | 70.3 | 29.35 | 0.94 | 47.4 | 86.6 | 28.35 |
| 0.96 | 34.3 | 77.1 | 29.24 | 1.10 | 31.5 | 76.9 | 29.63 |
| 0.89 | 35.1 | 68.0 | 29.27 | 1.10 | 10.6 | 86.3 | 29.56 |
| 1.00 | 10.7 | 79.0 | 29.78 | 1.10 | 11.2 | 86.0 | 29.48 |
| 1.10 | 12.9 | 67.4 | 29.39 | 0.91 | 73.3 | 76.3 | 29.40 |
| 1.15 | 8.3 | 66.8 | 29.69 | 0.87 | 75.4 | 77.9 | 29.28 |
| 1.03 | 20.1 | 76.9 | 29.48 | 0.78 | 96.6 | 78.7 | 29.29 |
| 0.77 | 72.2 | 77.7 | 29.09 | 0.82 | 107.4 | 86.8 | 29.03 |
| 1.07 | 24.0 | 67.7 | 29.60 | 0.95 | 54.9 | 70.9 | 29.37 |

3. Concerns about the increasing friction between some machine parts prompted an investigation of four different types of ball bearings. Five different machines were available and each type of ball bearing was tried in each machine. Given the observations on temperature, coded by subtracting the smallest value, *Machines* 1 2 3 4 5
   *Ball bearing* 1 10 8 7 4 6
   *Ball bearing* 2 10 7 12 5 11
   *Ball bearing* 3 8 9 11 12 10
   *Ball bearing* 4 12 8 6 11 13
   (a) decompose each observation $y_{ij}$ as
   $y_{ij} = y.. + (y_i. - y..) + (y._j - y..)+(y_{ij} - y_i. - y._j + y..)$
   (b) obtain the sum of squares and the degrees of freedom for each component;
   (c) construct the analysis of variance table and test for differences among the bearings using $\alpha = 0.01$.

**Course Outcome 2(CO2):**

1. Apply least square method to fit an exponential curve of the form $Y = ab^X$ to the following data

| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Y | 1.0 | 1.2 | 1.8 | 2.5 | 3.6 | 4.7 | 6.6 | 9.1 |

   The two regression lines are 4x – 5y + 53 = 0 and 20x – 9y = 107 and variance of X is 25. Calculate the values correlation coefficient and variance of Y
2. $X_1$, $X_2$, and X3 is a random sample of size 3 from a population with mean μ and variance $\sigma^2$ . $T_1$, $T_2$, $T_3$ are the estimators used to estimate the mean value μ, where $T_1 = X_1 + X_2 – X_3$ ; $T_2 = 2\ X_1 + 3\ X_3 – 4\ X_2$ and $T_3 = 1/3(\ \lambda\ X_1 + X_2 + X_3)$ (i) Are $T_1$ and $T_2$ unbiased estimators? Find $\lambda$ such that $T_3$ is an unbiased estimator for μ
3. Calculate the maximum likelihood estimator for λ when f (x; λ) is the Poisson distribution

**Course Outcome 3(CO3):**

1. A shoe manufacturer wants potential customers to compare two types of shoes, one made of the current PVC material *X* and one made of a new PVC material *Y*. Shoes made of both are available. Each person, in a sample of 52, is asked to wear one pair of each type for a whole day. After a walk of 2 km, they are asked to score that day's pair on a scale of 1 to 10, with higher scores being better. The differences in scores (New PVC *Y)* − (Current PVC *X*) have mean 2.6 and variance 3.9. Construct a 90% confidence interval for the mean difference.
2. Two different computer processors are compared by measuring the processing speed for different operations performed by computers using the two processors. If

12 measurements with the first processor had a standard deviation of 0.1 GHz and 16 measurements with the second processor had a standard deviation of 0.15 GHz, can it be concluded that the processing speed of the second processor is less uniform? Use a 0.05 level of significance. What assumptions must be made as to how the two samples are obtained?

3. Transceivers provide wireless communication among electronic components of consumer products. Responding to a need for a fast, low-cost test of Bluetooth-capable transceivers, engineers2 developed a product test at the wafer level. In one set of trials with 60 devices selected from different wafer lots, 48 devices passed. Test the null hypothesis $p = 0.70$ against the alternative hypothesis $p > 0.70$ at the 0.05 level of significance.

**Course Outcome 4 (CO4):**

1. The following are 42 consecutive pizza breads baked by a newly improved oven model during 6 weeks: 25, 28, 32, 31, 30, 29, 16, 18, 31, 24, 72, 55, 61, 33, 30, 44, 46, 59, 62, 75, 75, 80, 70, 64, 48, 52, 39, 38, 61, 64, 38, 48, 35, 34, 49, 58, 63, 36, 75, 80, 32, and 48. Use the method of runs above and below the median and the 0.01 level of significance to test the null hypothesis of randomness against the alternative that there is a trend.
2. In a vibration study, certain airplane components were subjected to severe vibrations until they showed structural failures. Given the following failure times (in minutes), test whether they can be looked upon as a sample from an exponential population with the mean $\mu = 10$:
   1.5 10.3 3.6 13.4 18.4 7.7 24.3 10.7 8.4
   15.4 4.9 2.8 7.9 11.9 12.0 16.2 6.8 14.7
   Use the Kolmogorov-Smirnov test with a 0.05 level of significance.
3. The following are the self-reported times (hours for month), spent on homework, by random samples of juniors in two different majors.
   *Major 1*: 63 72 29 58 81 65 79 57 40 76 47 55 60
   *Major 2*: 41 32 26 43 78 49 39 56 15 54 8 66 64
   Use the *U* test at the 0.05 level of significance to test whether or not students from the 2 groups devote the same amounts of time to homework.

**Course Outcome 5 (CO5):**

1. For the model $(1 - B)(1 - 0.2B)X_t = (1 - 0.5B)Z_t$
   (a) Classify the model as an ARIMA (p, *d, q)* process (i.e. find *p, d. q).*
   (b) Determine whether the process is stationary.
2. Suppose that the correlogram of a time series consisting of 100 observations has r1=0.31, r2 = 0.37, r3≈ -0.05, r4=0.06, *r5* = -0.21, r6 = 0.1 li r7 = 0.08, r8 ~0.05, r9=0.12, r10= —0.01
3. For the SARIMA(0, 0, 1)(1, 1, 0)12 model, find forecasts at time # for up to 12 steps ahead in terms of observations and estimated residuals up to time *N.*

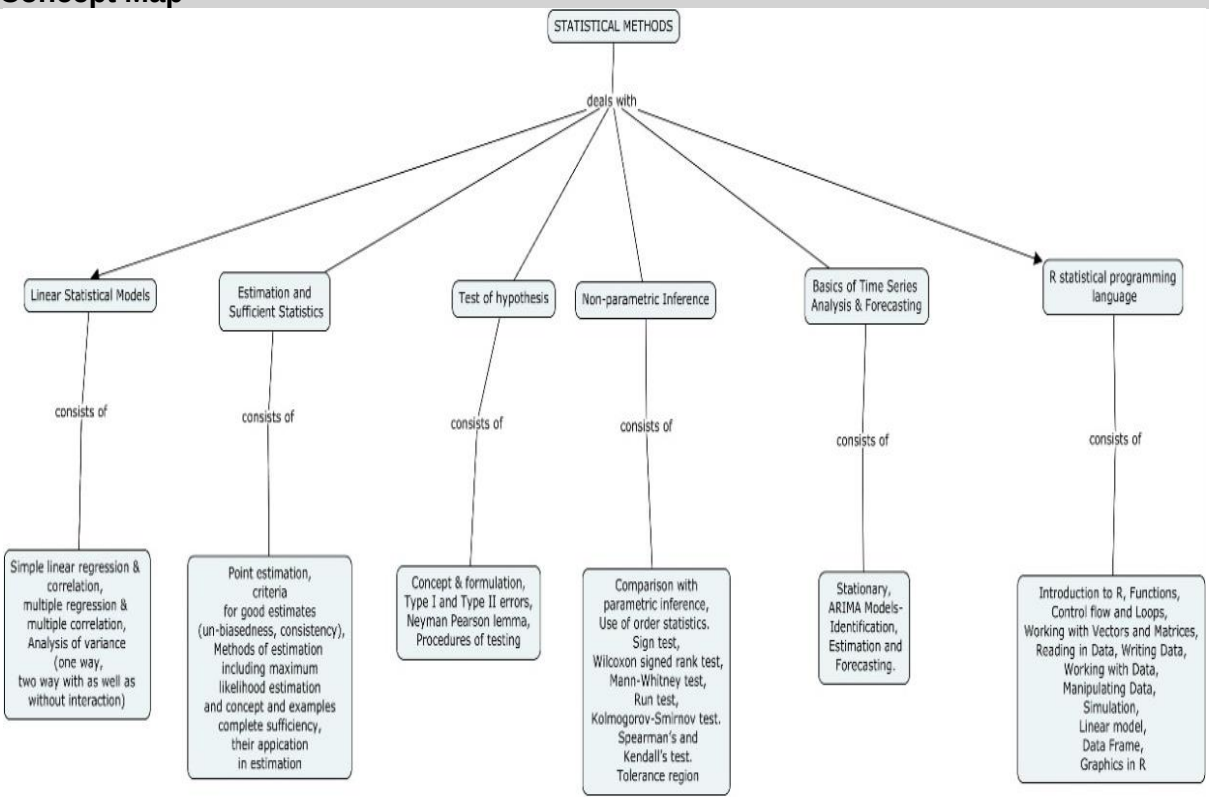
**Course Outcome 6(CO6):**

1. Can you spot the difference between a character string and a number? Which of these are character strings and which are numbers? 1, "1", "one".
2. Create an atomic vector that stores just the face names of the cards in a royal flush, for example, the ace of spades, king of spades, queen of spades, jack of spades, and ten of spades. The face name of the ace of spades would be “ace,” and “spades” is the suit. Which type of vector will you use to save the names?
3. Create the following matrix, which stores the name and suit of every card in a royal flush.

```
## [,1] [,2]
## [1,] "ace" "spades"
```

```
 ## [2,] "king" "spades"
## [3,] "queen" "spades"
## [4,] "jack" "spades"
## [5,] "ten" "spades"
```

