

## B.Sc. TABLE OF CONTENTS

		Page Numbers
<b>Foreword</b>		
<b>VFSTR - Vision &amp; Mission</b>		
<b>Vision &amp; Mission</b>		
<b>PEO's, PSO's and PO's</b>		
<b>Curriculum Structure</b>		
<b>Course Contents</b>		
<b>I YEAR I SEMESTER</b>		11
22BS101	Technical English Communication	13
22BS102	Calculus	16
22BS103	Descriptive Statistics and Probability Distributions	18
22BS104	Programming in C	20
22BS105	IT Workshop	30
<b>I YEAR II SEMESTER</b>		
22BS107	Digital Logic & Computer Organisation	33
22BS108	Algebra	36
22BS109	Mathematical Expectation and Probability Distributions	38
22BS110	Data Structures	40
<b>II YEAR I SEMESTER</b>		
22BS201	English Proficiency and Communication skills	47
22BS202	Discrete Mathematicakl Structure	49
22BS203	Statistical Methods	51
22BS204	Database Management Systems	53
22BS205	Object Oriented Programming	55
22BS206	Environmental Science	59
<b>II YEAR II SEMESTER</b>		
22BS208	Business English Communication – I	61
22BS209	Business English Communication (BEC) II	63
22BS210	Differential Equations	65
22BS211	Statistical Inference	67
22BS212	Operating Systems	69
22BS213	Design and Analysis of Algorithms	72
<b>III YEAR I SEMESTER</b>		
22BS301	Linear Algebra	77
22BS302	Real Analysis	79
22BS303	Sampling Techniques	81
22BS304	Econometrics	83
22BS305	Computer Networks	85
22BS306	Cyber Security	87
22BS307	Software Engineering	89

<b>III YEAR II SEMESTER</b>		
	*Mathematics Elective	
	*Statistics Elective	
	*Computer Elective	
22BS308	Project	
<b>SEMESTER ELECTIVE POOLS</b>		
22BS801	Analytical Geometry	95
22BS802	Graph Theory	97
22BS803	Numerical Analysis	99
22BS804	Complex Analysis	101
22BS805	Number Theory	103
22BS806	Integral Transforms	105
22BS811	Design of Experiments	107
22BS812	Statistical analysis through SPSS/R	109
22BS813	Advanced Probability	111
22BS814	Operations Research	113
22BS815	Applied Statistics	115
22BS821	Formal Languages and Automata Theory	117
22BS822	Machine Learning	121
22BS823	Web Technologies	124
22BS824	Python Programming	127

## FOREWORD

The vital aspect of B.Sc. program is to analyse and interpret data sets to build predictive models. This requires essentially mathematical skills to process large amount of data, statistical skills to interpret meaningful insights from the data and programming skills to organize unstructured data, identify data patterns, access the data, retrieving the data in a required format and handling complex and challenging large datasets. BSc graduates acquire these skills through their course of study.

R22 Curriculum enables our students to start with the basics of mathematics, statistics and introductory programming courses. Further, they learn the mathematical foundations of computing; get hands-on experience in programming and pursue advanced courses such as Artificial Intelligence, Machine Learning, Big Data & Analytics and much more.

The Board of Studies of B.Sc. Programme consists of a right mix of eminent personalities from Academic, Research and Industry Organizations, besides experienced faculty members of the University.

External BoS Members:

1. Prof. Y. N. Reddy, Professor, Department of CSE, NIT Warangal.
2. Dr. ED. Boobalan, Data Scientist, ZakApps software pvt ltd., Chennai, India

I thank all the BOS members, Academic Council Members and University authorities for their continuous support and encouragement towards design of this innovative curriculum for B.Sc.

**Dr. P.L.N.Varma,**  
HoD, Department of Mathematics  
VFSTR Deemed to be University



**VIGNAN'S**

Foundation for Science, Technology & Research

(Deemed to be **UNIVERSITY**)

-Estd. u/s 3 of UGC Act 1956

## **VISION**

To evolve in to a centre of excellence in Science & Technology through creative and innovative practices in teaching-learning, towards promoting academic achievement and research excellence to produce internationally accepted, competitive and world class professionals who are psychologically strong and emotionally balanced imbued with social consciousness and ethical values.

## **MISSION**

To provide high quality academic programmes, training activities, research facilities and opportunities supported by continuous industry-institute interaction aimed at promoting employability, entrepreneurship, leadership and research aptitude among students and contribute to the economic and technological development of the region, state and nation.

## **B.Sc. (Mathematics, Statistics and Computer Science)**

### **Programme Educational Objectives (PEOs)**

- PEO1:** Graduates will pursue higher studies in related fields including management
- PEO2:** Graduates will perform as employers in private/government institutions rising up to top positions
- PEO3:** Graduates will become entrepreneurs

### **Programme Specific Outcomes (PSOs)**

- PSO1:** Graduates will acquire a comprehensive knowledge and sound understanding of fundamentals of Mathematics, computer and statistics and develop practical, analytical and mathematical skills
- PSO2:** Graduates will be prepared to acquire a range of general skills, to solve problems, to evaluate information, to use computers productively, to communicate with society effectively and learn independently.
- Graduates will acquire a job efficiently in diverse fields such as Science , Education, Banking, Public Services, Business etc.,

### **Programme Outcomes (POs)**

- PO1:** Understanding and Thinking: understanding of mathematical concepts and concerned structures, and should be able to follow the basics of logic to accurate the studies and make a valid conclusion and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO2:** Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- PO3:** Design and Application: Select, design and apply appropriate experiment techniques along with IT tools to solve various problems.
- PO4:** Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO5:** Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
- PO6:** Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.



## Annexure - I R-22 CURRICULUM

(Applicable for students admitted into First Year from academic year 2022-23 onwards)

### I Year I Semester (Semester I)

Subject Code	Course Title	L	T	P	C	Course Category	Offered by
22BS101	Technical English Communication	2	2	2	4	Humanities	English
22BS102	Calculus	3	2	0	4	Core	Mathematics
22BS103	Descriptive Statistics and Probability Distributions	3	0	2	4	Core	Statistics
22BS104	Programming in C	2	0	4	4	Core	Computer Science
22BS105	IT Workshop	0	2	4	3	Life Skills	Computer Science
22BS106	Sports and Physical Fitness/ NCC/NSS			3	1	Binary Grade	
	<b>Total Credits</b>	<b>10</b>	<b>6</b>	<b>15</b>	<b>20</b>		
		<b>31 hr</b>					

### I Year I/II Semester (Semester 1/2)

Subject Code	Course Title	L	T	P	C	Course Category	Offered by
22BS112	Oriental Session	1	4		3	Binary Grade	SA

### I Year II Semester (Semester 2)

Subject Code	Course Title	L	T	P	C	Course Category	Offered by
22BS107	Digital Logic & Computer Organization	3	0	2	4	Core	Computer Science
22BS108	Algebra	3	2	0	4	Core	Mathematics
22BS109	Mathematical Expectation and Probability Distributions	3	0	2	4	Core	Statistics
22BS110	Data Structures	2	2	2	4	Core	Computer Science
22BS111	Sports / Physical fitness / Games			3	1	Binary Grade	
	<b>Total Credits</b>	<b>10</b>	<b>6</b>	<b>9</b>	<b>17</b>		
		<b>25 hr</b>					

L : Lecture Hours/week ; T : Tutorial Hours/week ;  
P : Practical Hours/week ; C : Credits of the Course

## R-22 CURRICULUM

(Applicable for students admitted into First Year from academic year 2022-23 onwards)

B.Sc.  
**3 YEARS**

DEGREE PROGRAMME

### II Year I Semester (Semester 3)

Subject Code	Course Title	L	T	P	C	Course Category	Offered by
22BS201	English Proficiency and Communication skills	0	2	2	2	Humanities	English
22BS202	Discrete Mathematical structures	3	2	0	4	Core	Mathematics
22BS203	Statistical Methods	3	0	2	4	Core	Statistics
22BS204	Database Management Systems	3	0	2	4	Core	Computer Science
22BS205	Object Oriented Programming	3	0	2	4	Core	Computer Science
22BS206	Environmental Science	0	1	1	1	Applied Science	Chemistry
22BS207	NCC / NSS / SAC / Paper presentation / Social Activities	0	0	2	0	Binary Grade	
	<b>Total Credits</b>	<b>12</b>	<b>05</b>	<b>11</b>	<b>19</b>		
		<b>28 hr</b>					

### II Year II Semester (Semester 4)

Subject Code	Course Title	L	T	P	C	Course Category	Offered by
22BS208	Business English Communication – I	0	2	2	2	Humanities	English
22BS209	Business English Communication II	0	2	2	2	Humanities	English
22BS210	Differential Equations	3	2	0	4	Core	Mathematics
22BS211	Statistical Inference	3	0	2	4	Core	Statistics
22BS212	Operating Systems	3	0	2	4	Core	Computer Science
22BS213	Design and analysis of algorithms	3	0	2	4	Core	Computer Science
22BS214	NCC / NSS / SAC / Paper presentation / Social \ Activities	0	0	2	1	Binary Grade	
	<b>Total Credits</b>	<b>12</b>	<b>06</b>	<b>12</b>	<b>21</b>		
		<b>30 hr</b>					



## R-22 CURRICULUM

(Applicable for students admitted into First Year from academic year 2022-23 onwards)

### III Year I Semester (Semester 5)

Subject Code	Course Title	L	T	P	C	Course Category	Offered by
22BS301	Linear Algebra	3	2	0	4	Core	Mathematics
22BS302	Real Analysis	3	2	0	4	Core	Mathematics
22BS303	Sampling Techniques	2	0	2	3	Core	Statistics
22BS304	Econometrics	2	2	0	3	Core	Statistics
22BS305	Computer Networks	3	0	2	4		
22BS306	Cyber Security	2	2	0	3		
22BS307	Software Engineering	2	2	0	3		
	<b>Total Credits</b>	<b>17</b>	<b>10</b>	<b>4</b>	<b>24</b>		
		<b>31 hr</b>					

### III Year II Semester (Semester 6)

Subject Code	Course Title	L	T	P	C	Course Category	Offered by
	Mathematics Elective I	3	2	0	4	Elective	Mathematics
	Statistics Elective II	3	0	2	4	Elective	Statistics
	Computer Elective III	3	0	2	4	Elective	Computer Science
22BS308	Project		2	6	4	Project	Mathematics / Statistics / Computer Science
	<b>Total Credits</b>	<b>9</b>	<b>4</b>	<b>10</b>	<b>16</b>		
		<b>23 hr</b>					

\* Candidate can also acquire a maximum of 4 credits through MOOCS (Swayam Based NPTEL) which can be considered equivalent to one of the electives.