## Concept Map




## Syllabus

**Linear Statistical Models**: Simple linear regression & correlation, multiple regression & multiple correlation, Analysis of variance (one way, two way with as well as without interaction)

**Estimation and Sufficient Statistic**: Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation. Sufficient Statistic: Concept & examples, complete sufficiency, their application in estimation

**Test of hypothesis**: Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing.

**Non-parametric Inference:** Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Tolerance region

**Basics of Time Series Analysis & Forecasting:** Stationary, ARIMA Models: Identification, Estimation and Forecasting.

**R statistical programming language:** Introduction to R, Functions, Control flow and Loops, Working with Vectors and Matrices, Reading in Data, Writing Data, Working with Data, Manipulating Data, Simulation, Linear model, Data Frame, Graphics in R

## Learning Resources

1. I.R. Miller, J.E. Freund and R. Johnson, *"Probability and Statistics for Engineers"* 9th Edition, Pearson.

2. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", vol. I & II, World Press.
3. Chris Chatfield, *"The Analysis of Time Series: An Introduction*", 6th edition, Chapman and Hall/CRC.
4. D.C. Montgomery & E.Peck, *"Introduction to Linear Regression Analysis"*, 5th edition, Wiley.
5. A.M. Mood, F.A. Graybill & D.C. Boes, "*Introduction to the Theory of Statistics*", 3rd edition, McGraw Hill.
6. N. Draper & H. Smith, *"Applied Regression Analysis*", 3rd edition, Wiley.
7. Garrett Grolemund, *"Hands-on Programming with R", 1st* edition, O'Reilly.
8. Jared P. Lander, *"R for Everyone: Advanced Analytics and Graphics"*, 2nd edition, Addison-Wesley Professional.

**Course Contents and Lecture Schedule**

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1. | **Linear Statistical Models** | | |
| 1.1 | Simple linear regression & correlation | 2 | CO1 |
| 1.2 | Multiple regression & Multiple correlation | 2 | CO1 |
| 1.3 | Tutorial | 1 | |
| 1.4 | Analysis of variance (one way, two way with as well as without interaction) | 2 | CO1 |
| 1.5 | Tutorial | 1 | |
| 2. | **Estimation and Sufficient Statistic** | | |
| 2.1 | Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency) | 1 | CO2 |
| 2.2 | Methods of estimation including maximum likelihood estimation | 2 | CO2 |
| 2.3 | Tutorial | 1 | |
| 2.4 | Sufficient Statistic: Concept & examples | 1 | CO2 |
| 2.5 | Sufficient Statistic: complete sufficiency | 1 | CO2 |
| 2.6 | Sufficient Statistic: their application in estimation | 1 | CO2 |
| 2.7 | Tutorial | 1 | |
| | Case study problems in correlation analysis and estimation-Assignment-I | | |
| 3. | **Test of hypothesis** | | |
| 3.1 | Concept & formulation, Type I and Type II errors | 2 | CO3 |
| 3.2 | Neyman Pearson lemma | 1 | CO3 |
| 3.3 | Tutorial | 1 | |
| 3.4 | Procedures of testing | 3 | CO3 |
| 3.5 | Tutorial | 1 | |
| 4. | **Non-parametric Inference** | | |
| 4.1 | Comparison with parametric inference, Use of order statistics | 1 | CO4 |
| 4.2 | Sign test, Wilcoxon signed rank test | 1 | CO4 |
| 4.3 | Mann-Whitney test, V | 1 | CO4 |
| 4.4 | Tutorial | 1 | |
| 4.5 | Kolmogorov-Smirnov test | 1 | CO4 |
| 4.6 | Spearman's and Kendall's test | 1 | CO4 |
| 4.7 | Tolerance region | 1 | CO4 |
| 4.8 | Tutorial | 1 | |
| | Case study problems in parametric and non-parametric tests- Assignment II | | |
| 5. | **Basics of Time Series Analysis & Forecasting:** | | |

| | | | |
|---|---|---|---|
| 5.1 | Stationary, ARIMA Models: Identification, Estimation and Forecasting | 3 | CO5 |
| 5.2 | Tutorial | 1 | |
| 6. | **R statistical programming language** | | |
| 6.1 | Introduction to R | 1 | CO6 |
| 6.2 | Functions, Control flow and Loops | 1 | CO6 |
| 6.3 | Working with Vectors and Matrices | 1 | CO6 |
| 6.4 | Tutorial | 1 | |
| 6.5 | Reading in Data, Writing Data, Working with Data, Manipulating Data | 2 | CO6 |
| 6.6 | Simulation | 1 | CO6 |
| 6.7 | Tutorial | 1 | |
| 6.8 | Linear model | 1 | CO6 |
| 6.9 | Data Frame, Graphics in R | 2 | CO6 |
| 6.10 | Tutorial | 1 | |
| | Case study problems in R-tool - Assignment III | | |
| | Total | 48 | |

**Course Designers:**

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2. Ms.H.Sri Vinodhini srivinodhini@tce.edu

| 20CB230 | DATA STRUCTURES AND ALGORITHMS |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| PC | 3 | 1 | 0 | 4 |

## Preamble

This course provides an introduction to the basic concepts and techniques of Linear and nonlinear data Structures and analyzes the various algorithms. It also discusses the use of data structures and the algorithm design techniques to provide efficient software solutions.

## Prerequisite

- 20CB130-Fundamentals of Computer Science

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Construct algorithms for performing operations on a data structure, with an understanding of the trade-off between the time and space complexity. | 20 |
| CO2 | Demonstrate how linear data structures like array, stack, queue and linked list are represented in the main memory and manipulated or used by different operations. | 20 |
| CO3 | Apply non-linear data structures like Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree and Graphs in different operations. | 20 |
| CO4 | Identify the computational efficiency of searching algorithms. | 10 |
| CO5 | Determine the computational efficiency of sorting and hashing algorithms. | 15 |
| CO6 | Illustrate the organization of files and its accessing schemes | 15 |

*** Weightage depends on Bloom's Level, number of contact hours,

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS 3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO2 | TPS 3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO3 | TPS 3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO4 | TPS 3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO5 | TPS 3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO6 | TPS 3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 2 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 3 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 4 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 5 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |
| CO 6 | S | M | L | L | - | L | - | L | | | L | L | M | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | |
| Remember | 10 | 10 | 10 | - | - | - | 10 |
| Understand | 30 | 30 | 10 | - | - | - | 10 |
| Apply | 60 | 60 | 80 | 100 | 100 | 100 | 80 |
| Analyse | | | | | | | |
| Evaluate | | | | | | | |
| Create | | | | | | | |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Miniproject /Assignment/Practical Component |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | 100 |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

**Sample Questions for Course Outcome Assessment****

** (2 to 3 at the cognitive level of course outcome)

**Course Outcome 1(CO1):**

1. There are three towers and sixty four disks of different diameters placed on the first tower. The disks are in order of decreasing diameter as one scans up the tower. Monks were reputedly supposed to move the disks from tower 1 to tower 3 obeying the rules: (i) only one disk can be moved at any time; (ii) no disk can be placed on top of a disk with smaller diameter. Write a recursive procedure which prints the sequence of moves which accomplish this task.
2. Is $f(n) = \Theta(n^2)$, where f(n) is defined to be the running time of the program A(n):

```
def A(n): a tuple = tuple(range(0, n))    # a tuple is an immutable version of a
                                          # list, so we can hash it
S = set()
   for i in range(0, n):
```

```
for j in range(i+1, n):
    S.add(atuple[i:j])          # add tuple (i,...,j-1) to set S.
```

Justify your answer.

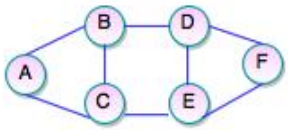
3. Given an array A which stores 0 and 1, such that each entry containing 0 appears before all those entries containing 1. In other words, it is like {0, 0, 0,..., 0, 0, 1, 1,..., 111}. Design an algorithm to find out the small index i in the array A such that A[i] = 1 using c log n instructions in the worst case for some positive constant c.

**Course Outcome 2(CO2):**

1. Two stacks are to be represented in an array V(1:m) .Write algorithms ADD(i.X) and DELETE(i) to add X and delete an element from stack i, $1 \leq i \leq 2$. Your algorithms should be able to add elements to the stacks so long as there are fewer than m elements in both stacks together.
2. Explain how to implement doubly linked lists using only one pointer value x:np per item instead of the usual two (next and prev). Assume that all pointer values can be interpreted as k-bit integers, and define x:np to be x:np D x:next XOR x:prev, the k-bit "exclusive-or" of x:next and x:prev. (The value NIL is represented by 0.) Be sure to describe what information you need to access the head of the list. Show how to implement the SEARCH, INSERT, and DELETE operations on such a list. Also show how to reverse such a list in O(1) time.
3. Write an algorithm to transform from prefix to postfix. Carefully state any assumptions you make regarding the input. How much time and space does your algorithm take?

**Course Outcome 3(CO3):**

1. Write an algorithm which inserts a new node T as the left child of node S in a threaded binary tree. The left pointer of S becomes the left pointer of T.
2. Show how the graph below would look if represented by its adjacency matrix, adjacency lists,adjacency multilist.




3. Write algorithm to insert key values into AVL trees, B-trees of order 3, B*-trees of order 3 and B'-trees of order 3. Evaluate the relative performance of these four representations of internal tables.

**Course Outcome 4 (CO4):**

1. Consider linear search - How many elements of the input sequence need to be checked on the average, assuming that the element being searched for is equally likely to be any element in the array? How about in the worst case? What are the average-case and worst-case running times of linear search ? Justify your answers
2. Consider the searching problem: given an array A[1…n] and a value v output an Index i such that v = A[i] or the special value ϕ if v does not appear in A. If the array J is sorted, we can perform a binary search: compare P with the midpoint of the array and repeat the search on one half of array, eliminating the other half from further consideration.
   (a) Construct a pseudocode for binary search as a recursive procedure.
   (b) Rewrite your binary search procedure in an iterative style.
3. Show that in an undirected graph, classifying an edge (u, v) as a tree edge or a back edge according to whether (u, v)or (v, u) is encountered first during the depth-first search is equivalent to classifying it according to the ordering of the four types in the classification scheme.

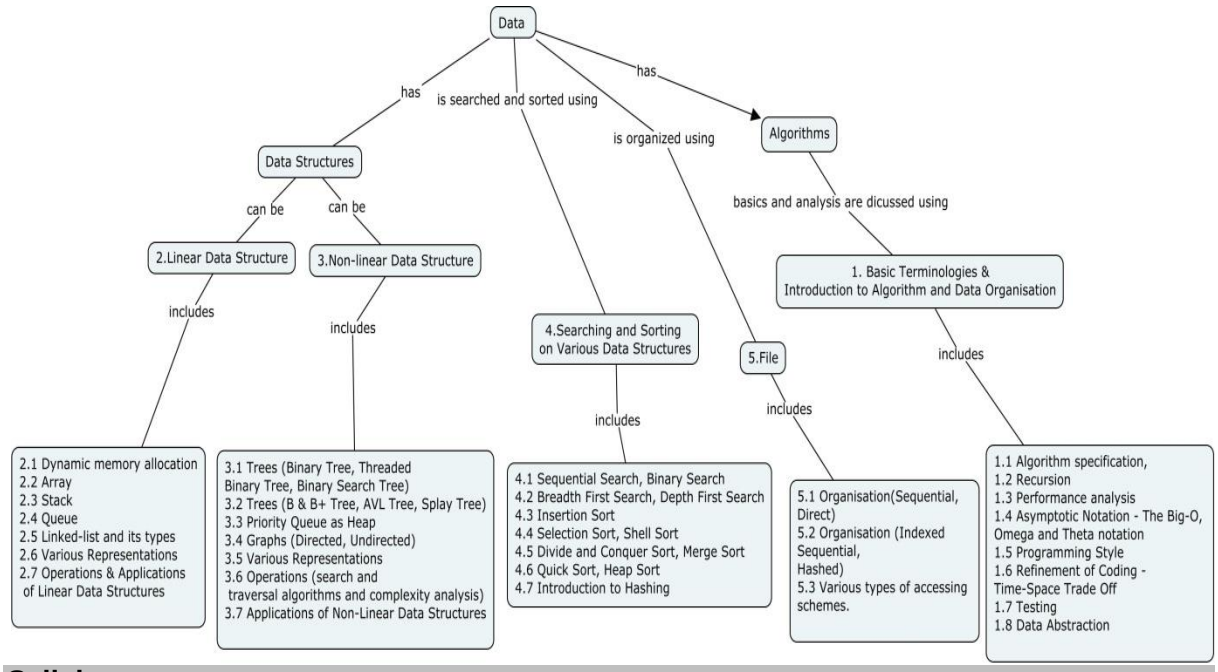
**Course Outcome 5 (CO5):**

1. Consider sorting n numbers stored in array A by first finding the smallest element of A and exchanging it with the element in AOE1_. Then find the second smallest element of A, and exchange it with AOE2_. Continue in this manner for the first n_1 elements of A. Write pseudocode for this algorithm, which is known as selection sort. What loop invariant does this algorithm maintain? Why does it need to run for only the first n _ 1 elements, rather than for all n elements? Give the best-case and worst-case running times of selection sort in ,-notation
2. Show that the running time of QUICKSORT is θ (n2) when the array A contains distinct elements and is sorted in decreasing order.
3. Consider implementing a hash table for an application in which we will build an initial hash table by inserting a substantial collection of records. After this, we expect that the number of insertions and the number of deletions performed to be roughly the same, although there may be long runs of consecutive insertions or consecutive deletions. Furthermore, the table will use a probe strategy to resolve any collisions that occur during insertion, and therefore we will "tombstone" cells from which a record has been deleted. If we implement the hash table described above, then when we search for a record, we cannot conclude the record is not in the table until we have found an empty cell in the table, not just a tombstone. (We will ensurethat the table never reaches the state that there are no empty cells.) Explain carefully why the search cannot stopwhen a tombstone is encountered

**Course Outcome 6(CO6):**

1. Write an algorithm to process a tape file in the batched mode. Assume the master file is ordered by increasing primary key value and that all such values are distinct. The transaction file contains transactions labeled: update, delete and insert. Each such transaction also contains the primary key value of the record to be updated, deleted or inserted. A new updated master file is to be created. What is the complexity of your algorithm?
2. Describe briefly how to do the following:
   (i) In a multilist organization: (a) output all records with KEY1 = PROG and KEY2 = NY. How many accesses are needed to carry this out? (b) Output all records with KEY1 = PROG or KEY2 = NY. How many accesses are needed for this. Assume that each access retrieves only one record.
   (ii) If a ring organization is used instead, what complications are introduced into (a) and (b) above?
3. A 105 record file is maintained as an inverted file on a disk with track capacity 5000 characters. This disk has 200 tracks on each of its 10 surfaces. Each record in the file is 50 characters long and has five key fields. Each key is binary (i.e., has only two distinct values) and so the index for each key can be maintained as a binary bit string of length 105 bits. If 1 character is 6 bits long, then each index takes about 4 tracks. How should the 5 indexes be stored on disk so as to minimize total seek time while processing the indexes in order to determine which records satisfy a given boolean query Q? This processing involves reading in 1 track of each index and testing the query against records represented by this track. Then the next set of index tracks is input and so on. How much time does it take to process all the indexes in order to determine which records are to be retrieved? Assume a seek time of 1/10 sec and a latency time of 1/40 sec. Also assume that only the input time is significant. If k records satisfy this query, how much more time is needed to retrieve these k records? Using other file structures it may be necessary to read in the whole file. What is the minimum time needed to read in the entire file of 105 records? How does this compare with the time needed to retrieve k records using an inverted file structure?

## Concept Map




## Syllabus

**Basic Terminologies &Introduction to Algorithm and Data Organisation:** Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

**Linear Data Structure:** Dynamic memory allocation**,**Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

**Non-linear Data Structure:** Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) , Priority queue as heap, Graphs (Directed, Undirected), Various Representations, Operations (search and traversal algorithms and complexity analysis) & Applications of Non-Linear Data Structures

**Searching and Sorting on Various Data Structures:** Sequential Search, Binary Search, Breadth First Search, Depth First Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort, Introduction to Hashing

**File:** Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.

## Learning Resources

1. E. Horowitz and S. Sahni , Fundamentals of Data Structures , Computer Science Press, 1977.
2. AlfredV.Aho, John E.Hopperoft, Jeffrey D.UIlman, Data Structures and Algorithms,Pearson Education,2002.
3. Donald E. Knuth ,The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth,3rd edition,Pearson Education.
4. Charles E. Leiserson, Thomas H. Cormen, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third edition, PHI, 2010.
5. Pat Morin,Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st ed. Edition , AU Press,2013

**Course Contents and Lecture Schedule**

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1. | **Basic Terminologies &Introduction to Algorithm and Data Organisation** | | |
| 1.1 | Algorithm specification, | 1 | CO1 |
| 1.2 | Recursion | 1 | CO1 |
| 1.3 | Performance analysis | 1 | CO1 |
| 1.4 | Asymptotic Notation - The Big-O, Omega and Theta notation | 1 | CO1 |
| 1.5 | Programming Style | 1 | CO1 |
| 1.6 | Refinement of Coding - Time-Space Trade Off | 1 | CO1 |
| 1.7 | Testing | 1 | CO1 |
| 1.8 | Data Abstraction | 1 | CO1 |
| | Tutorial | 3 | |
| 2 | **Linear Data Structure** | | |
| 2.1 | Dynamic Memory allocation | 1 | CO2 |
| 2.2 | Array | 1 | CO2 |
| 2.3 | Stack | 1 | CO2 |
| 2.4 | Queue | 1 | CO2 |
| 2.5 | Linked-list and its types | 1 | CO2 |
| 2.6 | Various Representations | 1 | CO2 |
| 2.7 | Operations & Applications of Linear Data Structures | 1 | CO2 |
| | Tutorial | 3 | |
| 3 | **Non-linear Data Structure** | | |
| 3.1 | Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree) | 2 | CO3 |
| 3.2 | Trees (B & B+ Tree, AVL Tree, Splay Tree) | 2 | CO3 |
| 3.3 | Priority Queue as Heap | 1 | CO3 |
| 3.4 | Graphs (Directed, Undirected) | 1 | CO3 |
| 3.4 | Various Representations | 1 | CO3 |
| 3.6 | Operations (search and traversal algorithms and complexity analysis) | 1 | CO3 |
| 3.7 | Applications of Non-Linear Data Structures | 1 | CO3 |
| | Tutorial | 3 | |
| 4 | **Searching and Sorting on Various Data Structures** | | |
| 4.1 | Sequential Search, Binary Search | 1 | CO4 |
| 4.2 | Breadth First Search, Depth First Search | 1 | CO4 |
| 4.3 | Insertion Sort | 1 | CO4 |
| 4.4 | Selection Sort, Shell Sort | 1 | CO5 |
| 4.5 | Divide and Conquer Sort, Merge Sort | 1 | CO5 |
| 4.6 | Quick Sort, Heap Sort | 1 | CO5 |
| 4.7 | Introduction to Hashing | 1 | CO5 |
| | Tutorial | 3 | |
| 5 | **File** | | |
| 5.1 | Organisation(Sequential,Direct) | 1 | CO6 |
| 5.2 | Organisation (Indexed Sequential, Hashed) | 2 | CO6 |
| 5.3 | Various types of accessing schemes. | 2 | CO6 |
| | **Total Hours** | 48 | |

**Course Designers:**

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2. Raja Lavanya rlit@tce.edu

| 20CB240 | PRINCIPLES OF ELECTRONICS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 2 | 0 | 0 | 2 |

## Preamble

This course seeks to cover the basics of semiconductor devices including the physics of energy bands, doping and carrier statistics and transport leading up to the understanding of common semiconductor devices including p-n junctions and their applications, BJTs , FETs and MOSFETs. Having learnt the fundamental operating principals of active devices, feedback concept is also introduced to understand the working of amplifiers. The course will also give a flavour of the basics of integrated circuits and to digital electronic fundamentals. The course will ensure that undergraduates, with no background in semiconductors are able to grasp the content. The aim of the course is to develop physics and engineering strategies of semiconductor devices and to discuss their functionalities in modern electronic devices.