## R-22 CURRICULUM

(Applicable for students admitted into First Year from academic year 2022-23 onwards)

B.Sc.  
**3 YEARS**

DEGREE  
PROGRAMME



Odd Semester Elective Pools	Subject Code	Even Semester Elective Pools	Subject Code
<b>MATHEMATICS</b>			
Analytical Geometry	22BS801	Complex Analysis	22BS804
Graph Theory	22BS802	Number Theory	22BS805
Numerical Analysis	22BS803	Integral Transforms	22BS806
<b>STATISTICS</b>			
Design of Experiments	22BS811	Operations Research	22BS814
Statistical analysis through SPSS/R	22BS812	Applied Statistics	22BS815
Advanced Probability	22BS813		
<b>COMPUTER SCIENCE</b>			
Formal Languages and Automata Theory	22BS821	Web Technologies	22BS823
Machine Learning	22BS822	Python Programming	22BS824

# I YEAR

## B.Sc.

### COURSE CONTENTS

I SEM & II SEM

#### I SEMESTER

▶ 22BS101 - Technical English Communication

---

▶ 22BS102 - Calculus

---

▶ 22BS103 - Descriptive Statistics and Probability  
Distributions

---

▶ 22BS104 - Programming in C

---

▶ 22BS105 - IT Workshop

---

▶ 22BS106 - Sports / Physical fitness / Games

---

▶ 22BS112 - Oriental Session

---

#### II SEMESTER

▶ 22BS108 - Algebra

---

▶ 22BS109 - Mathematical Expectation and Probability  
Distributions

---

▶ 22BS110 - Data Structures

---

▶ 22BS107 - Digital Logic & Computer Organization

---

▶ 22BS111 - Sports / Physical fitness / Games

---



# 22BS101 TECHNICAL ENGLISH COMMUNICATION

Hours Per Week :

L	T	P	C
2	2	2	4

**PREREQUISITE KNOWLEDGE:** Basic sentence formation. understanding contextual meanings, basic writing skills and moderate fluency in English.

## COURSE DESCRIPTION AND OBJECTIVES:

In this course students will read, analyze, and interpret material from technical and general fields, and practice reading, writing, listening and speaking skills to gain exposure and functional English on a variety of contemporary topics. The overall course objective is to provide English for Specific Purposes (ESP) instruction to enhance students' reading, writing, listening and speaking skills through a practice in the language. It will aim to build students' confidence and motivation through exposure to academic skills like Note making/taking, Paraphrasing, Summarizing, Report Writing, Making Presentations etc., so as to generate interest in the language from an ESP perspective. Finally, students are expected through the course to gain key strategies and expression for communicating with professionals and non-specialists

## MODULE-1

### UNIT – 1

[8L+8T+8P=24 Hours]

#### GENETICS

**Reading:** Reading for **Note Making** Sub skills: Reading for global understanding (skimming), specific information (scanning), understanding main ideas and supporting ideas, guessing contextual meanings from the text. **-Vocabulary building:** commonly used roots, prefixes, and suffixes.

**Writing: Note making,** organizing main points and sub points, numbering and sequencing, suggesting titles, paraphrasing and summarizing. **Functional grammar:** Common Errors in Articles and Prepositions (Handout)

**Listening:** Listening for **Note Taking:** top down and bottomup approach, listening for main ideas and supporting points.

**Speaking: Presentation** in teams - ideas on the topic summarized, making a PPT, effective introductions and conclusions, logical organization of content, using appropriate structure and cohesive devices

### UNIT – 2:

[8L+8T+8P=24 Hours]

#### ALIENS

**Reading:** Reading: predicting, skimming, scanning, reading for inference, extrapolative reading  
**Vocabulary building:** Academic vocabulary from the text: synonyms, antonyms, Words often confused

**Writing: Paragraph writing;** writing a topic sentence, supporting sentences, effective introductions and conclusions, use of cohesive devices. Types of Paragraphs: Descriptive, narrative, argumentative and expository. **Functional grammar:** Common Errors in Verb forms and Conditional sentences (Handout)

**Listening:** Listening for identifying parts from a description, listening to and sorting information, listening for specific information.

**Speaking:** Narrating/Retelling an incident, using suitable cohesive devices/discourse markers Speaking of past and present habits/ activities/events - Speaking of future plans.

## PRACTICES:

- Note making
- Summarizing
- Paragraph Writing
- Error correction and Restructuring
- Vocabulary building
- Listening comprehension
- Note taking

**SKILLS:**

- ✓ Apply different sub skills like skimming, scanning, reading for information, reading for inference etc. to understand different kinds of text.
- ✓ Apply different sub skills like top down, bottom-up approaches to listening.
- ✓ Use functional vocabulary relevant to engineering and technology to express ideas lucidly.
- ✓ Use appropriate sentence structure, cohesive devices to construct simple text in regular correspondence like e-mails and letters.

**MODULE-2****UNIT – 1:****[8L+8T+8P=24 Hours]****SOCIAL MEDIA – HEALTH AND NUTRITION**

**Reading:** Reading for factual information researching for supporting evidence - skimming, scanning,  
**Vocabulary building:** One-word substitutes.

**Writing:** Letter Writing - E-mail writing – New age communication – Format, protocol, and style- WhatsApp, Facebook and Twitter **Functional grammar:** Common Errors in Sub-Verb Agreement and Modals

**Listening:** Listening to a **Business Presentation:** Listening for deducing information, for abstract details and specific details, listening for taking a message.

**Speaking:** Making a presentation with a PPT on a topic assigned- organizing the presentation using appropriate discourse markers - presenting a point of view - Extempore.

**UNIT – 2:****[8L+8T+8P=24 Hours]****FASHION**

**Reading:** Reading for data interpretation and information transfer from graphical aids to text reports (pictograms, tables, graphs, pie charts, flow charts), deducing specific information and general information  
**-Vocabulary building:** business vocabulary, collocations, idioms and phrasal verbs

**Writing:** Writing a **Report:** Drafting general and factual reports - writing an overview - an effective introduction - organizing information into paragraphs (Stages of writing: planning /organizing /writing / editing /rewriting) - **Functional grammar:** transformations and miscellaneous common errors

**Listening:** Listening to a Ted talk and sorting information – taking notes from a discussion.

**Speaking: Group Discussion** – prerequisites -generating content - initiating a discussion - expressing one's opinion ~ leading a discussion - agreeing/ disagreeing to someone's view - cutting into a speech - body language and voice modulation.

**PRACTICES:**

- E-mail writing
- Letter writing
- Report writing
- Messaging in social media
- Extempore
- Making PPTs

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	apply a variety of strategies to interpret and comprehend spoken texts/ discourse using contextual clues	Apply	1	2,6
2	apply appropriate reading strategies to interpret content / material related to engineering and technology domain	Apply	1	2,6
3	possess an ability to write clearly on topics related to science and technology and communication	Analyze	1, 2	2,6
4	choose functional language, grammar structures, cohesive devices and skills of organization to express clearly in speaking	Evaluate	1, 2	2,6
5	participate in discussions and make short presentations on general and technical topics	Create	2	2,6

### **LANGUAGE LAB ACTIVITIES**

Session – 1: Dictionary Skills

Session – 2: Introduction to Phonetics and Identifying Phonemes

Session – 3: Pronunciation Practice (Commonly mispronounced words)

Session – 4: Rosetta Stone (Exercises on LSRW)

Session – 5: Listening Comprehension (Summarising exercise on a Ted Talk)

Session – 6: Technical Presentations (Individual)

Session – 7: Technical Presentations (Team)

Session – 8: TOEFL Mastery

### **TEXT BOOKS:**

1. N P Sudharshana & C Savitha, "English for Technical Communication", Cambridge University Press, 2016.
2. Ashraf Rizvi M, "Effective Technical Communication", 2nd Edition, McGraw Hill Education, 2017.

### **REFERENCE BOOKS:**

1. Balasubramanian T, "A Text book of Phonetics for Indian Students", Orient Longman, New Delhi, 1989.
2. Krishnaswamy, N and Sriraman, T, "Current English for Colleges", Trinity publications, 2016.
3. Mohan Krishna and Meera Banerjee, "Developing Communication Skills", Macmillan India Ltd. New Delhi, 1990.
4. Narayanaswamy V R, "Strengthen your Writing", Third Edition Orient Black Swan, New Delhi, 2005.
5. Naterop, Jean, B. and Rod Revell, "Telephoning in English", Cambridge University Press, Cambridge, 1997.

# 22BS102 CALCULUS

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Elementary calculus, introductory knowledge on differentiation and integration.

## COURSE DESCRIPTION AND OBJECTIVES:

The primary learning goals of this course are to expose the students to some basic notions in differential calculus. By the time students complete the course, they realize wide ranging applications of this subject in various fields such as medical, mathematical, engineering sciences, industries and other real time environments.

### MODULE-1

#### UNIT-1

[12L+8T+0P=20 Hours]

#### DIFFERENTIABILITY AND EXPANSION OF FUNCTIONS

Notion of convergence of sequences and series of real numbers, - definition of limit and continuity of a real valued function; Differentiability and its geometrical interpretation; Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem.

Successive differentiation and Leibnitz theorem, Maclaurin's and Taylor's theorems for expansion of a function, Expansions of exponential, logarithmic and trigonometric functions.

#### UNIT-2

[12L+8T+0P=20 Hours]

#### APPLICATIONS OF DIFFERENTIATION

Applications of differentiation, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Leibnitz theorem, Maclaurin's theorems and Taylor's theorems in real time environments. Bi polar junction transistor- operation, types (NPN & PNP)

#### PRACTICES:

- Justification of continuity of functions
- Justification of convergence of functions
- Differentiation of simple functions
- Expansions of functions in the required form.

### MODULE-2

#### UNIT-1

[12L+8T+0P =20Hours]

#### PARTIAL DERIVATIVES AND INTEGRALS

Limit, continuity and first order partial derivatives, Higher order partial derivatives, Change of variables, Euler's theorem for homogeneous functions, Taylor's theorem, Total differentiation and Jacobians.

Definite integral of functions of one variable, reduction formulae, Double integration over rectangular and nonrectangular regions, Double integrals in polar co-ordinates.

#### UNIT-2

[12L+8T+0P =20Hours]

#### APPLICATIONS OF INTEGRALS

General applications of double and triple integrals in science, engineering technology and real time environments

**PRACTICES:**

- Evaluating line integrals.
- Evaluating area integrals.
- Evaluating volume integrals.
- Applications of double integrals in various real time problems.
- Applications of triple integrals in various real time problems.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Calculate the limit and examine the continuity and understand the geometrical interpretation of differentiability.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Apply the consequences of various mean value theorems.	Apply	1	1, 2, 5, 9, 10
3	Apply conceptual variations while advancing from one variable to several variables in calculus.	Apply	2	1, 2, 3, 5, 9, 10
4	Apply the concepts of Inter-relationship amongst the line integral, double and triple integral formulations.	Apply	2	1, 2, 5, 9, 10, 12
5	Draw curves in Cartesian and polar coordinate systems.	Apply	2	1, 2, 5, 9, 10, 12

**TEXT BOOKS:**

1. S. Narayanan, T. K. Manicavachagom Pillay, Calculus V.1, Viswanathan, S., Printers & Publishers Pvt Ltd, 2009.
2. N. P. Bali, Vector Algebra, Golden Series, Laxmi Publications, 2020.

**REFERENCE BOOKS:**

1. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition), Wiley India.
2. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
3. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
4. Gorakh Prasad (2016). Integral Calculus.

**SKILLS:**

- ✓ Realize importance and applications of Green, Gauss and Stokes' theorems.
- ✓ Master the dimension formula and theorem which are often exploited.
- ✓ Learn the theory of determinants and put them in practice.
- ✓ Calculate simple integrations
- ✓ Calculate simple area integrations
- ✓ Calculate volume of given solids.



# 22BS103 DESCRIPTIVE STATISTICS AND PROBABILITY

Hours Per Week :

L	T	P	C
3	0	2	4

**PREREQUISITE KNOWLEDGE:** Basic knowledge in mathematical calculations

## COURSE DESCRIPTION AND OBJECTIVES:

It provides the foundation to the students on elementary topics of Statistics and prepares them to describe the given data. The students try to know and measure the chance of happening different events and their occurrence numerically. Students understand how probability has been distributed to the different events and standard notions of probability distributions.

## MODULE-1

### UNIT-1

[12L+0T+8P = 20 Hours]

#### DATA COLLECTION AND STATISTICAL AVERAGES

Introduction to Statistics: Concepts of Primary and Secondary data. Methods of collection and editing of primary data, Secondary data. Graphical Representation, Designing a questionnaire and a schedule.