## Prerequisite

High school physics & math, 10+2 physics

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Summarize the important concepts related to semiconductor Technology | 10 |
| CO2 | Design and characterization of Diode, BJT and FET devices using specifications from the datasheet. | 25 |
| CO3 | Categorize the feedback mechanisms | 10 |
| CO4 | Design op-amp based circuits | 20 |
| CO5 | Summarize the significance of Digital Systems, how they differ from analog systems and their applications. | 10 |
| CO6 | Apply the principles of Boolean algebra to manipulate and minimize logic expressions to design simple combinational logic circuits using basic gates. | 25 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS2 | Understand | Respond | - | 1.2.3, 2.4.6 |
| CO2 | TPS3 | Apply | Value | - | 1.2.2, 2.1.1, 2.1.2, 2.1.3, 2.5.1 |
| CO3 | TPS2 | Understand | Respond | - | 1.2.3, 2.4.6 |
| CO4 | TPS3 | Apply | Value | - | 1.2.2, 2.1.1, 2.1.2, 2.5.1 |
| CO5 | TPS2 | Understand | Respond | - | 1.2.3, 2.4.6 |
| CO6 | TPS3 | Apply | Value | - | 1.2.2, 2.1.1, 2.1.2, 2.5.1 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | M | L | | | | L | L | L | | L | | L | L | L | L |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 2 | S | M | L | L | | L | L | L | L | L | | L | M | L | L |
| CO 3 | M | L | | | | L | L | L | | L | | L | L | L | L |
| CO 4 | S | M | L | L | | L | L | L | L | L | | L | M | L | L |
| CO 5 | M | L | | | | L | L | L | | L | | L | L | L | L |
| CO 6 | S | M | L | L | | L | L | L | L | L | | L | M | L | L |

S- Strong; M-Medium; L-Low

## Assessment Pattern: Cognitive Domain

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | 1 | 2 | 3 | |
| Remember | - | - | - | - | - | - | - |
| Understand | 40 | 40 | 40 | 50 | - | - | 20 |
| Apply | 60 | 60 | 60 | 50 | 100 | 100 | 80 |
| Analyse | - | 0 | 0 | 0 | 0 | 0 | - |
| Evaluate | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Create | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

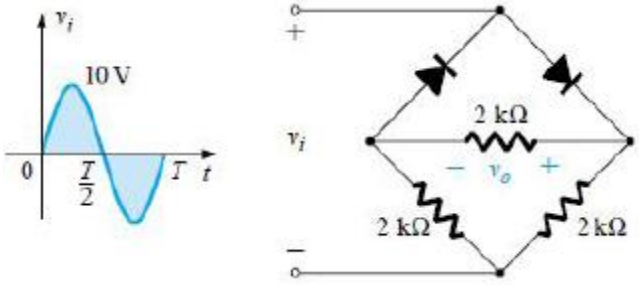
## Sample Questions for Course Outcome Assessment**

**Course Outcome 1(CO1):**

1. Differentiate between intrinsic and extrinsic semiconductors with examples.
2. Calculate the drift velocity of the free electrons in a conductor of area 10-4m2,given the electron density to be 8x1028/m3when a current of 5A flows through it.

**Course Outcome 2(CO2):**

1. Explain the input and output characteristics of BJT in CE configuration
2. Determine the output waveform for the network of Figure and calculate the output dc level and the required PIV of each diode.




**Course Outcome 3 (CO3):**

1. Draw the block diagram of feedback amplifier.
2. Determine the voltage gain, input, and output impedance with feedback for voltage series feedback having *A*=-100, *Ri* = 10 kΩ, *Ro* = 20 kΩ for feedback of (a) β=-0.1 and (b) β=-0.5

**Course Outcome 4 (CO4):**

1. Calculate the maximum frequency for an op-amp with sine wave output voltage of 10 V peak and slew rate is 2 V/μs.
2. Construct an inverting amplifier with gain of 10 and a non-inverting amplifier with gain of 100 using op-amp

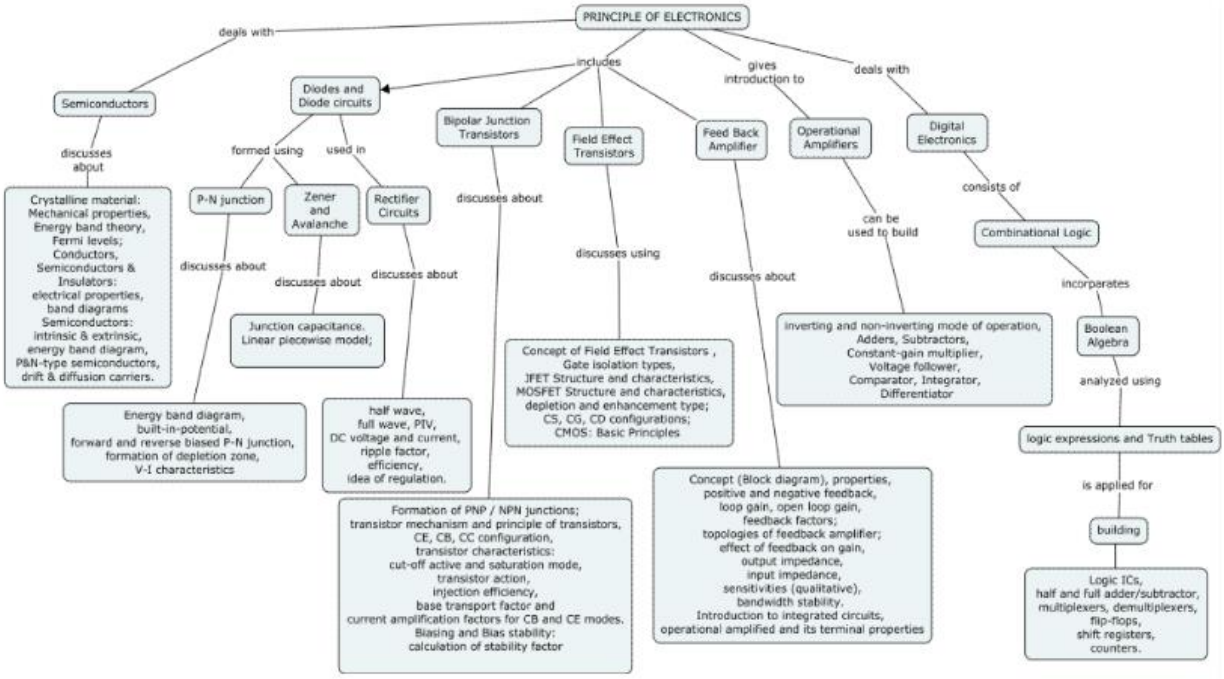
**Course Outcome 5(CO5):**

1. Discuss the advantages of processing information in digital form.
2. Describe the software aspects of Digital design.

**Course Outcome 6(CO6):**

1. Simplify the given logic expression using Demorgan's theorem=(A+B+(AB)'+CD)'
2. Prove the commutative and distributive laws in Boolean algebra.

## Concept Map




## Syllabus

**Semiconductors:** Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers.

**Diodes and Diode Circuits:** Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance. Linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

**Bipolar Junction Transistors:** Formation of PNP / NPN junctions; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, base transport factor and

current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor

**Field Effect Transistors:** Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles

**Feed Back Amplifier, and Operational Amplifiers:** Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability. Introduction to integrated circuits, operational amplified and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator

**Digital Electronics Fundamentals:** Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters.

## Learning Resources


1. Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits: Theory and Application”, 7th Edition, Oxford University Press, 2017.
2. Jacob millman, christos halkias chetan parikh,"Millman's Integrated Electronics "McGraw Hill education (India) private limited,2009
3. M. Morris Mano," *Digital Logic & Computer Design"* Pearson India Educational Services PvT. Limited, 2016
4. Robert L. Boylestad, Louis Nashelsky*,"Electronic Devices and Circuit Theory"*, Pearson India Educational Services PvT. Limited,2015
5. Ben Streetman, Sanjay Banerjee," *Solid State Electronic Devices"*,6th Edition, Prentice Hall of India 2005
6. NPTEL online Course on “Fundamentals of Semiconductor devices”, Course Link: https://onlinecourses.nptel.ac.in/noc19_ee04/
7. https://www.electronics-tutorials.ws/
8. https://circuitverse.org/


## Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1. | **Semiconductors:** Crystalline material: Mechanical properties, Energy band theory | 1 | CO1 |
| 1.1 | Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams | 1 | CO1 |
| 1.2 | Intrinsic & extrinsic, P&N-type semiconductors | 1 | CO1 |
| 1.3 | Drift & diffusion carriers | 1 | CO1 |
| 2 | **Diodes and Diode Circuits:** Formation of P-N junction, built-in-potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics | 1 | CO2 |
| 2.1 | Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance. Linear piecewise model; | 1 | CO2 |
| 2.2 | Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation. | 2 | CO2 |
| 3 | **Bipolar Junction Transistors:** Formation of PNP / NPN junctions; transistor mechanism and principle of | 1 | CO2 |

| | | | |
|---|---|---|---|
| | transistors, | | |
| 3.1 | CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action | 1 | CO2 |
| 3.2 | Injection efficiency, base transport factor and current amplification factors for CB and CE modes. | 1 | CO2 |
| 3.3 | Need for Biasing | 1 | CO2 |
| 4 | **Field Effect Transistors:** Concept of Field Effect Transistors (channel width modulation), Gate isolation; CS, CG, CD configurations; | 1 | CO2 |
| 4.1 | Types, JFET Structure and characteristics, | 1 | CO2 |
| 4.2 | MOSFET Structure and characteristics, depletion and enhancement type | 1 | CO2 |
| 4.3 | CMOS: Basic Principles | 1 | CO2 |
| 5 | **Feed Back Amplifier, and Operational Amplifiers:** Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors | 1 | CO3 |
| 5.1 | Topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability. | 2 | CO3 |
| 5.2 | Introduction to integrated circuits, operational amplified and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier | 1 | CO4 |
| 5.3 | Voltage follower, Comparator, Integrator, Differentiator | 1 | CO4 |
| 6 | **Digital Electronics Fundamentals:** Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols | 1 | CO5 |
| 6.1 | Truth tables, logic expressions, Logic simplification using K- map | 2 | CO6 |
| 6.2 | Logic ICs, half and full adder/ subtractor | 1 | CO6 |
| 6.3 | Concept of Multiplexers, flip-flops, shift registers, counters. | 2 | CO6 |

**Course Designers:**

1. Dr.S.Kanthamani skmece@tce.edu

| 20CB250 | FUNDAMENTALS OF ECONOMICS |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| HSS | 2 | 0 | 0 | 2 |

## Preamble

The objective of this course is to provide the basic knowledge on micro and macroeconomics to analyse the market structure and demand-supply in real time economy. Further it imparts the knowledge of economic decision making by exploring the performance and behaviour of an economy.