**Measures of Central Tendency:** Mean, Median, Mode, Geometric Mean and Harmonic Mean.

### UNIT-2

[12L+0T+8P = 20 Hours]

#### MEASURES OF DISPERSION AND MOMENTS

**Measures of Dispersion:** Range, Quartile Deviation, Mean Deviation and Standard Deviation.

**Moments:** Central and Non-Central moments and their interrelationship. Sheppard's correction for moments. Skewness and kurtosis.

#### PRACTICES:

- Various graphical presentation techniques
- Measures of central tendency
- Calculation of variations
- Computation of Non-central moments
- Moments about mean
- Karl Pearson's coefficient of skewness

## MODULE-2

### UNIT-1

[12L+0T+8P = 20 Hours]

#### PROBABILITY

Introduction to Probability: Basic Concepts of Probability, random experiments, trial, outcome, sample space, event, mutually exclusive and exhaustive events, equally likely and favorable outcomes. Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events. Probability theorems: Addition and multiplication theorems of probability for 2 and for n events. Boole's inequality and Baye's theorems and problems based on Baye's theorem.

### UNIT-2

[12L+0T+8P = 20 Hours]

#### RANDOM VARIABLES

Univariate Random Variables: Definition of random variable, discrete and continuous random variables, functions of random variable. Probability mass function. Probability density function, Distribution function and its properties.

**Bivariate Random Variables** - meaning, joint, marginal and conditional Distributions, independence of random variables.

**PRACTICES:**

- Estimate the probability of different types of events
- Obtain the conditional probabilities
- Applications of addition and multiplication theorems
- Applications of Bayes theorem
- Measure the chance of uncertainty of random variables.
- Calculate the probabilities of marginal distributions from joint distributions

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Use statistical averages and dispersion methods to study the characteristics of the data	Apply	1	1,2
2	Apply descriptive statistics tools in data collection and describing data.	Apply	1	1,2
3	Apply probability in real time situations and identify randomness in experiments	Apply	2	1,2,3
4	Calculate moments for random variables	Analyze	1,2	1,2
5	Estimate bivariate random variables probabilities	Evaluate	2	1,2,3,5

**TEXT BOOKS:**

1. V. K. Kapoor and S. C. Gupta, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
2. Stephen Bernstein-Ruth Bernstein, Elements of Statistics I Descriptive Statistics and Probability, Schaum's Outlines, 2020.
3. K.V.S. Sarma, Statistics Made Simple: Do it yourself on PC. PHI, 2nd edition, 2010.

**REFERENCE BOOKS:**

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I, Wiley, 1971.
2. A.M. Gun, M.K. Gupta B. Dasgupta, Fundamentals of Statistics, Vol-I, the World Press, 2019.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house, 1984.

**SKILLS:**

- ✓ Collect the data from various data sources and evaluate mean, median, mode, mean deviation and standard deviation
- ✓ Draw suitable graphs for statistical data
- ✓ Assess the chance of happening of events
- ✓ Fit an appropriate probability distribution for a given data.



# 22BS104 PROGRAMMING IN C

Hours Per Week :

L	T	P	C
2	0	4	4

**PREREQUISITE KNOWLEDGE:** Fundamentals of Problem Solving

## **COURSE DESCRIPTION AND OBJECTIVES:**

This course is aimed to impart knowledge on basic concepts of C programming language and problem solving through programming. It covers basic structure of C program, data types, operators, decision making statements, loops, functions, strings, pointers, and also file manipulations. At the end of this course, students will be able to design, implement, test and debug complex problems using features of C.

## **MODULE-1**

### **UNIT-1**

[8L+0T+16P=24 Hours]

#### **INTRODUCTION TO ALGORITHMS AND PROGRAMMING LANGUAGES**

Introduction to Algorithms: Basics of algorithms; Flow charts; Generations of programming languages. Introduction to C: Structure of a C program - pre-processor statement, inline comments, variable declaration statements, executable statements; C Tokens - C character set, identifiers and keywords, type qualifiers, type modifiers, variables, constants, punctuations and operators.

**Data Types and Operators:** Basic data types; Storage classes; Scope of a variable; Formatted I/O; Reading and writing characters; Operators - assignment, arithmetic, relational, logical, bitwise, ternary, address, indirection, size of, dot, arrow, parentheses operators; Expressions - operator precedence, associative rules.

Control Statements: Introduction to category of control statements; Conditional branching statements - if, if- else, nested-if, if - else ladder, switch case; Iterative statements - for, while, do - while, nested loops; Jump statements - break, jump, go to and continue.

### **UNIT-2**

[8L+0T+16P=24 Hours]

#### **ARRAYS & STRINGS**

**Arrays:** Introduction; Types of arrays; Single dimensional array - declaration, initialization, usage, reading, writing, accessing, memory representation, operations; Multidimensional arrays.

**Strings:** Character array, reading string from the standard input device, displaying strings on the standard output device, Importance of terminating a string, Standard string library functions.

#### **PRACTICES:**

- Write a program to accept a character as input from the user and print it.
- Write a program to accept a number as input from the user and print it.
- Write a program to accept a float value from the user and print it.
- Write a program to accept a message as input from the user and print it.
- Write a program to accept a message from the user as input and print it in 3 different lines.
- Write a program to accept 2 numbers from the user as input and print their sum.
- Write a program to accept 2 numbers from the user as input and print their product.
- Write a program to accept a number as input from the user which denotes the temperature in Celsius, convert it to Fahrenheit reading and print it.
- Write a program to accept a number as input from the user which denotes the radius and print the area of the circle.

- Write a program to accept a character as input from the user and print its corresponding ASCII value.

#### Questions on Control Statements - Looping – Level 1:

- Write a C program to print all the characters from a to z once.
- Write a C program to print all the characters from Z to A once.
- Write a C program to print all the characters from A to Z 3 times.
- Write a C program to print the first N natural numbers, where N is given as input by the user.
- Write a C program to print the first N natural numbers and their sum, where N is given as input by the user.
- Write a C program to print all the odd numbers between 1 and N where N is given as input by the user.
- Write a C program to print all the even numbers between 1 and N where N is given as input by the user.
- Write a C program to print the squares of the first N natural numbers between 1 and N, where N is given as input by the user.
- Write a C program to print the cubes of the first N natural numbers between 1 and N, where N is given as input by the user.
- Write a C program to print the squares of every 5th number starting from 1 to N, where N is given as input by the user.

#### Questions on Control Statements – Decision Making – Level 1:

- Write a program to accept two numbers as input check if they are equal.
- Write a program to accept two characters as input and check if they are equal.
- Write a program to accept two numbers as input and print the greater of the 2 numbers.
- Write a program to accept two numbers as input and print the lesser of the 2 numbers.
- Write a program to accept 3 numbers as input and print the maximum of the 3.
- Write a program to accept 3 numbers as input and print the minimum of the 3.
- Write a program to accept a number as input and print EVEN if it is an even number and ODD if it is an odd number.
- Write a program to accept a number as input and check if it is divisible by 3. If it is divisible by 3 print YES else print NO.
- Write a program to accept a number as input and check if it is divisible by both 3 & 5. If it is divisible print YES else print NO.
- Write a program to accept a number as input and check if it is positive, negative or zero.

#### Questions on Patterns – Level 1:

- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
\*\*\*\*\*  
\*\*\*\*\*  
\*\*\*\*\*  
\*\*\*\*\*  
\*\*\*\*\*
- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
\*\*\*\*\*  
\* \*  
\* \*  
\* \*  
\*\*\*\*\*

#### SKILLS:

- ✓ Analysis of the problem to be solved.
- ✓ Select static or dynamic data structures for a given problem and manipulation of data items.
- ✓ Application of various file operations effectively in solving real world problems.
- ✓ Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.

- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
\*  
\*\*  
\*\*\*  
\*\*\*\*  
\*\*\*\*\*
- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
\*  
\*\*  
\*\*\*  
\*\*\*\*  
\*\*\*\*\*
- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
1  
12  
123  
1234  
12345
- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
1  
22  
333  
4444  
55555
- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
54321  
4321  
321  
21  
1
- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
12345  
2345  
345  
45  
5
- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
A  
AB  
ABC  
ABCD  
ABCDE

- Write a program to accept a number N as input from the user and print the following pattern.  
Sample N = 5.  
A  
BC  
DEF  
GHIJ  
KLMNO

#### Questions on Number Crunching – Level 1:s

- Write a program to accept a number as input and print the number of digits in the number.
- Write a program to accept a number as input print the sum of its digits.
- Write a program to accept a number as input, reverse the number and print it.
- Write a program to accept a number and digit as input and find the number of occurrences of the digit in the number.
- Write a program to accept a number as input and check if it is an Armstrong number.
- Write a program to accept a number as input and check if it is an Adam number.
- Write a program to accept a number as input and check if is a prime number.
- Write a program to accept 2 numbers as input and check if they are amicable or not.
- Write a program to accept a number as input and check if it is a power of 2.
- Write a program to accept 2 numbers as input and find their LCM.

#### Questions on Arrays – Level 1:

- Print the contents of an array from the left to the right.
- Print the contents of an array from the right to the left.
- Find the sum of the elements of an array.
- Find the maximum element in an unsorted array.
- Find the minimum element in an unsorted array.
- Find the average of the elements in an unsorted array.
- Count the number of 0s and 1s in an array having 0s and 1s in random order.
- Count the number of elements in an array whose elements are lesser than a key element in an unsorted array.
- Print all the elements in an array whose values are lesser than a key element in an unsorted array.
- Find the repeated elements in a sorted array.

#### Questions Number crunching – Level 2:

- Write a program to accept a number as input and print the product of its digits.
- Write a program to accept a number as input and check if it is a palindrome.
- Write a program to accept a number as input and print the frequency of occurrence of each digit.
- Write a program to accept a number as input and print its factors.
- Write a program to accept a number as input and print its prime factors.
- Write a program to accept a number as input and check if it is a perfect square or not.
- Write a program to accept 2 numbers as input and check if they are betrothed numbers or not.
- Write a program to accept 2 numbers as input and print their HCF.
- Write a program to accept a number as input and check if is a strong number.
- Write a program to generate prime numbers between two intervals given as input.

#### Questions on Arrays – Level 2:

- Find the sum of the maximum and minimum numbers of an unsorted array.
- Replace every element in an array with the sum of its every other element.
- Replace every element in an array with the sum of its right side elements.
- Replace every element in an array with the sum of its left side elements.
- Reverse the elements of an array (in place replacement).

- Reverse the first half of an array.
- Reverse the second half of an array.
- Write a program to find the second largest element in an unsorted array.
- Write a program to find the second smallest element in an unsorted array.
- Write a program to print the number of odd and even numbers in an unsorted array.

#### Questions on Strings – Level 1:

- Write a program to accept a string as input and print it.
- Write a program to accept a string as input and count the number of vowels in it.
- Write a program to accept a string as input and count the number of consonants in it.
- Write a program to accept a string as input and print its length.
- Write a program to accept a string as input and print the reversed string.
- Write a program to accept 2 strings as input and check if they are the same.
- Write a program to accept a string as input and copy the contents into a second string and print the second string.
- Write a program to accept 2 strings as input and concatenate them into a third string and print the third string.
- Write a program to accept a string as input and check if it is a palindrome.
- Write a program to accept two strings as input and check if the second string is a substring of the first.

#### Questions on Strings – Level 2:

- Implement the string length function.
- Implement the string copy function.
- Implement the string concatenate function.
- Implement the string compare function.
- Implement the vowel count function.
- Implement the consonant count function.
- Implement the count words function.
- Implement the string reverse function.
- Implement the strstr function.
- Complete the code snippet to implement the is Palindrome function that checks if a given string is a palindrome. You will need to use the 3 functions string Copy, str Reverse and string Compare functions provided to accomplish this.

## MODULE-2

### UNIT-1

[8L+0T+16P=24 Hours]

#### FUNCTIONS & POINTERS

**User-defined functions:** Function declaration - definition, header of a function, body of a function, function invocation; Call by value; Call by address; Passing arrays to functions; Command line arguments; Recursion; Library Functions.

**Pointers: Declaration,** Initialization, Multiple indirection, Pointer arithmetic, Relationship between arrays and pointers, Scaling up - array of arrays, array of pointers, pointer to a pointer and pointer to an array; Dynamic memory allocation functions.

### UNIT-2

[8L+0T+16P=24 Hours]

#### STRUCTURES, UNIONS & FILES

**Structures:** Defining a structure, declaring structure variable, Operations on structures, Pointers to structure - declaring pointer to a structure, accessing structure members using pointer; Array of structures, Nested structures, passing structures to functions - passing each member of a structure as a separate argument, passing structure variable by value, passing structure variable by reference/ address; Typedef and structures.

**Unions:** Defining a union - declaring union variable, operations on union; Pointers to union - declaring

pointer to a union, accessing union members using pointer; Array of union, Nested union, Typedef and union, Enumerations, Bit-fields.

**Files:** Introduction to files, Streams, I/O using streams – opening a stream, closing stream; Character input, Character output, File position indicator, End of file and errors, Line input and line output, Formatted I/O, Block input and output, File type, Files and command line arguments.

### PRACTICES:

#### Questions on Strings – Level 3:

- Write a program to swap two given strings and print the swapped strings.
- Write a program to swap two given words of the given sentence and print the altered string.
- Return the maximum occurring character in the string.
- Write a program to print the character in the string with the count where count is the occurrence of the character.
- Write a program to print the duplicate characters in the given string.
- Write a program to remove the duplicate characters in the given string.
- Write a program to remove the vowels from a given string.
- Write a program to rotate a given string N number of times.
- Write a program to check if 2 strings are rotations of each other.
- Write a program to remove the characters from the first string that are present in the second string.

#### Questions on 2D Arrays – Level 1:

- Print the contents of a 2D array row-wise.
- Print the contents of a 2D array column-wise.
- Print the contents of a 2D array in a zig-zag order.
- Print the contents of a 2D array diagonal-wise.
- Print the contents of a 2D array right-diagonal order.
- Print the contents of a 2D array left-diagonal order.
- Print the contents of a 2D array in the upper triangular order – left top to right bottom.
- Print the contents of a 2D array in the lower triangular order.
- Find and print the maximum element along with its position in a matrix.
- Find and print the minimum element along with its position in a matrix.

#### Questions on 2D Arrays – Level 2:

- Find and print the maximum element of each row of a matrix.
- Find and print the minimum elements of each row of a matrix.
- Find and print the maximum element of each column of a matrix.
- Find and print the minimum element of each column of a matrix.
- Find the lowest value in the upper triangle area and the largest value in the lower triangular area of a matrix and print their product.
- Find the sum of the elements of each row and each column of a matrix and print the minimum row sum and maximum sum column.
- Write a program to find the row with the maximum number of 1's in a matrix consisting of only 0's and 1's.
- Write a program to print the quotient and remainder on dividing sum of left-top to right-bottom diagonal by sum of right-top to left-bottom diagonal.
- Write a program to print the absolute difference of the sum of major diagonal elements and the sum of minor diagonals of the given matrix.
- Write a program to search a given element in a row-wise and column-wise sorted 2D array.

#### Questions on 2D Arrays – Level 3:

- Write a program to find the Kth smallest element in the given matrix.
- Write a program to find the Kth largest element in the given matrix.



- Write a program to check whether the given two two-dimensional array of same dimensions are equal or not.
- Write a program to add the given two two-dimensional array of same dimensions.
- Write a program to subtract the given two two-dimensional array of same dimensions.
- Write a program to multiply the given two two-dimensional array of same dimensions.
- Write a program to sort each row of a matrix.
- Write a program to find the sum of the elements in 'Z' sequence of the given 2D array.
- Write a program to print the unique rows of the given two-dimensional array consisting of only 0's and 1's.
- Write a program to print the unique columns of the given two-dimensional array consisting of only 0's and 1's.

#### Questions on Files, Structures & Unions:

- Write a C program to create a struct, named Student, representing the student's details as follows: first name, last name, Age and standard.

Example

Read student data

john

Carmack

15

10

Display the data in the following format

First Name: john

Last Name: Carmack

Age: 15

Standard: 10

- Declare a structure POINT. Input the coordinates of point variable and write a C program to determine the quadrant in which it lies. The following table can be used to determine the quadrant.

Quadrant	X	Y
1	Positive	Positive
2	Negative	Positive
3	Negative	Negative
4	Positive	Negative

#### Example

Input the values for X and Y coordinate: 7 9

The coordinate point (7,9) lies in the First quadrant.

- Bob and Alice both are friends. Bob asked Alice how to store the information of the books using Structures. Then Alice written a c program to store the information of books using book structure by taking different attributes like book name, author, book id, price. Write a C program to read and display the attributes of the books using structures.

Sample Input:

Enter number of books: 1

Enter the book name: c Programming

Enter the author name: Balaguruswamy

Enter the book ID: 23413

Enter the book price: 500

Sample Output:

The details of the book are:

The book name is: c Programming

The author name is: Balaguruswamy

The book ID is: 23413

The book price is: 500.00

- Ramesh wants to do addition on complex numbers. He did it with regular practice but Charan asked him to do with the help of structures by following below Criteria.
- Write a C program that defines a structure named 'Complex' consisting of two floating point members called "real and imaginary". Let c1 and c2 are two Complex variables; compute the sum of two variables.

Example:

c1= 2 8

c2= 6 4

Sum= 8.000000+12.000000i

- Customer Payment Details is a structure with members as customers name, address, account number, payment status (paid (1)/ not paid (0)), due date, and amount. In this example, payment date is another structure with month, day and year as integer members. So, every customer record can be considered as an array of structures.

Write a C program that displays the amount to be paid by each customer along with their names. If payment status is 1, display NIL for such customers.

**Input Format:**

First line of input contains 'n' number of customers, followed by 8 lines of input for each customer. Each line represents (customers name, address, account number, amount payment status (paid (1)/ not paid (0)), and due date).

**Output Format:** First line of output is Amount to be paid by each customer as on date: followed by n lines of output. Each line contains name of the customer followed by tab space, and amount to be paid.

**Hint:** Use nested structure to represent date.

Write a 'C' program to accept customer details such as: Account no, Name, Balance using structure. Assume 3 customers in the bank. Write a function to print the account no. and name of each customer whose balance < 100 Rs.

- Write a C program to accept details of 'n' employee (eno, ename, salary) and display the details of employee having highest salary. Use array of structure.
- Write a C program to print the bill details of 'N' number of customers with the following data: meter number, customer name, no of units consumed, bill date, last date to deposit and city. The bill is to be calculated according to the following conditions:

No. of units	Charges
For first 100 units	Rs.0.75 per unit
For the next 200 units	Rs.1.80 per unit
For the next 200 units	Rs.2.75 per unit

**Sample Input**

Enter no. of customers

1

Enter Meter Number AP01213

Enter Customer Name: Karthik

Enter No. of units consumed: 200

Enter Bill date:22/01/2021

Enter Last date: 12/2/2021

Enter City: Guntur

**Sample Output**

Meter Number AP01213

Customer Name: Karthik

No. of units consumed: 200

Bill date:22/01/2021

Last date: 12/2/2021

City: Guntur

Total Amount: 255.000000

- Write a C program that creates a student file containing {Roll No, Student Name, Address, Stream}, where the data will be inserted and display the list of students who are in CSE (Stream=CSE).

Input: A file name

Output: The attributes such as Roll No, Student Name, Stream, Address.

**Sample Input**

```
201fa4200      Raja   CSE   Guntur
201fa4201      Bala   IT    Tenali
```

**Sample Output**

```
201fa4200      Raja   CSE   Guntur
```

- Write a C program that reads content from an existing text file and write the same in a new file by changing all lowercase alphabetic character to upper case. (Existing file may contain digit and special characters).

Example:

**Input:** Enter the file name.

**Output:** New file with updated content.

- Write a C program to count the occurrences of the given string in a file.

Example:

**Input:** Enter the File name to read the string to be counted.

**Output:** Display the count of occurrences of the string.

- Write a C Program to transfer the data from one location to another location without changing the order of the content.

Example:

Read the file name from the user. If the source file exists, Transfer the data and display the message as "Data is transferred successfully" otherwise display the message "No such file is existing in the directory."

- Write a C program that reads numbers and write them into a text-file. Also find odd and even numbers in that file and store it in 2 separate files named odd.txt and even.txt. All the values should be in ascending order.

Input: Enter the values.

Output: Creates a separate file for Even and Odd numbers.

Sample Input:

```
4 43 2 53 45
```

Sample Output:

Even.txt: 2 4

Odd.txt: 43 45 53

- Write a C program to replace the content in the given text file.

Input: Enter the file name, line number to be replaced and the new content

Output: New file with replaced lines.

Example:

Sample Input: Enter the file name: abc.txt

Enter the line no to replace: 3

Enter the content: Files stores data presently.

Sample Output:

Line no 3 is replaced with the given content.

The content of the file abc.txt contains:

test line 1

test line 2

Files stores data presently

test line 4

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify suitable data type for operands and design of expressions having right precedence.	Apply	1,2	1
2	Apply decision making and iterative features of C Programming language effectively.	Apply	1,2	1
3	Select problem specific data structures and suitable accessing methods.	Analyze	1,2	1,2
4	Design and develop non- recursive and recursive functions and their usage to build large modular programs and also able to design string manipulation functions.	Create	1,2	3
5	Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.	Evaluate	1,2	3,4

**TEXT BOOKS:**

1. Behrouz A. Forouzan, Richard F.Gilberg, "Programming for Problem Solving", 1st edition, Cengage publications, 2019.
2. Ajay Mittal, "Programming in C - A Practical Approach", 1st edition, Pearson Education, India, 2010.

**REFERENCE BOOKS:**

1. Reema Thareja, "Computer Fundamentals and Programming in C", 1st edition, Oxford University Press, India, 2013.
2. Herbert Schildt, "C: The Complete Reference", 4th edition, Tata McGraw-Hill, 2017.
3. Byron S Gottfried, "Programming with C", 4th edition, Tata McGraw-Hill, 2018.



Source:

e-Resources:

1) [https://explorers-posts.grc.nasa.gov/post631/2006-2007/computer\\_basics/ComputerPorts.doc](https://explorers-posts.grc.nasa.gov/post631/2006-2007/computer_basics/ComputerPorts.doc)

Image source: <https://www.facebook.com/TheITWorkshopWA>

## 22BS105 IT WORKSHOP

Hours Per Week :

L	T	P	C
0	2	4	3

**PREREQUISITE KNOWLEDGE:** Basics of Computer knowledge, Default Applications of Computers..

### **COURSE DESCRIPTION AND OBJECTIVES:**

This course enables the students to learn various components of a computer system, assembly and dis-assembly of various components, troubleshooting, installation of OS and other applications. Also practicing of the usage of software tools such as word, excel, ppt and La-TeX, text and image editors.