## Prerequisite

Nil

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Explain the basic principles and concepts of microeconomics for economic decision making. | 8 |
| CO2 | Select the appropriate microeconomic demand-supply concepts to solve the business problems. | 8 |
| CO3 | Develop a strategy that measure, critique and interpret consumer's behavior in decision making. | 21 |
| CO4 | Make use of the different production and cost functions to derive product decision. | 17 |
| CO5 | Analyze with the macroeconomics components and Keynesian Multiplier to solve the real time economy problems. | 21 |
| CO6 | Examine the banking and central bank's monetary policy concepts in economic development of a nation. | 25 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS2 | Understand | Respond | - | 1.1.1,2.1.3 |
| CO2 | TPS3 | Apply | Value | - | 1.1.1,2.1.3,2.1.4 |
| CO3 | TPS3 | Apply | Value | - | 2.1.3,2.1.4,2.1.5 |
| CO4 | TPS3 | Apply | Value | - | 2.2.4 |
| CO5 | TPS4 | Analyse | Organise | - | 2.5.4,4.3.4 |
| CO6 | TPS3 | Apply | Value | - | 2.5.4,3.1.5,3.2.5 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | M | L | | | | | | | | | | | L | | |
| CO 2 | S | M | L | | | | | | | | | | M | | |
| CO 3 | S | M | L | | | | | | | | | | M | | |
| CO 4 | S | M | L | | | | | | | | | | M | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 5 | S | S | M | L | L | | | M | M | M | L | L | M | M | L |
| CO 6 | S | M | L | | | | | M | L | | | L | M | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Continuous Assessment Tests | | | Assignment | | | Terminal Examination |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | |
| Remember | 20 | 20 | 20 | - | - | - | 20 |
| Understand | 30 | 20 | 20 | - | - | - | 20 |
| Apply | 50 | 60 | 60 | 100 | 60 | 60 | 60 |
| Analyse | 0 | 0 | 0 | 0 | 40 | 40 | 0 |
| Evaluate | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Create | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Miniproject /Assignment/Practical Component |
|---|---|
| Perception | - |
| Set | - |
| Guided Response | - |
| Mechanism | - |
| Complex Overt Responses | - |
| Adaptation | - |
| Origination | - |

**Sample Questions for Course Outcome Assessment****

**Course Outcome 1(CO1):**

1. State the uses of the study of microeconomics.
2. Differentiate between a firm and industry.
3. Explain various types of price elasticity of demand with the help of diagrams.

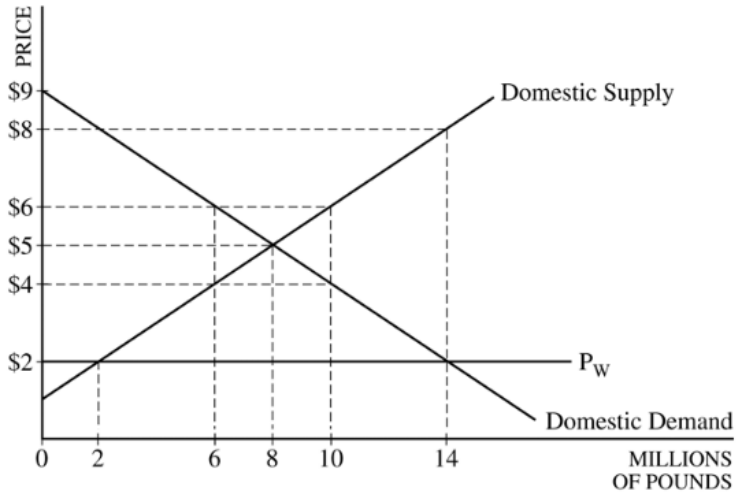
**Course Outcome 2(CO2):**

1. Suppose research shows that the more college education individuals receive, the more responsible citizens they become and the less likely they are to commit crimes.
   (a) Draw a correctly labeled graph for the college education market and show each of the following.
   (i) Private market equilibrium quantity and price of college education, labeled Qm and Pm, respectively
   (ii) Socially optimal quantity of education, labeled Qs
   (iii) Deadweight loss at the market equilibrium, completely shaded
   (b) Assume that the government imposes an effective (binding) price ceiling on the price of college education.
   (i) Show the price ceiling on your graph in part (a), labelling the price ceiling Pc.
   (ii) Does this price ceiling increase, decrease, or have no impact on the deadweight loss in this industry?
2. Assume that the market for avocados is perfectly competitive. The typical firm is earning positive economic profit in the short-run equilibrium. (a) Draw a correctly labeled graph for the typical firm, illustrating the short-run equilibrium and labeling the equilibrium market price and output PE and QE, respectively. (b) Assume there is an increase in the market

wage rate for labor, a variable input. Show on your graph in part (a) the effect of the wage increase on the marginal cost curve in the short run. (c) Assume that avocado producers hire workers from a perfectly competitive labor market. Draw a graph of labor supply and demand for the typical firm and label the supply curve MFC and the demand curve MRP. Assume the market wage rate increases from w1 to w2. Show the effect of the wage increase on the graph, labeling the initial quantity of labor hired QL1 and the new quantity of labor hired QL2.

**Course Outcome 3(CO3):**

1. Assume that the market for good X is perfectly competitive and that the production of good X creates a negative externality. (a) Draw a correctly labelled graph of the market for good X and show each of the following. (i) The marginal private cost and marginal social cost of good X, labeled MPC and MSC, respectively (ii) The market quantity, labeled Qm (iii) The allocatively efficient quantity, labeled Qs (iv) The area of deadweight loss, shaded completely (b) Assume that a lump-sum tax is imposed on the producers of good X. What happens to the deadweight loss? Explain.
2. Sugar is freely traded in the world market. Assume that a country, Loriland, is a price taker in the world market for sugar. Some of the sugar consumed in Loriland is produced domestically while the rest is imported. The world price of sugar is $2 per pound. The graph below shows Loriland's sugar market, and PW represents the world price




(a) At the world price of $2 per pound, how much sugar is Loriland importing?
(b) Suppose that Loriland imposes a per-unit tariff on sugar imports and the new domestic price including the tariff is $4. (i) Identify the new level of domestic production. (ii) Calculate the domestic consumer surplus for Loriland. (iii) Calculate the total tariff revenue collected by the government. (c) Given the world price of $2, what per-unit tariff maximizes the sum of Loriland's domestic consumer surplus and producer surplus?

**Course Outcome 4 (CO4):**

1. The table below shows the output a firm produces using different amounts of capital (K) and labor (L). The markets for capital and labor are perfectly competitive. The rental rate of capital is $75 per unit, and the wage rate is $200 per unit. In the short run, capital is fixed and labor is variable.

| Labor | Output with K=1 | Output with K=2 |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 10 | 20 |
| 2 | 25 | 50 |
| 3 | 38 | 75 |

(a) If the firm uses one unit of capital and one unit of labor, will it be operating with constant, increasing, or decreasing returns to scale? Explain using numbers from the table.
(b) Assume, the firm currently has two units of capital and is using three units of labor.

(i) Calculate the marginal product for the third unit of labor.
(ii) Did the firm experience diminishing marginal returns with the addition of the third unit of labor? Explain using numbers from the table.
(iii) Calculate the firm's average total cost for its current level of production.
(iv) If the firm's output is sold in a competitive market, what is the lowest output price at which the third unit of labor would be hired?

2. Camden's Cakery is one of many dessert cafés serving a local community. Each café produces a slightly differentiated product, there are no barriers to entry or exit, and the firm is in long-run equilibrium.
(a) Draw a correctly labeled graph showing Camden's demand curve, marginal revenue curve, marginal cost curve, and long-run average total cost curve. Label Camden's profit-maximizing output Qm and its price Pm.
(b) On your graph in part (a), label the output at which total revenue is maximized QR.
(c) Do firms in this market experience economies of scale, diseconomies of scale, or neither in long-run equilibrium? Explain.

**Course Outcome 5 (CO5):**

1. Assume a simplified economy where the quantity theory of money holds, with a constant velocity of money circulation *V*, and where all inflation is fully anticipated. Also, this economy does not trade with the rest of the world, and experiences the annual production function $Y=K^{\alpha}L^{1-\alpha}$, where *L* is the total number of worker-hours and *K* is the accumulated capital stock. Assume that all product markets are perfectly competitive and clear instantaneously, that the population is fixed at size *N*, that all individuals work an equal number of hours per year *H*, and that all workers are equally productive. Assume also that the capital stock is fixed for each year, and that there is no depreciation. Finally, assume there is no indirect taxation.
(a) What will the relationship be between gross domestic product (GDP), gross national product (GNP) and national income (NI) for this economy?
(b) By dividing national income *Y* into private consumption spending *C*, government consumption spending *G* and private investment spending *I*, explain how the following macroeconomic variables will be determined in this model. (Assume a constant private savings rate, *s*, and tax burden, *T,* and let the nominal money supply be *M*):
(i) Real GDP (annual)
(ii) Real GDP per capita (annual)
(iii) Real hourly and annual wages.
(iv) Nominal GDP (annual)
(v) Nominal GDP per capita (annual)
(vi) Nominal hourly and annual wages
(vii) Private saving (annual in real terms)
(viii) Private consumption (annual in real terms)