### **MODULE-1**

**[0L+16T+32P=48Hours]**

#### **PRACTICING EXERCISES ON HARDWARE DEVICES**

- Demo of various physical components of a computer system.
- Integration of various components of a computer system and dismantling.
- Installation of OS in a computer system through various storage devices.
- Installation of OS in a computer system through cloning.
- Demonstration of booting process of a computer system
- Detection of faulty components such as hard disk, RAM, SMPS, network interface in a computer system.
- Demonstration of program execution environment
- Demo of Windows/Linux file system.
- Demo of location OS files in the file system (Windows/Linux).
- Configuration of network interface in a computer system and troubleshooting of network connectivity issues.
- Demo of shell scripts for maintenance and administration of a computer system
- Usage of editor tools
- Installation of software tools such as C compiler / interpreter, Java IDE, Python IDLE, PyCharm etc.
- Installation of antivirus software, web browsers and application of servers such as Apache server etc.

#### **ACTIVITIES:**

- Assemble and dis-assemble of various components of a computer system.
- Connect devices to various interfaces —(a) Serial Port, (b) Parallel Port, (c) USB Port, (d) Fire wire, (e) RJ45 connector, (f) VGA connector, (g) Audio plugs (Line-In, Line-Out and microphone), (h) PS/2 Port, and (h) SCSI Port.
- Install Linux/windows OS in your computer.
- Identification of different Computer hardware problems and troubleshooting of the same.
- Editing of image, audio and video files using different editor tools.
- Build Ethernet and Wi-Fi LANs.

**MODULE-2****[0L+16T+32P=48Hours]****PRACTICING EXERCISES USING SOFTWARE TOOLS**

- Prepare your resume using MS-word
- Design a “Birthday Invitation” card.
- Design a Timetable given to you at the beginning of the semester without grid lines.
- Using Draw Table feature, insert a 7-column, 6-row table to create a calendar for the current month.
  - a. Enter the names of the days of the week in the first row of the table.
  - b. Centre the day names horizontally and vertically.
  - c. Change the font and font size as desired.
  - d. Insert a row at the top of the table.
  - e. Merge the cells in the row and enter the current month and year using a large font size.
  - f. Shade the row.
  - g. Enter and right-align the dates for the month in the appropriate cells of the table.
  - h. Change the outside border to a more decorative border. Identify two important dates in the calendar and shade them.
- Prepare mark sheet using MS-Excel.
- Create a pivot table to analyse your worksheet data.
- Prepare a presentation on your university using MS-PowerPoint.
- Design a Magazine cover. Use the following:
  - (1) Select a theme for the page,
  - (2) Insert either a picture or clipart, and
  - (3) Use WordArt.
- Design a poster inviting all students of your university to the Computer Festival.
- Installation and demonstration of LaTeX.
- Prepare professional pdf documents using LaTeX.
- Prepare LaTeX document containing mathematical equations.

**ACTIVITIES :**

- Create a 5-page document. Use hyperlinks, insert bookmarks in the same document.
- Design a worksheet using the following functions—MODE, STDDEV, VARIANCE, MEDIAN, SIN, COS, TAN, COUNT, MAX, MIN, ABS, MOD, SUM, SUMIF, POWER.
- Create bar graphs, pie charts and line charts in excel.
- Create a 5-slide presentation on any topic. Use Images, Graphs, Chart, Tables, Animation, Time, Bullets, Transition, Sound, Hyperlink, Background template, Header and Footer.
- Create a following numbered list using LaTeX.

**INTRODUCTION**

This is a display of numbered list

1. Abstract
2. Introduction
3. Section 1.
  - i. Section 1.1
  - ii. Section 1.2
4. Section 2

**SKILLS:**

- ✓ *Integration of various components of a computer system.*
- ✓ *Trouble shooting of components of a computer system.*
- ✓ *Installation of OS and its various tools/ applications.*
- ✓ *Usage of IT tools such as MS-Word, La-TeX etc.*
- ✓ *Creating the documents using MS-Word and LaTeX.*
- ✓ *Analysing and visualizing data with excel.*
- ✓ *Developing various power point presentations.*

**COURSE OUTCOMES:**

Upon completion of the course the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Ability to assemble and disassemble the computer system components and trouble shooting.	Apply	1	1
2	Installing Operating Systems and understanding the system booting process.	Apply	1	1
3	Ability to develop system maintenance using shell scripts.	Apply	1	1
4	Draw curves in Cartesian and polar coordinate systems.	Apply	2	1, 2, 5, 9, 10, 12
5	Create word documents, presentations and spread sheets by applying various tools.	Create	2	2,5

**TEXT BOOKS:**

1. Fundamentals of Computers by Reema Thareja, Oxford University Press 2nd edition 2019, India
2. Stefan Kottwitz, "LaTeX Beginner's Guide: Create visually appealing texts, articles, and books for business and science using LaTeX", 2nd Edition, Kindle, 2021.

**REFERENCE BOOKS:**

1. Priti Sinha and Pradeep K. Sinha, "Computer Fundamentals: Concepts, Systems and Applications", 8th edition, BPB Publications, 2004.
2. Microsoft Office 2010 Bible by John Walkenbach, Herb Tyson, Michael R.Groh and FaitheWempen, Publishers : Wiley

# 22BS107 DIGITAL LOGIC AND COMPUTER ORGANIZATION

Hours Per Week :

L	T	P	C
3	0	2	4

**PREREQUISITE KNOWLEDGE:** Algebra.

## COURSE DESCRIPTION AND OBJECTIVES:

The emphasis is on understanding the design of computer and its components. This course introduces the basic knowledge on number systems, design of combinational and sequential circuits. The course mainly focuses on micro operations, memory organizations and input output organization.

### MODULE-1

#### UNIT – 1

[12L+0T+8P = 20 Hours]

#### BOOLEAN ALGEBRA

**Boolean Algebra:** Fundamental concepts of Boolean algebra basic theorems and properties of Boolean Functions.

**Gate-Level Minimization:** Canonical and standard forms - SOP and POS forms, Digital Logic gates, The map method – two, three, four variable K map; POS and SOP simplification; Don't care conditions;

#### UNIT – 2:

[12L+0T+8P = 20 Hours]

#### COMBINATIONAL LOGIC CIRCUITS

Combinational Logic Circuits: combinational circuits analysis, design procedure; Half adder, Full adder, Half subtractor, Full subtractor, Binary adder/subtractor; Binary Incrementor, Decimal Adder, Binary multiplier; Magnitude comparator; Decoders; Encoders; Multiplexers; De-Multiplexer. Synchronous Sequential Logic: Sequential circuits; storage elements - latches, flip flops; Flipflop conversion; counters

### MODULE-2

#### UNIT-1

[12L+0T+8P = 20 Hours]

#### CONTINUOUS DISTRIBUTIONS

Rectangular, Normal Distribution, Exponential, Gamma, Beta Distributions of two kinds. Other properties such as mean, variance, M.G.F, C.G.F, C.F, reproductive property.

#### UNIT-2

[12L+0T+8P = 20 Hours]

#### APPROXIMATIONS OF DISTRIBUTIONS

Poisson approximation to Binomial distribution, Binomial approximation to Hyper Geometric Distribution, Poisson approximation to Negative binomial distribution, Interrelation between Normal and Binomial, Normal and Poisson distribution Practices:

#### PRACTICES:

- Design a Common bus system for eight registers with eight bits each using multiplexers.
- Design a Common bus system for four registers with four bits each using three state gate buffers.
- A digital computer has a common bus system for 16 registers of 32 bits each. The bus is constructed with multiplexers
  - o How many selection inputs are there in each multiplexer?
  - o What size of the multiplexers are needed?
  - o How many multiplexers are there in the bus?



**SKILLS:**

- ✓ Digital circuit Design.
- ✓ Number system Conversion.
- ✓ Analyse the principles of computer architecture.
- ✓ Design digital circuitry for implementing different operations.
- ✓ Identify the types of memories and their uses
- ✓ Study various data transfer mechanisms in digital computer and I/O

- Perform arithmetic operations  $(+42) + (-13)$  and  $(-42) - (-13)$  in binary using signed 2's complement representation for negative numbers.
- Design a 4-bit combinational decremter circuit using 4 full adder circuits.
- Register A holds the 8-bit binary 11011001. Determine the B operand and the logic micro operation to be performed in order to change the value in A to :
  - o 01101101
  - o b. 11111101
- An 8-bit register contains the binary value 10011100. What is the register value after an arithmetic shift right? Starting from the initial number 10011 100, determine the register value after an arithmetic shift left, and state whether there is an overflow.
- Starting from an initial value of  $R = 11011101$ , determine the sequence of binary values in R after a logical shift-left, followed by a circular shift-right, followed by a logical shift-right and a circular shift-left.
- Design arithmetic logic shift unit that performs different operations on 4 bits.
- The content of PC in the basic computer is 3AF (all numbers are in hexadecimal). The content of AC is 7EC3. The content of memory at address 3AF is 932E. The content of memory at address 32E is 09AC. The content of memory at address 9AC is 8B9F.
  - o What is the instruction that will be fetched and executed next?
  - o Show the binary operation that will be performed in the AC when the instruction is executed.
  - o Give the contents of registers PC, AR, DR, AC, and IR in hexadecimal and the values of E, I, and the sequence counter SC in binary at the end of the instruction cycle.
- How many characters per second can be transmitted over a 1200-baud line in each of the following modes? (Assume a character code of eight bits.)
  - o Synchronous serial transmission.
  - o Asynchronous serial transmission with two stop bits.
  - o Asynchronous serial transmission with one stop bit.

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1.	Apply the knowledge of digital logic concepts to optimize digital circuits and Boolean algebra rules & Karnaugh map method for reducing the Boolean functions.	Apply	1	1
2.	Analyse Combinational and sequential digital circuits for the given problem statement.	Analyse	1	2
3.	Demonstrate computer architecture concepts related to the design of modern processor, memory, and I/O systems.	Analyse	2	1,2
4.	Evaluate the performance of a processor and memory in terms of speed, size and cost.	Evaluation	2	1,2
5.	Design of Combinational and sequential digital circuits for the given problem statement and improve the performance by reducing the complexities.	Creating	1	3

**TEXT BOOKS:**

1. M Morris Mano and Michael D. Ciletti, "Digital Design", 5th edition, Pearson Education, 2013.
2. M.Moris Mano, "Computer Systems Architecture", 3rd edition, Pearson/Prentice Hall India, 2007.

**REFERENCE BOOKS:**

1. John F.Wakerly, "Digital Design Principles and Practices", Third Edition, Pearson/PHI, 2015.
2. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
3. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
4. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", 5th edition, Tata McGraw Hill, 2007.
5. William Stallings, "Computer Organization and Architecture", 6th edition, Pearson/Prentice Hall India, 2007.

**22BS108 ALGEBRA**

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** sets, relations, functions**COURSE DESCRIPTION AND OBJECTIVES:**

Learn the elementary concepts and basic ideas involved in GROUPS and SUBGROUPS. Develop the ability to form and evaluate group theory and its actions. Understand the fundamental concepts of abstract algebra.

**MODULE-1****UNIT – 1****[12L+8T+0P=20 Hours]****GROUPS AND THEIR ELEMENTARY PROPERTIES**

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties  
Finite and Infinite groups – examples – order of a group. Composition tables with examples.

**UNIT – 2:****[12L+8T+0P=20 Hours]****SUB GROUPS**

Complex Definition – Multiplication of two complexes, Inverse of a complex-Subgroup definition – examples-criterion for a complex to be a subgroup.

Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

Co-sets and Lagrange's Theorem: - Cosets Definition – properties of Cosets–Index of a subgroups of a finite group– Lagrange's Theorem.

**PRACTICES:**

- To check whether an operation is binary or not.
- Check whether set with binary operation is an algebraic structure.
- To test for semi group.
- To find out whether a complex is a subgroup.
- To prove Lagrange's theorem.

**MODULE-2****UNIT-1****[12L+8T+0P=20 Hours]****NORMAL SUBGROUPS**

Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group – simple group – quotient group – criteria for the existence of a quotient group.

**UNIT-2****[12L+8T+0P=20 Hours]****PERMUTATION GROUPS**

Cycle notation for permutations, Properties of permutations, Even and odd permutations, alternating groups, Cayley's theorem and its applications.Practices:

**PRACTICES:**

- To test a subgroup for its normality.
- Test for quotient group.
- To find subgroup of index 2 is normal.
- To prove Cayley's theorem

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various properties and Apply for different sets	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Identify the nature of a sub group.	Apply	1, 2	1, 2, 5, 9, 10
3	Analyze permutation groups	Analyze	1, 2	1, 2, 3, 5, 9, 10
4	Inspect composite groups	Analyze	2	1, 2, 5, 9, 10, 12
5	Evaluate the properties of different groups.	Evaluate	1, 2	1, 2, 3, 4, 5, 9, 10, 12

**TEXT BOOKS:**

1. A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, S.Chand & Co., New Delhi, 2021.
2. Abstract Algebra, by J.B. Fraleigh, Narosa Publishing house, New Delhi, Reprint 2013.

**REFERENCE BOOKS:**

1. I. N. Herstein, Topics in Algebra, Wiley Eastern, 1975.
2. C. Musili, Introduction to Rings and Modules, Narosa Publishing House, 1992
3. John B. Fraleigh, First Course in Abstract Algebra, A, 7th Edition, University of Rhode Island, Pearson Education©2003.

**SKILLS:**

- ✓ Be able to grasp features, properties of GROUPS.
- ✓ Demonstrate understanding of algebraic extensions and algebraic closures.
- ✓ Describe the structure of certain finite groups.

# 22BS109 MATHEMATICAL EXPECTATION AND PROBABILITY DISTRIBUTIONS

Hours Per Week :

L	T	P	C
3	0	2	4

**PREREQUISITE KNOWLEDGE:** Basic knowledge in mathematical calculations, differentiation and integration.

## COURSE DESCRIPTION AND OBJECTIVES:

In this course students learn about mathematical expectations and various generating functions such as moment generating function, cumulative generating function, probability generating function and characteristic functions for random variables as well as different types of statistical distributions. Also students should be able to calculate the statistical measures for random variables and distributions by the mathematical expectations.

## MODULE-1

### UNIT – 1

[12L+0T+8P = 20 Hours]

#### MATHEMATICAL EXPECTATIONS

Mathematical expectation (ME) of a random variable and function of a random variable. Moments and covariance using mathematical expectation with examples. Addition and Multiplication theorems on expectation. Definitions of M.G.F, C.G.F, P.G.F, C.F its properties. Chebyshev and Cauchy - Schwartz inequalities.

### UNIT – 2:

[12L+0T+8P=Hours20]

#### DISCRETE DISTRIBUTIONS

Binomial, Poisson, Negative Binomial, geometric and hyper geometric distributions, their definitions, 1st to 4th central moments, M.G.F, C.F, C.G.F, P.G.F, mean, variance, additive property if exists.

#### PRACTICES:

- Derive the mathematical expectations of random variables
- Obtain moment generating functions
- Derive probability generating function
- Obtain cumulative generating function
- Find characteristic function

## MODULE-2

### UNIT-1

[12L+0T+8P=20Hours]

#### CONTINUOUS DISTRIBUTIONS

Rectangular, Normal Distribution, Exponential, Gamma, Beta Distributions of two kinds. Other properties such as mean, variance, M.G.F, C.G.F, C.F, reproductive property.

### UNIT-2

[12L+0T+8P = 20 Hours]

#### APPROXIMATIONS OF DISTRIBUTIONS

Poisson approximation to Binomial distribution, Binomial approximation to Hyper Geometric Distribution, Poisson approximation to Negative binomial distribution, Interrelation between Normal and Binomial, Normal and Poisson distribution Practices:

**PRACTICES:**

- Obtain moment generating functions
- Derive probability generating function
- Obtain cumulative generating function
- Find characteristic function
- Study the inter relations between distributions

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Use mathematical expectations to find moments of random variables	Apply	1	1,2
2	Illustrate the recurrence relations of distributions	Apply	2	1,2,3
3	Calculate moments for continuous distributions by generating functions	Analyze	2	1,2,4
4	Evaluate the different types of generating functions for discrete distributions	Evaluate	1	1,2,4
5	Evaluate the properties of different groups.	Evaluate	1, 2	1, 2, 3, 4, 5, 9, 10, 12

**TEXT BOOKS:**

1. V. K. Kapoor and S. C. Gupta, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
2. K.V.S. Sarma, Statistics Made Simple: Do it yourself on PC. PHI, 2nd edition, 2010.

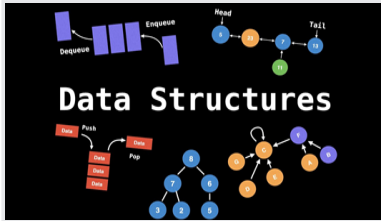
**REFERENCE BOOKS:**

1. Stephen Bernstein-Ruth Bernstein, Elements of Statistics-I Descriptive Statistics and Probability, Schaum's Outlines, 2020.
2. Willam Feller: Introduction to Probability theory and its applications. Volume –I, Wiley, 1971.
3. A.M. Gun, M.K. Gupta B. Dasgupta, Fundamentals of Statistics, Vol-I, the World Press, 2019.
4. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house, 1984.

**SKILLS:**

- ✓ Derive different types of generating functions for discrete and continuous distributions
- ✓ Study the interrelations between distributions

# 22BS110 DATA STRUCTURES



<https://www.youtube.com/watch?v=Qmt0QwzEmh0>

Hours Per Week :

L	T	P	C
2	2	2	4

**PREREQUISITE KNOWLEDGE:** Programming in C .

## COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at offering fundamentals concepts of data structures and explains how to implement them. It begins with the basic concepts of data, data structures and then introduces the primitive and non-primitive data structures in detail. It forms the basis for understanding various ways of representing data and its usage in different computing applications.

## MODULE-1

### UNIT – 1

[8L+8T+8P = 24 Hours]

#### DATA STRUCTURES BASICS

**Basic Terminology** – data, information, datatype; Data Structures – Introduction, storage structures- sequential and linked storage representations; classification of data structures; Applications of data structures.

**Sorting:** Selection Sort, Bubble Sort, Insertion Sort, Quick Sort and Merge Sort.

**Searching:** Linear Search and Binary Search.

### UNIT – 2:

[8L+8T+8P = 24 Hours]

#### LINKED LISTS AND STACKS, QUEUES

**Linked List:** Introduction, Types of linked list – Singly linked list, doubly linked list and circular linked list, representation of linked list, Operations of linked list: Traverse forward/ reverse order, searching, insertion and deletion; Applications of linked lists.

**Stack** – Introduction, array and linked representations, implementation and their applications;

**Queue** – Introduction, array and linked representations, implementation; Types – Linear, circular and doubly ended queues – operations; Applications of Queues.

#### PRACTICES:

##### Problems on Recursion – Level 1

- Find the product of 2 numbers using recursion.
- Find the sum of natural numbers using recursion.
- Find the factorial of a number using recursion.
- Find the Nth term of Fibonacci series using recursion.
- Calculate the power using recursion.
- Write a recursive program for checking if a given number, is a prime number.
- Given two integers write a function to sum the numbers without using any arithmetic operators.
- Convert a decimal to binary using recursion.
- Print all factors using recursion.
- Find the maximum product of digits among numbers less than or equal to N.

##### Problems Recursion – Level 2

- Implement insertion sort recursively.
- Write a program to find the numbers less than N that are product of exactly 2 distinct prime numbers - using recursion.

- Implement selection sort recursively.
- Find the middle of a singly linked list using recursion.
- Find the sum of even numbers of an array using recursion.
- Check if a given array is in sorted order using recursion.
- Print alternate nodes of a linked list using recursion.
- Reverse a doubly linked list using recursion.
- Write a recursive function that returns all permutations of a given list.
- Implement bubble sort recursively.

#### Problems on Sorting and Searching – Level 1

- Implement the insertion sort function.
- Implement the bubble sort function.
- Implement the quick sort function.
- Implement the merge sort function.
- Implement the selection sort function.
- Implement linear search function.
- Implement binary search function.

#### Problems on SLL – Level 1

- Implement the insert function to insert nodes into a singly linked list (ascending order).
- Implement the insert function to insert nodes into a singly linked list (descending order).
- Implement the search node function.
- Implement the delete node function.
- Display forwards function.
- Display backwards function.
- Count the number of nodes in a singly linked list.
- Swap alternate nodes of a singly linked list.
- Move last node to the front of the linked list.
- Move first node to the last of the linked list.

#### Problems on Stacks – Level 1

- Implement two stacks using a single array.
- Given an array replace every element with nearest greater element on the right.
- Given a stack reverse the elements using only push and pop functions.
- Postfix evaluation using stack.
- Balance symbols.
- Find middle element in a stack.
- Remove middle element from a stack.
- Implement push and pop using linked list.
- Given an array of characters with the middle marked by X, check if the string is a palindrome.
- Maximum sum in sliding window.

#### Problems on Queues – Level 1

- Write a program to accept two numbers as input check if they are equal.
- Write a program to accept two characters as input and check if they are equal.
- Write a program to accept two numbers as input and print the greater of the 2 numbers.
- Write a program to accept two numbers as input and print the lesser of the 2 numbers.
- Write a program to accept 3 numbers as input and print the maximum of the 3.
- Write a program to accept 3 numbers as input and print the minimum of the 3.
- Write a program to accept a number as input and print EVEN if it is an even number and ODD if it is an odd number.
- Write a program to accept a number as input and check if it is divisible by 3. If it is divisible by 3 print YES else print NO.
- Write a program to accept a number as input and check if it is divisible by both 3 & 5. If it is divisible print YES else print NO.
- Write a program to accept a number as input and check if it is positive, negative or zero.

#### SKILLS:

- ✓ Experienced to Store data and various types of data to handle.
- ✓ Ordering and sorting of data.
- ✓ Indexing and searching of required data from large data sequences.
- ✓ Exposed to various characteristics such as Linear or non-linear, Homogeneous or heterogeneous and Static and Dynamic.



**Problems on DLL – Level 1**

- Implement insert function.
- Implement display forward function.
- Implement display backward function.
- Implement search function.
- Implement delete function.
- Reverse a doubly linked list from M to N.
- Find the sum of the odd and even nodes.
- Count odd keys of the linked list.
- Merge two sorted lists.
- Delete adjacent duplicate nodes.

**Problems on CLL – Level 1**

- Insert function (circular doubly linked list).
- Search function.
- Display forward.
- Display backward.
- Delete node (circular doubly linked list).
- Print the middle N nodes of a circular singly linked list.
- Move the last node of a circular singly linked list to the beginning.
- Delete adjacent duplicate nodes of a circular singly linked list.
- Delete nodes greater than a value from a circular doubly linked list.
- Find the sum of the nodes of a circular linked list.