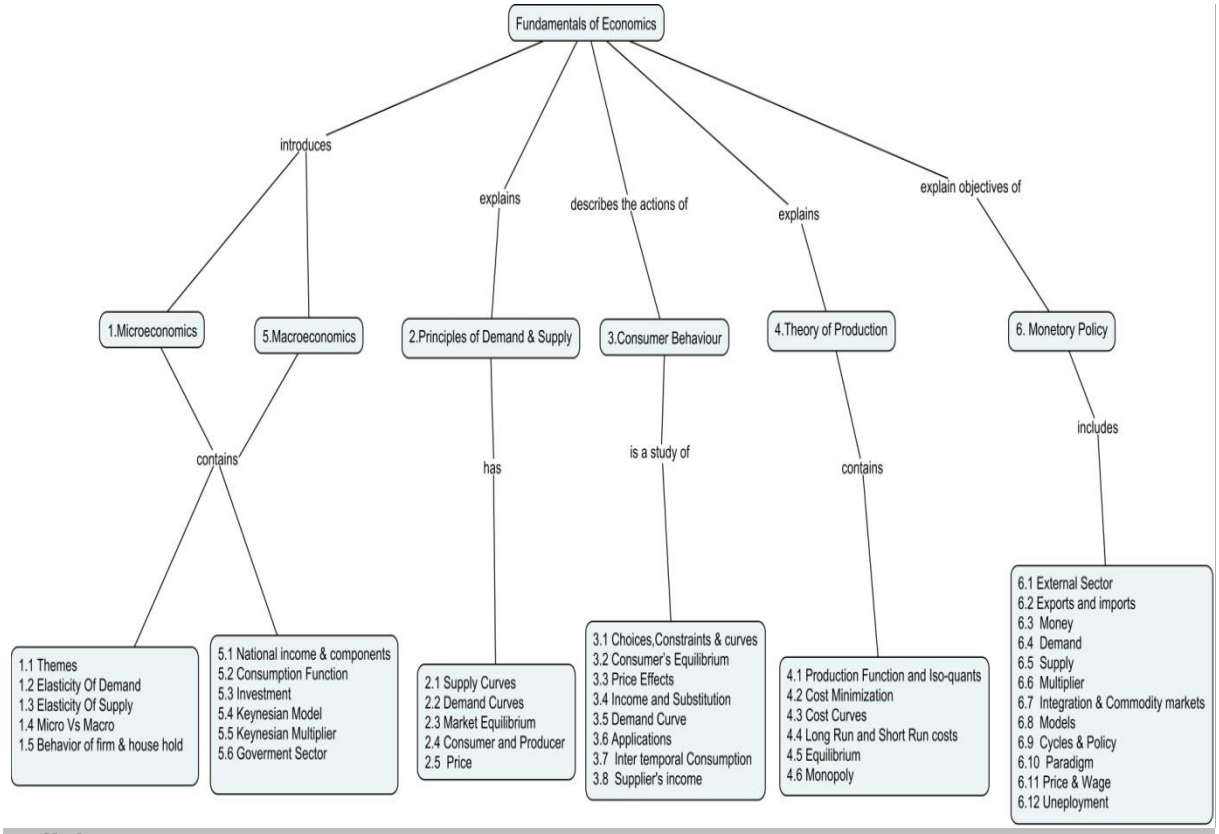
(ix) Private investment (annual in real terms)
(x) The real interest rate.

2. Analyse a Keynesian multiplier model for the short run level of aggregate demand in the closed economy which includes a proportional income tax rate *t*, a private saving rate *s*, exogenous government spending *G0*, autonomous consumption *C0* and autonomous investment *I0*. With reference to the role of the Keynesian multiplier and the circular flow model, explain the effect on (i) the equilibrium level of demand, (ii) equilibrium consumption, (iii) the equilibrium government budget deficit and (iv) equilibrium net private savings of the following:
   (a) An increase in *G0*.
   (b) An increase in *C0*.
   (c) An increase in *I0*.
   (d) An increase in *s*.
   (e) An increase in *t.*
   (f) An increase in government spending, where tax intake is raised simultaneously, so as to maintain a balanced budget.

**Course Outcome 6(CO6):**

1. Use the closed economy IS-LM framework to analyse the impact of each of the following policies on (i) Income/output, (ii) The real interest rate, (iii) Investment, (iv) The government budget deficit.
   Pay particular attention to the role of the slope of the IS and LM curves:
   (a) An increase in government expenditure.
   (b) An increase in the proportional income tax rate.
   (c) An increase in the saving rate.
   (d) An increase in the nominal money supply.
2. Apply the Baumol-Tobin theory of money management to derive the impact of the following on an individual's demand for nominal money balances:
   (a) An increase in the nominal interest rate offered on corporate and government bonds.
   (b) An increase in the riskiness of bonds.
   (c) An increase in real income.
   (d) An increase in the price level.
   (e) A rise in the expected rate of inflation.
   (f) Introduction of charges for withdrawals at cash machines.

## Concept Map




## Syllabus

**Introduction to Microeconomics:** The themes of microeconomics, Elasticity of Supply, Elasticity of Demand, Microeconomics versus Macroeconomics, Behavior of firm and House hold.

**Principles of Demand and Supply:** Supply Curves of Firms — Demand Curves of Households; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve); Welfare Analysis — Consumers' and Producers' Surplus — Price Ceilings and Price Floors.

**Consumer Behaviour:** Axioms of Choice — Budget Constraints and Indifference Curves; Consumer's Equilibrium — Effects of a Price Change, Income and Substitution Effects — Derivation of a Demand Curve; Applications — Tax and Subsidies — Intertemporal Consumption — Suppliers' Income Effect.

**Theory of Production:** Production Function and Iso-quants — Cost Minimization; Cost Curves — Total, Average and Marginal Costs — Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition.

**Introduction to Macroeconomics:** National Income and its Components — GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector — Taxes and Subsidies.

**Monetary Policy:** External Sector — Exports and Imports; Money — Definitions; Demand for Money —Transactionary and Speculative Demand; Supply of Money — Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets — IS, LM Model; Business Cycles and Stabilization — Monetary and Fiscal Policy — Central Bank and the

Government; The Classical Paradigm — Price and Wage Rigidities — Voluntary and Involuntary Unemployment.

## Learning Resources


1. Pindyck, Robert S., and Daniel L. Rubinfeld, "Microeconomics", 8th Edition, The Pearson Education, Inc., 2013.
2. Dornbusch, Fischer and Startz, "Macroeconomics", 13th Edition, McGraw Hill, 2018.
3. Paul Anthony Samuelson, William D. Nordhaus, "Economics", 19th Edition, McGraw Hill International Edition, 2009.
4. https://data.oecd.org/economy.htm
5. https://www.focus-economics.com
6. https://www.rbi.org.in


## Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| **1.** | **Introduction to Microeconomics** | | |
| 1.1 | The themes of microeconomics | | CO1 |
| 1.2 | Elasticity of Supply | | CO1 |
| 1.3 | Elasticity of Demand | 1 | CO1 |
| 1.4 | Microeconomics versus Macroeconomics | | CO1 |
| 1.5 | Behaviour of firm and House hold | 1 | CO1 |
| **2.** | **Principles of Demand and Supply** | | |
| 2.1 | Supply Curves of Firms | | CO2 |
| 2.2 | Demand Curves of Households | 1 | CO2 |
| 2.3 | Market Equilibrium & Comparative Statics | | CO2 |
| 2.4 | Consumers' and Producers' Surplus | 1 | CO2 |
| 2.5 | Price Ceilings and Price Floors | | CO2 |
| **3.** | **Consumer Behaviour** | | |
| 3.1 | Axioms of Choice, Budget Constraints and Indifference Curves | 1 | CO3 |
| 3.2 | Consumer's Equilibrium | 1 | CO3 |
| 3.3 | Effects of a Price Change | | CO3 |
| 3.4 | Income and Substitution Effects | 1 | CO3 |
| 3.5 | Derivation of a Demand Curve | | CO3 |
| 3.6 | Applications: Tax and Subsidies | | CO3 |
| 3.7 | Inter temporal Consumption | 1 | CO3 |
| 3.8 | Suppliers' Income Effect | 1 | CO3 |
| **4.** | **Theory of Production** | | |
| 4.1 | Production Function and Iso-quants | 1 | CO4 |
| 4.2 | Cost Minimization | | CO4 |
| 4.3 | Cost Curves: Total, Average and Marginal Costs | 1 | CO4 |
| 4.4 | Long Run and Short Run Costs | 1 | CO4 |
| 4.5 | Equilibrium of a Firm Under Perfect Competition | 1 | CO4 |
| 4.6 | Monopoly and Monopolistic Competition | | CO4 |
| **5.** | **Introduction to Macroeconomics** | | |
| 5.1 | National Income and its Components | 1 | CO5 |
| 5.1.1 | GNP, NNP, GDP, NDP | | CO5 |
| 5.2 | Consumption Function | 1 | CO5 |
| 5.3 | Investment | | CO5 |
| 5.4 | Simple Keynesian Model of Income | 1 | CO5 |

| | | | |
|---|---|---|---|
| | Determination | | |
| 5.5 | Keynesian Multiplier | 1 | CO5 |
| 5.6 | Government Sector | 1 | CO5 |
| 5.6.1 | Taxes and Subsidies | | CO5 |
| **6.** | **Monetary Policy** | | |
| 6.1 | External Sector | 1 | CO6 |
| 6.2 | Exports and Imports | | CO6 |
| 6.3 | Money — Definitions, Demand for Money | 1 | CO6 |
| 6.4 | Transactionary and Speculative Demand | 1 | CO6 |
| 6.5 | Supply of Money | | CO6 |
| 6.6 | Bank's Credit Creation Multiplier | | CO6 |
| 6.7 | Integrating Money and Commodity Markets | 1 | CO6 |
| 6.8 | IS, LM Model | | CO6 |
| 6.9 | Business Cycles and Stabilization, Monetary and Fiscal Policy | 1 | CO6 |
| 6.10 | Central Bank and the Government; The Classical Paradigm | | CO6 |
| 6.11 | Price and Wage Rigidities | 1 | CO6 |
| 6.12 | Voluntary and Involuntary Unemployment | | CO6 |
| | **Total Hours** | **24** | |

**Course Designers:**

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2. M. Manikandakumar mmrit@tce.edu

| 20CB260 | BUSINESS COMMUNICATION & VALUE SCIENCE – II |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| Project | 2 | - | - | 2 |

## Preamble

This course aims at developing effective reading, writing, presentation and group discussion skills and helps students identify personality traits and evolve as a better team player besides introducing them to key concepts of morality, behaviour and beliefs, and diversity and inclusion.