**Problems on Linked List – Level 2**

- Given 2 sorted linked lists, print the common elements.
- Reverse a list (using Stack).
- Given a pointer to a node (not the last node), delete the node.
- Reverse a list (Recursive).
- Reverse a list (Iterative).
- Reverse a singly linked list in pairs (recursive).
- Reverse a singly linked list in pairs (iterative).
- Check if a singly linked list is a palindrome or not.
- Remove the loop if exists.
- Given 2 linked lists with data in the ascending order, merge them into a single list.

**MODULE-2****UNIT-1****[8L+8T+8P=24 Hours]****TREES**

Trees: Basic Terminology, Types of Trees, Binary Tree – Introduction, properties, array and linked representations; Tree traversals and their implementation; Expression trees; BST – definition and operations, AVL trees – definition and construction; Applications of binary trees.

**UNIT-2****[8L+8T+8P=24 Hours]****GRAPHS & HASHING**

**Graphs:** Basic Terminology, Types of Graphs, Graphs representations – adjacency matrix, adjacency list; Traversals - breath first search and depth first search; Applications of graphs.

**Hashing:** Introduction, Different hash functions, collision: avoidance and handling methods.

**PRACTICES:****Problems on BST – Level 1**

- Insert function.

- Insert function (recursive).
- Search function.
- Pre order traversal.
- Post order traversal.
- In order traversal.
- Level order traversal.
- Delete child node.
- Delete parent node.
- Delete nodes greater than a value from a circular doubly linked list.

#### Problems on Priority Queues – Level 1

- Meeting rooms problem.
- Ugly number.
- Find median from data stream.
- Find the top K frequent elements.
- Find K Pairs with smallest sums.
- Find the Kth smallest element in a sorted matrix.
- Trapping Rain Water.
- Rearrange String k distance apart.
- Sort characters by frequency.
- Solve the maze problem.

#### Problems on Graphs – Level 1

- Implement Graph data structure.
- Implement BFS - iterative solution.
- Implement BFS - recursive solution.
- Implement DFS - iterative solution.
- Implement DFS - recursive solution.
- Check if given graph is strongly connected or not.
- Check if given graph is strongly connected or not - using DFS.
- Given a graph find the arrival and departure time of its vertices in DFS. Arrival time is the time when the vertex was explored for the first time, and departure time is the time at which all the neighbours are explored and are ready to backtrack.
- Given a directed acyclic graph and a source vertex, find the cost of the shortest path from source vertex to all other vertices present in the graph. If a vertex cannot be reached from given source vertex that distance may be printed as infinite.
- Given an undirected graph, check if the graph is 2 edges connected or not.

#### Problems on Hashing – Level 1

- Print a binary tree in vertical order.
- Find whether an array is subset of another array.
- Given an array A [] and a number x, check for pair in A [] with sum as x.
- Minimum operation to make all elements equal in array.
- Maximum distance between two occurrences of same element in array.
- Check if a given array contains duplicate elements within k distance from each other.
- Find duplicates in a given array when elements are not limited to a range.
- Most frequent element in an array.
- Smallest subarray with all occurrences of a most frequent element.
- First element occurring k times in an array.

**Problems on Graphs – Level 2**

- Find the shortest graph distances between every pair vertex in a given path. Assume that the graph does not have any negative edges.
- Find the shortest graph distances between every pair of vertices in a given path. The graph can have negative edges.
- Detect cycle in DFS.
- Count the number of connected components of a graph represented in the adjacent matrix.
- Count the number of connected components of a graph represented in the adjacent matrix - using DFS.
- Find a spanning tree - not necessarily a minimum spanning tree.
- Detect cycle in an undirected graph.
- Given an undirected graph, find its depth.
- Determine if a directed graph has a unique topological ordering.
- Given a directed acyclic graph and two vertices v and w, find the lowest common ancestor.

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Explore the organization of several ADTs and the manipulation (searching, insertion, deletion, traversing) of data stored in various data structures.	Apply	1,2	1
2	Apply different data structures to solve a given problem.	Apply	1,2	1
3	Analyze the efficiency of using different data structures and choose the efficient data structure for solving a given problem.	Analyze	1,2	2
4	Develop new algorithms to solve various problems.	Create	1,2	3,4

**TEXT BOOKS:**

1. Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford University Press, 2014.
2. Seymour Lipschutz, "Data Structures with C", 1st Edition, McGraw Hill Education, 2017.

**REFERENCE BOOKS:**

1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures", illustrated edition, Computer Science Press, 2006.
2. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, CENAGE Learning, 2005.
3. R G Dromey and Pearson, "How to solve it by Computer", 2nd edition, Impression edition, 1998.

# II YEAR

## B.Sc.

### COURSE CONTENTS

I SEM & II SEM

#### III SEMESTER

- ▶ 22BS201 - English Proficiency and Communication skills
- ▶ 22BS202 - Discrete Mathematical structures
- ▶ 22BS203 - Statistical Methods
- ▶ 22BS204 - Database Management Systems
- ▶ 22BS205 - Object Oriented Programming
- ▶ 22BS206 - Environmental Science
- ▶ 22BS207 - NCC / NSS / SAC / Paper presentation / Social Activities

#### IV SEMESTER

- ▶ 22BS208 - Business English Communication – I
- ▶ 22BS209 - Business English Communication (BEC) II
- ▶ 22BS210 - Differential Equations
- ▶ 22BS211 - Statistical Inference
- ▶ 22BS212 - Operating Systems
- ▶ 22BS213 - Design and analysis of algorithms
- ▶ 22BS214 - NCC / NSS / SAC / Paper presentation / Social Activities



# 22BS201 ENGLISH PROFICIENCY AND COMMUNICATION SKILLS

Hours Per Week :

L	T	P	C
0	2	2	2

**PREREQUISITE KNOWLEDGE:** Basics of grammar, Read and understand for global context, Cultural sensitivity and Basic writing skills.

## COURSE DESCRIPTION AND OBJECTIVES:

English Proficiency and Communication Skills seeks to develop the students' abilities in grammar, speaking, reading, writing and overall comprehension skills. The course will provide students an exposure on a wide range of language use in everyday situations. It will make the students to equip with functional English and make them use it confidently in their professional and social contexts. Finally, students will strengthen their reading, writing, listening and speaking skills in English

## MODULE-1

### UNIT – 1

[0L+8T+8P=16 Hours]

- Reading – Understanding main message, factual information global meaning, specific information and paraphrasing.
- Writing – Developing hints-based mail, Writing short messages/paragraphs
- Listening – Understanding short monologues or dialogues and choose the correct visual.
- Speaking – Express simple opinions /cultural matters in a limited way.
- Vocabulary – Discerning use of right word suiting the context, B1 Preliminary word list
- Grammar – Frequency Adverbs, State Verbs, AFV and Prepositions

### UNIT – 2:

[0L+8T+8P=16 Hours]

- Reading – Longer text for detailed comprehension, gist and inference
- Writing – Developing notes and responding to penfriends or 'e-pals'
- Listening – Understand straightforward instructions or public announcements.
- Speaking – Describing people, things and places in a photograph
- Vocabulary/Grammar – Comparatives and Superlatives, Gradable and non-gradable adjectives, Cloze tests

### PRACTICES:

- Developing hints-based mail
- Writing short messages
- Writing paragraphs
- Expressing opinions and cultural matters
- Understanding short monologues
- Understanding straightforward instructions and public announcements
- Describing people, things and places in a photograph

## MODULE-2

### UNIT-1

[0L+8T+8P=16 Hours]

- Reading – Reading for understanding coherence of the text and drawing inferences.
- Writing – Reading an announcement from a magazine or website for preparing an article
- Listening – Discussion activities and listening to understand the gist of each short dialogue
- Speaking – Snap Talks, Make and respond to suggestions, discuss alternatives and negotiate agreement.
- Vocabulary / Grammar – Punctuation, Prepositions, Phrasal Verbs, B1 Preliminary word list

**SKILLS:**

- ✓ Use of appropriate grammar and vocabulary with syntactic patterns in short texts.
- ✓ Read and extract the main message, global meaning, specific information, detailed comprehension, understanding of attitude, opinion and writer purpose and inference.
- ✓ Listen to understand key information, specific information, gist and detailed meaning and to interpret meaning.
- ✓ Understand questions and make appropriate responses and talk freely on everyday topics

**UNIT-2****[0L+8T+8P=16Hours]**

- Reading – Content, Communicative Achievement, Organisation and Language.
- Writing – Developing a story with clear links to the given opening sentence.
- Listening – An interview for a detailed understanding of meaning and to identify attitudes and opinions.
- Speaking – Discuss likes, dislikes, experiences, opinions, habits, etc.
- Vocabulary / Grammar – Modals, Conditionals, Verb forms (Time and Tense)

**PRACTICES:**

- Listening to understand the gist of each short dialogue
- Listening to an interview for a detailed understanding of meaning and to identify attitudes and opinions.
- Preparing an article
- Discuss for alternatives and negotiate agreement.
- Discussion on likes, dislikes, experiences, opinions, habits, etc.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	apply to read and grasp content on a range of topics/texts related to their everyday life like notifications, advertisements, travel brochures, news reports, articles.	Apply	1	2,6
2	apply suitable strategies to achieve comprehension, like listening for main points and checking comprehension using contextual clues etc.	Apply	1	2,6
3	demonstrate vocabulary beyond that of the familiar subjects	Analyze	1, 2	2,6
4	show sufficient control of English grammar and sentence variety to coherently organise information at sentence and discourse levels	Evaluate	2	2,6
5	use functional English to communicate and interact effectively in everyday situations	Create	1, 2	2,6

**TEXT BOOKS:**

1. Emma Heyderman and Peter May, "Complete Preliminary", Student's Book with Answers, 2nd edition, Cambridge University Press, 2019.

**REFERENCE BOOKS:**

1. Annette Capel and Rosemary Nixon, "Introduction to PET", Oxford University Press, 2009.
2. Adrian Doff and Craig Thaine, "Empower Pre intermediate", Cambridge University Press, 2015.
3. Louise Hashemi and Barbara Thomas, "Objective PET", Cambridge University Press, 2010.

# 22BS202 DISCRETE MATHEMATICAL STRUCTURES

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Basics of set theory, algebra

## COURSE DESCRIPTION AND OBJECTIVES:

The course objective is to provide students with an overview of discrete mathematics. Students will learn about of group and expected to demonstrate analytical and combinatorial methods such as propositional logic , Mathematical Induction, Boolean functions, combinatorial ,recurrence relation, generating function and graph theory

## MODULE-1

### UNIT-1

[12L+8T+0P = 20 Hours]

#### BOOLEAN ALGEBRA AND LOGIC

**Group:** Group, Subgroup, Lagrange's theorem, Introduction to rings and fields.

**Boolean algebra:** Boolean algebra, Truth table, Basic logic gates, Postulates of Boolean algebra, Principle of duality, Propositions, Connectives, Equivalence and Normal form.

### UNIT-2

[12L+8T+0P = 20 Hours]

#### APPLICATIONS OF LOGIC & BOOLEAN ALGEBRA

Normal form: CNF, DNF, CDNF, CCNF, Conversion of CNF to DNF and vice versa.

Minimization of Boolean function (Karnaugh Maps), Generalized Pigeonhole Principle.

## MODULE-2

### UNIT-1

[12L+8T+0P = 20 Hours]

#### COMBINATORICS AND GRAPHS

Combinatorics: The basics of counting, Permutations and combinations, Discrete Numeric Functions. Recurrence relations and Generating functions.