## Prerequisite

Basic Knowledge of English and completion of 20CB150

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Understand the basic tools of Reading, Writing and Presentation skills | 15 |
| CO2 | Use the skills of reading, writing and presentation skills effectively | 25 |
| CO3 | Comprehend and review the concepts of morality, diversity and inclusion | 15 |
| CO4 | Identify the personality traits and team work | 15 |
| CO5 | Organize and document the concepts and theory dedicated to a social cause. | 20 |
| CO6 | Create an E-Magazine (Morality, diversity and inclusion) | 10 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS2 | Understand | Respond | Guided Response | 1.2, 2.5, 3.1,3.2,3.3.1 3.2.1, 3.2.3,3.2.6,4.2 |
| CO2 | TPS3 | Apply | Value | Guided Response | 1.2, 2.5, 3.1,3.2,3.3.1 3.2.1, 3.2.3,3.2.6,4.2 |
| CO3 | TPS2 | Understand | Respond | Perception | 1.2, 2.5, 3.1,3.2,3.3.1 3.2.1, 3.2.3,3.2.6,4.2 |
| CO4 | TPS2 | Understand | Respond | Perception | 1.2, 2.5, 3.1,3.2,3.3.1 3.2.1, 3.2.3,3.2.6,4.2 |
| CO5 | TPS3 | Apply | Value | Guided Response | 1.2, 2.5, 3.1,3.2,3.3.1 3.2.1, 3.2.3,3.2.6,4.2 |
| CO6 | TPS6 | Create | Characterize | Origination | 4.4.1, 4.4.3, 4.4.6, 4.5 |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | | | | M | L | M | M | M | M | M | L | M | M |
| CO2 | S | M | L | | | M | L | M | M | M | M | M | M | M | M |
| CO3 | M | L | | | | M | L | M | M | M | M | M | L | M | M |
| CO4 | M | L | | | | M | L | M | M | M | M | M | L | M | M |
| CO5 | S | M | L | | | M | L | M | M | M | M | M | M | M | M |
| CO6 | S | | | | | M | L | | | | | S | L | | M |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

**INTERNALS**

No CAT will be conducted.

**SUMMATIVE- Activity Based Evaluation (No External Examination)**

Evaluation is done in classroom activities as given below

| | | | |
|---|---|---|---|
| Reading and Writing | CO1 | UNDERSTAND | 20 |
| Presentation | CO2 | APPLY | 10 |
| E-magazine | CO6 | CREATE | 10 |
| Review on movie | CO3 | UNDERSTAND | 5 |
| Group Discussion/enacting a play | CO4 | APPLY | 5 |

| | | | |
|---|---|---|---|
| Resume Submission | CO1 | | 10 |
| Interview – Immersion | CO5 | | 20 |
| Presentation | CO2 | | 20 |
| | | Total | 100 |

**Assessment Pattern: Psychomotor**

| **Psychomotor Skill** | **Miniproject /Assignment/Practical Component** |
|---|---|
| Perception | |
| Set | |
| Guided Response | 50 |
| Mechanism | 50 |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

**Sample Questions for Course Outcome Assessment****

** (2 to 3 at the cognitive level of course outcome)

**Course Outcome 1(CO1): (20 marks + 10 marks)**

1. Read the following passage and comprehend it. (10 marks)

2. Resume Writing / Blog Writing / Story writing. (5 marks)
3. **A**) **Spot the error**. **(2 marks)**
   If you lend him book (A) he will lend it to someone else (B) and never you get it back (C) No error (D)
   **B**) **Punctuate the following. (3 marks)**
   i remember the maps of the holy land coloured they were very pretty the dead sea was pale and blue the very look of it made me thirsty

**Course Outcome 2(CO2): (10 marks + 20 marks)**

Individual presentation on any one of the topics given:

1. Social media in the classroom
2. Lack of practical knowledge in the education system
3. The history behind the currency

**Course Outcome 3(CO3): (5 marks)**

Write a review on an English movie that you watched recently (Or) Write a review on your favourite story book.

**Course Outcome 4 (CO4): (5 marks)**

**Group Discussion**

1. Digital India: Whom does it Benefit?
2. Future of Crypto currencies.
3. Which is more important creativity or efficiency?

**(Or)**

**Skit**

**Select any one the topic and enact a play**

1. Child right to Education
2. Unemployment
3. Women Empowerment

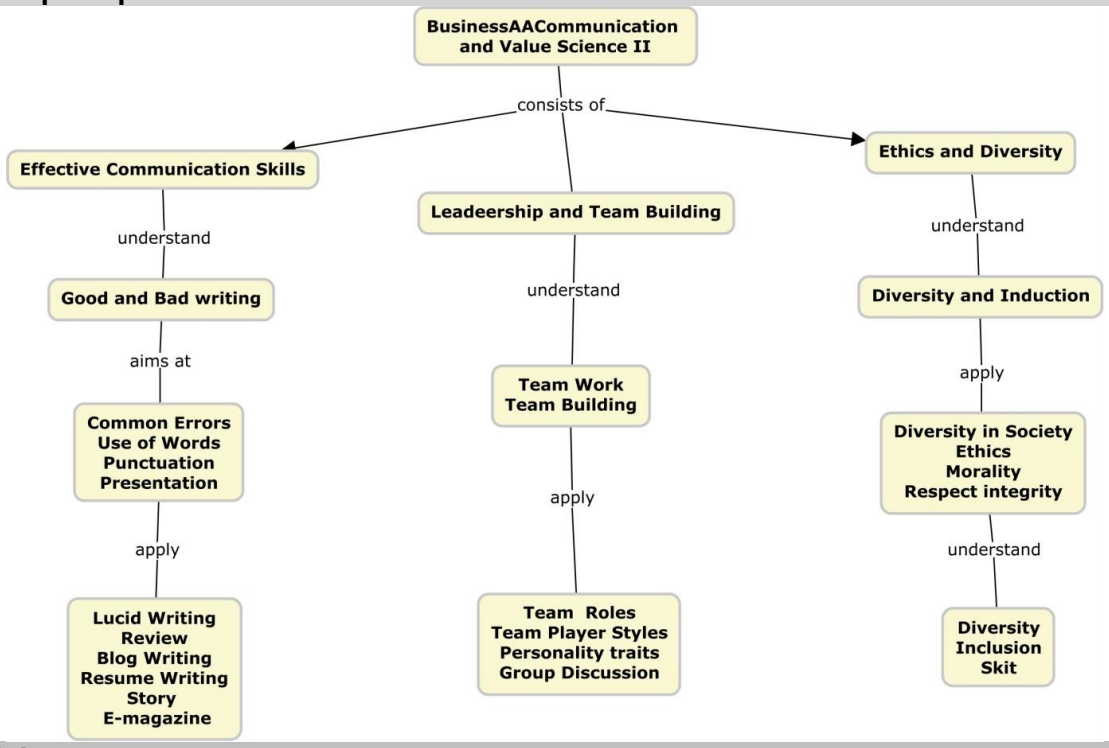
**Course Outcome 5 (CO5): (20 Marks)**

Interview and Immersion

**Course Outcome 6 (CO6): (10 marks)**

Create an **E-Magazine** based on the concepts of morality, diversity and inclusion

## Concept Map




## Syllabus

Effective Communication Skills: Good and Bad Writing – Common Errors, Punctuation rules, Use of Words, Lucid Writing, Speed Reading, Skimming, Scanning, Presentation Techniques, Book/Film/Incident Review, Blog Writing, Resume Writing, Story Writing, E Magazine

Leadership and Team Building: Team Work, Team Building, Introduction to Dr. Meredith Belbin and his 8 Team Roles and Team Player Styles, Lindgren's Big 5 Personality Traits, Myer Brigg's Questionnaire, Team Falcon Practical to identify individual personality traits, Group Discussion.

Ethics and Diversity: Diversity and Inclusion, Different types of Diversity in Society, Ethics, Morality and respect for individuals, Case study discussion be used to learn Values, Respect for individual and integrity, understanding Diversity inclusion, Skit,

## Learning Resources

| | |
|---|---|
| **Text Books:** There are no prescribed texts for Semester 2 – there will be handouts and reference links shared | |
| **Reference Books:** | |
| 1 | Guiding Souls : Dialogues on the purpose of life; Dr. A.P.J Abdul Kalam ;Publishing Year-2005; Co-author—ArunTiwari |
| 2 | The Family and the Nation; Dr. A.P.J Abdul Kalam; Publishing year: 2015; Co-author: AcharyaMahapragya |
| 3 | The Scientific India: A twenty First Century Guide to the World around Us; Dr. A.P.J Abdul Kalam; Publishing year: 2011; Co-author- Y.S.Rajan |
| 4 | Forge Your Future: Candid, Forthright, Inspiring ; Dr. A.P.J Abdul Kalam; Publishing year: 2014 |

| | |
|---|---|
| 5 | Abundance: The Future is Better Than You Think; Peter H. Diamandis and Steven Kotler; Published: 21 Feb, 2012; Publisher: Free Press |
| 6 | Start With Why: How Great Leaders Inspire Everyone to Take Action; Simon Sinek; Published: 6 October 2011; Publisher: Penguin |
| 7 | Advertising & IMC: Principles and Practice; Sandra Moriarty, Nancy D. Mitchell, William D. Wells; Published: 15 June 2016; Publisher: Pearson Education India |
| **Web References:** | |
| 1 | ETHICS FUNDAMENTALS AND APPROACHES TO ETHICS https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf |
| 2 | A Framework for Making Ethical Decisions https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions |
| 3 | Five Basic Approaches to Ethical Decision- http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf |
| **Online Resources:** | |
| 1 | https://youtu.be/CsaTslhSDI |
| 2 | https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M |
| 3 | https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y How To Begin Your Presentation with Simon Sinek |
| 4 | https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be POWER Writing - Write ANYTHING in English Easily |
| 5 | https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be |

Course Contents and Lecture Schedule

| Module No. | Topic | No. of Hours | Course Outcome |
|---|---|---|---|
| 1.1 | Introduction, Identification of a social issue for presentation | 1 | CO2 |
| 1.2 | Presentation of the social issue in groups | 2 | CO2 |
| 1.3 | Good and Bad writing - common errors and punctuation rules | 1 | CO1 |
| 1.4 | Elevator pitch | 1 | CO1 |
| 1.5 | Discussion on Writing techniques by Catherine Morris & Joanie Mcmahon | 2 | CO1 |
| 1.6 | Planning and designing of E magazine with objective & guidelines | 1 | CO5 |
| 1.7 | Creating and the launching of E-magazine | 2 | CO6 |
| 2.1 | Introduction to basic presentation skills & practice using ORAI app | 2 (lab) | CO1 |
| 2.2 | Introduction and practice to skimming and scanning | 2 | CO1 |
| 2.3 | Introducing Dr. Meredith Belbin's research on teamwork | 1 | CO4 |
| 2.4 | Watching Belbin's 8 Team roles, 8 team player styles and Lindgren's Big 5 personality traits | 1 (lab) | CO4 |
| 2.5 | Myer Brigg's AVK Method questionnaire | 1(lab) | CO4 |
| 2.6 | Creating a story in groups based on the social issue - feedback | 2 1 | CO5 |
| 2.7 | Researching on a book, or film akin to the topic of your social issue and writing about it | 2 1 | CO3 |
| 3.1 | Watching a short film on Diversity and discussing in groups | 1 (lab) | CO4 |
| 3.2 | Watching the film "The Fish and I" and debriefing in classroom | 2 1 (lab) | CO3 |
| 3.3 | Introduction to Diversity and Inclusion with reference to our society | 1 | CO3 |
| 3.4 | Debating on the topic of diversity with an angle of ethics, morality and respect for individual | 2 | CO3 |

| | | | |
|---|---|---|---|
| 3.5 | Narrating the challenges faced by a member of a diverse group in 4 minutes | 2 | CO3 |
| 3.6 | (Case study discussion be used to learn Values, respect for individual and integrity ) Discussing on Values, Respect for individual and integrity using appropriate case study. | 2 | CO1 |
| 3.7 | Preparing a CV with the activities done so far | 2 | CO1 |

**Course Designers:**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| 20CB270 | DATA STRUCTURES AND ALGORITHMS LAB |
|---|---|

| Category | L | T | P | Credit |
|---|---|---|---|---|
| PC | 0 | 0 | 4 | 2 |

## Preamble

The laboratory course is designed to enable the students to solve simple mathematical, numerical and engineering problems and provide solutions using suitable data structures. The list of experiments includes the implementation of various linear and non-linear data structures and traversal through graphs. These experiments will strengthen the concepts learnt in the corresponding theory course.

## Prerequisite

20CB130: Fundamentals of Computer Science

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Construct and Implement the stack and queue functionality for suitable applications. | 20 |
| CO2 | Implement the operations in linked list data structure for suitable applications | 20 |
| CO3 | Implement appropriate data structure for string manipulations and text editors | 10 |
| CO4 | Implement appropriate searching and sorting techniques, with an understanding of the trade-off between the time and space complexity. | 20 |
| CO5 | Implement graph traversals and manipulate with disjoint sets. | 20 |
| CO6 | Manipulate files to store and retrieve non-linear data structure. | 10 |

*** Weightage depends on Bloom's Level, number of contact hours,

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO2 | TPS3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO3 | TPS3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO4 | TPS3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO5 | TPS3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |
| CO6 | TPS3 | Apply | Value | Mechanism | 1.2, 2.1.5,2.2.3,2.5.1,3.2.3, 4.5.3 |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | M | L | L | L | L | - | L | M | L | L | L | M | L | L |
| CO 2 | S | M | L | L | L | L | - | L | M | L | L | L | M | L | L |
| CO 3 | S | M | L | L | L | L | - | L | M | L | L | L | M | L | L |
| CO 4 | S | M | L | L | L | L | - | L | M | L | L | L | M | L | L |
| CO 5 | S | M | L | L | L | L | - | L | M | L | L | L | M | L | L |
| CO 6 | S | M | L | L | L | L | - | L | M | L | L | L | M | L | L |

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

| Cognitive Levels | Model Examination | Terminal Examination |
|---|---|---|
| Remember | | |
| Understand | | |
| Apply | 100 | 100 |
| Analyse | | |
| Evaluate | | |
| Create | | |

**Assessment Pattern: Psychomotor**

| Psychomotor Skill | Miniproject /Practical Component/Observation |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | 100 |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

**List of Experiments/Activities with CO Mapping**

| Module No. | Topic | Course Outcome |
|---|---|---|
| 1 | Implementation of Stack using arrays and linked list. | CO1 |
| 2 | Implementation of Queue using arrays and linked list. | CO1 |
| 3 | Implementation of Towers of Hanoi using user defined stacks. | CO1 |
| 4 | Implementation of Singly Linked List. | CO2 |
| 5 | Implementation of Doubly Linked List. | CO2 |
| 6 | Implementation of reading, writing, and addition of polynomials. | CO2 |
| 7 | Implementation of Line editor. | CO3 |
| 8 | Implementation of Binary Search Tree operations and traversals | CO4 |

| | | |
|---|---|---|
| 9 | Implementation of AVL Tree. | CO4 |
| 10 | Implementation of B Tree. | CO4 |
| 11 | Implementation of Merge sort and Quick sort | CO4 |
| 11 | Implementation of Disjoint Set. | CO5 |
| 12 | Implementation of Breadth First Traversal and Depth First Traversal | CO5 |
| 13 | Saving / retrieving non-linear data structure in/from a file | CO6 |
| | **Total sessions** | |

## Learning Resources


1. E. Horowitz and S. Sahni , Fundamentals of Data Structures , Computer Science Press, 1977.
2. AlfredV.Aho, John E.Hopperoft, Jeffrey D.Ullman, Data Structures and Algorithms,Pearson Education,2002.
3. Donald E. Knuth ,The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth,3rd edition,Pearson Education.
4. Charles E. Leiserson, Thomas H. Cormen, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third edition, PHI, 2010.
5. Pat Morin,Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st ed. Edition , AU Press,2013


## Course Designers:


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| 20CB280 | PRINCIPLES OF ELECTRONICS LAB | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 0 | 0 | 2 | 1 |

## Preamble

The goal of this course is to supplement the theory course '20CB280 Principles of Electronics' by giving a practical exposure to the students to learn the characteristics of various electronic devices such as diodes, BJT,FET that are used nowadays in most of the electronic circuits. The students also learn the design and the construction of different electronic circuits based on the above electronic devices.

## Prerequisite

NIL

## Course Outcomes

On the successful completion of the course students will be able to

| CO Number | Course Outcome Statement | Weightage*** in % |
|---|---|---|
| CO1 | Study the characteristics of Diodes experimentally | 20 |
| CO2 | Find the equivalent circuit parameters of the given BJT,FET experimentally | 20 |
| CO3 | Analyze the characteristics of the designed zener regulator for the given specifications experimentally | 10 |
| CO4 | Analyze the performance of the diode rectifier circuit for the given specifications experimentally | 10 |
| CO5 | Analyze the performance of the designed amplifiers to meet the given specifications experimentally | 20 |
| CO6 | Demonstrate minimization of the given Boolean function using K-Map and realize it using logic gates | 20 |

## CO Mapping with CDIO Curriculum Framework

| CO # | TCE Proficiency Scale | Learning Domain Level | | | CDIO Curricular Components (X.Y.Z) |
|---|---|---|---|---|---|
| | | Cognitive | Affective | Psychomotor | |
| CO1 | TPS3 | Apply | Value | Mechanism | 1.2.3, 2.2.3,4.3.2,4.5.4,4.6.1 |
| CO2 | TPS3 | Apply | Value | Mechanism | 1.2.3, 2.2.3,4.3.2,4.5.4,4.6.1 |
| CO3 | TPS4 | Analyze | Organize | Complex Overt Responses | 1.2.3, 2.2.3,4.3.2,4.5.4,4.6.1 |
| CO4 | TPS4 | Analyze | Organize | Complex Overt Responses | 1.2.3, 2.2.3,4.3.2,4.5.4,4.6.1 |
| CO5 | TPS4 | Analyze | Organize | Complex Overt Responses | 1.2.3, 2.2.3,4.3.2,4.5.4,4.6.1 |
| CO6 | TPS3 | Apply | Value | Mechanism | 1.2.3, 2.2.3,4.3.2,4.5.4,4.6.1 |

## Mapping with Programme Outcomes and Programme Specific Outcomes

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | S | M | L | L | S | | | M | M | M | L | L | M | M | L |
| CO 2 | S | M | L | L | S | | | M | M | M | L | L | M | M | L |
| CO 3 | S | S | S | M | S | | | M | M | M | L | L | S | M | L |
| CO 4 | S | S | S | M | S | | | M | M | M | L | L | S | M | L |
| CO 5 | S | S | S | M | S | | | M | M | M | L | L | S | M | L |
| CO 6 | S | M | L | L | S | | | M | M | M | L | L | M | M | L |

S- Strong; M-Medium; L-Low

## Assessment Pattern: Cognitive Domain

| Cognitive Levels | Model Examination | Terminal Examination |
|---|---|---|
| Remember | | |
| Understand | | |
| Apply | 20 | 20 |
| Analyse | 50 | 50 |
| Evaluate | | |
| Create | | |

## Assessment Pattern: Psychomotor

| Psychomotor Skill | Practical Component |
|---|---|
| Perception | |
| Set | |
| Guided Response | |
| Mechanism | 30 |
| Complex Overt Responses | |
| Adaptation | |
| Origination | |

## List of Experiments/Activities with CO Mapping

| Sl.No. | Name of the Experiment | Course Outcome |
|---|---|---|
| 1. | Familiarization of CRO,DSO,AFO, Bread board ,Devices, Data sheet | CO1 - CO6 |
| 2. | Characteristics of PN junction diode and Zener diode | CO1 |
| 3. | Design of DC voltage regulator using zener diode | CO3 |

| | | |
|---|---|---|
| 4. | Design of Rectifier with and without filter | CO1 |
| 5. | Characteristics of BJT, FET | CO2 |
| 6. | Design of CE amplifier | CO5 |
| 7. | Simplification and Realization of digital circuits using logic gates | CO6 |

## Learning Resources


1. Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits: Theory and Application”, 7th Edition, Oxford University Press, 2017.
2. Jacob millman, christos halkias chetan parikh,"Millman's Integrated Electronics "Macgraw Hill education (india) private limited,2009
3. M. Morris Mano," *Digital Logic & Computer Design"* Pearson India Educational Services PvT. Limited, 2016
4. Robert L. Boylestad, Louis Nashelsky*,"Electronic Devices and Circuit Theory"*, Pearson India Educational Services PvT. Limited,2015
5. Ben Streetman, Sanjay Banerjee," *Solid State Electronic Devices"*,6th Edition, Prentice Hall of India 2005
6. NPTEL Video Lecture on “Basic Electronics and Lab” , weblink: https://nptel.ac.in/courses/122106025
7. MIT Video Lecture on “Circuits and Electronics” , weblink: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/index.htm


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