### UNIT-2

[12L+8T+0P = 20 Hours]

#### GRAPH THEORY

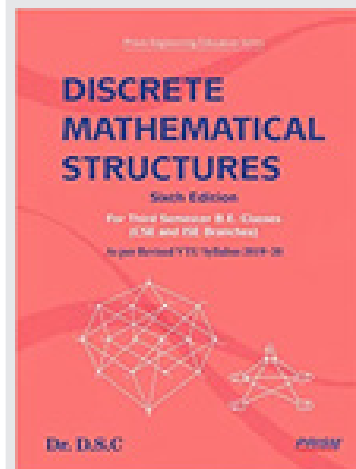
Graph terminology, Special types of graphs, Connected graph, Weighed graph, Graph Isomorphism, Euler and Hamiltonian paths and circuits, Planar graphs, Bipartite graph, Tree.

#### APPLICATIONS OF COMBINATORICS AND GRAPHS

Graph Coloring, Chromatic number, Matrix representation of graph, DFS, BFS algorithms, Minimum spanning tree.

#### PRACTICES:

- Determine order of an element of group.
- Determine the order of a subgroup of a finite group.
- Determine whether algebraic structure is a Ring or a Field.
- Construct Truth table of propositions.



<https://www.amazon.in/Discrete-Mathematical-Structures-Dr-D-S-C/dp/9388478398>



**SKILLS:**

- ✓ Familiarity of concepts of statements, logic and truth tables.
- ✓ Analyze closed form of discrete numeric function.
- ✓ Understand some basic properties of graphs, trees and related discrete structures.

- Check whether propositions are equivalence.
- Obtain CNF, DNF of expression.
- Draw 2 –variables, 3-variables K-map.
- Minimize the Boolean function by K-map.
- Simplify the Boolean expression using Boolean algebra laws.
- Determine the homogeneous solution and particular solution for recurrence relation.
- Switching Circuit in Boolean algebra, Combination of two switches in a Circuit,
- Represent sequence by Generating function.
- Solve Generation function by recurrence relation.
- Find degree of digraph and undirected graph.
- Identify Isomorphic graph, Euler circuit, Hamiltonian circuit.
- Determine matrix representation of graph.
- Determine the regions of planer connected graph.
- Draw  $K_n$ ,  $K_{m,n}$ .
- Determine the chromatic number of graphs.
- Find the weight of minimum spanning tree.
- Find number of arrangements that are possible.

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of mathematical logic and Boolean algebra.	Apply	1	1, 2, 9, 10, 12
2	Apply karanaugh map to minimize	Apply	1	1, 2, 9, 10, 12
3	Solve generating function by recurrence relations	Apply	2	1, 2, 9, 10, 12
4	Model and solve real world problems using graphs and trees	Apply	2	1, 2, 9, 10, 12

**TEXT BOOKS:**

1. Tremblay, J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", 30th Reprint, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2017.
2. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2018.

**REFERENCE BOOKS:**

1. R.P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2017.
2. S. Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2021.
3. T. Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2015.
4. S B Singh. "Discrete Structures", Khanna Book Publishers Co-Pvt. Ltd. 2019.

# 22BS203 STATISTICAL METHODS

Hours Per Week :

L	T	P	C
3	0	2	4

**PREREQUISITE KNOWLEDGE:** Basic knowledge in mathematical calculations

## COURSE DESCRIPTION AND OBJECTIVES:

To impart the knowledge of Correlation and regression in data analysis and be able to fit appropriate mathematical curve to the given data and predict the future values of the interested variables. Also, able to assess the association between the various attributes.

### MODULE-1

#### UNIT-1

[12L+0T+8P = 20 Hours]

#### ATTRIBUTES

Introduction, Nature, and consistency and mention its conditions. Independence and association of attributes, co-efficient of association, coefficients of contingency and their problems.

#### UNIT-2

[12L+0T+8P = 20 Hours]

#### CORRELATION

Correlation: Definition, scatter diagram, its coefficient and its properties, scatter diagram, computation of correlation coefficient for ungrouped data. spearman's rank correlation coefficient, properties of Spearman's correlation coefficients and problems. Practices:

#### PRACTICES:

- Identify the association between the attributes
- Verify the attributes are independent or not
- Measures the correlation between the variables
- Apply Spearman's correlation for ranked data
- Analyse strength and relation between the variables

### MODULE-2

#### UNIT-1

[12L+0T+8P = 20 Hours]

#### CURVE FITTING

Definition, method of least square, fitting of linear, quadratic, exponential and power curves and their applications.

#### UNIT-2

[12L+0T+8P = 20 Hours]

#### REGRESSION

simple linear regression, properties of regression coefficients. Regression lines, Concept of Correlation ratio, partial and multiple correlation coefficients, correlation verses regression and their problems.s.

#### PRACTICES:

- Fitting of various various curves for ungrouped data
- Construction of linear regression line of y on x
- Construction of linear regression line of x on y
- Computation of regression coefficients
- Identification regression lines y on x or x on y

**SKILLS:**

- ✓ Carryout the correlation and regression analysis for industrial and research data
- ✓ Fit appropriate curves to the given data and predict the future values of the variables using tools

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Use regression analysis to construct mathematical model and predict the future values of the variables	Apply	2	1,2
2	Analyze the linear association between variables by correlation	Analyze	1	1,2,3
3	Estimate the statistical relations between categorical variables	Evaluate	1	1,2,3
4	Construct an appropriate curve for the data	Create	2	1,2,4,5

**TEXT BOOKS:**

1. V. K. Kapoor and S. C. Gupta, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
2. Stephen Bernstein-Ruth Bernstein, Elements of Statistics I Descriptive Statistics and Probability, Schaum's Outlines, 2020.
3. K.V.S. Sarma, Statistics Made Simple: Do it yourself on PC. PHI, 2nd edition, 2010.

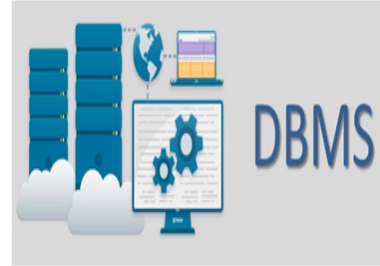
**REFERENCE BOOKS:**

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I, Wiley, 1971.
2. A.M. Gun, M.K. Gupta B. Dasgupta, Fundamentals of Statistics , Vol-I, the World Press, 2019.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house, 1984.

# 22BS204 DATABASE MANAGEMENT SYSTEMS

Hours Per Week :

L	T	P	C
3	0	2	4



<https://www.youtube.com/watch?v=IDpB9zF8LBw>

**PREREQUISITE KNOWLEDGE:** Discrete Mathematical Structures.

## COURSE DESCRIPTION AND OBJECTIVES:

This course presents an introduction to database management systems with an emphasis on how to organize, maintain and retrieve data efficiently from a relational database. It also focuses on requirements gathering and conceptual, logical, physical database design. The objective of the course is to enable the student to understand database design, expressing queries using SQL, query optimization and transaction processing

## MODULE-1

### UNIT-1

[12L+0T+8P = 20 Hours]

#### DATABASE SYSTEM CONCEPTS

**Databases And Database Users:** Introduction; Characteristics of the database approach; Actors on the scene; Advantages of using DBMS approach.

**Database System Concepts and Architecture:** Data models, Schemas and instances; Three-Schema architecture and data Independence; Database languages and interfaces; The database system environment; Centralized and Client-Server architectures for DBMS.

**Conceptual Data Modeling and Database Design:** Entity types, Entity sets, Attributes and keys; Relationship types, Relationship sets, Roles and structural constraints; Weak entity types; Relationship types.

### UNIT-2

[12L+0T+8P = 20 Hours]

#### RELATIONAL DATABASE DESIGN

**Relational Database Design by ER-To-Relational Mapping:** Relational Database design using ER-to-Relational mapping.

**The Relational Data Model and Relational Database Constraints:** Relational model concepts; Relational model constraints and Relational database schemas.

**Relational Algebra:** Unary relational operations - SELECT and PROJECT; Relational algebra operations from set theory; Binary relational operations- JOIN and DIVISION.

**SQL:** SQL data definition and data types; specifying constraints in SQL, Basic retrieval queries in SQL; INSERT, DELETE, and UPDATE statements in SQL.

#### PRACTICES:

- Design ER Model for various real time database applications.
- Development of Relational Database schemas for Company/Student/Sailors/ using DDL constructs of SQL.
- Apply various DML Commands such as select, insert, update etc. of SQL on Relational Database.
- Design of Relational Database schemas by specifying different types of Constraints.
- Apply various Relational Database operators (Arithmetic, Logical & comparison) and string-matching constructs of SQL.
- Expressing queries using Aggregate Functions of SQL on Relational Database.
- Queries on Relational Database using GROUP BY, HAVING and ORDER BY clauses of SQL.

**SKILLS:**

- ✓ Develop E-R model for real life applications.
- ✓ Design of relational databases for real world applications.
- ✓ Devise queries using relational algebra and SQL.
- ✓ Analyze transaction processing, concurrency control and recovery techniques.

**MODULE-2****UNIT-1****[12L+0T+8P = 20 Hours]****NORMALIZATION**

**Complex Queries, Triggers, Views:** More complex SQL retrieval queries; Specifying constraints as assertions and actions as triggers; Views (virtual tables) in PL/SQL.

**Basics Of Functional Dependencies and Normalization for Relational Databases:** Informal design guidelines for relation schemas; Functional dependencies-inference rules, equivalence and minimal cover; Normal forms based on primary keys; Boyce-Codd normal form; Properties of relational decompositions, multi valued dependency, join dependencies.

**UNIT-2****[12L+0T+8P = 20 Hours]****TRANSACTION PROCESSING**

**Introduction to Transaction Processing Concepts and Theory:** Introduction to transaction processing; Transaction and system concepts; Desirable properties of transactions; Characterizing schedules based on serializability.

**Concurrency Control Techniques:** Two-phase locking techniques for concurrency control, concurrency control based on timestamp ordering.

**Database Recovery Techniques:** Recovery concepts; Shadow paging; The ARIES recovery algorithm.

**Indexing Structures for Files and Physical Database Design:** Single level and multi-Level indexing; Dynamic multi-level indexing using B-trees and B+ trees.

**PRACTICES:**

- Design and Development of company database and expressing Nested queries using SQL.
- Design and Development of student database and specifying queries using set operations.
- Design and Development of sailor's database and specifying queries using different types of JOINS.
- Implementation of PL/SQL programs with Control Structures.
- Implementation of PL/SQL programs with Procedures.
- Implementation of PL/SQL programs with Function.
- Implementation of PL/SQL programs with Triggers.
- Creation and dropping of VIEWS.
- Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values.  $F = \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$  is a set of functional dependencies (FDs) so that  $F^+$  is exactly the set of FDs that hold for R. How many candidate keys does the relation R have?
- Apply various DCL and TCL constructs of SQL on Relational Database.

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Develop an E-R model for real life applications.	Apply	1	1,10
2	Express queries using database tools like Oracle, DB2, MYSQL.	Apply	2	5,10
3	Devise queries using Relational Algebra and SQL.	Analyze	2	2
4	Design and normalize databases for real time applications.	Create	1	1,3

**TEXT BOOKS:**

1. Ramez, Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.
2. Raghu Rama Krishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, Tata McGraw Hill, 2013.

**REFERENCE BOOKS:**

1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", 7th edition, Tata Mc Graw Hill,2019.
2. Allen G. Taylor "Database Development for Dummies" 1st Edition, 2011
3. C. J. Date "Introduction to Database Systems" 7th Edition, Addison Wesley, 2003.

# 22BS205 OBJECT ORIENTED PROGRAMMING

Hours Per Week :

L	T	P	C
3	0	2	4



Source: <https://www.datasciencecentral.com/wp-content/uploads/2021/10/8667507462.jpeg>

**PREREQUISITE KNOWLEDGE:** Classes, Objects and Inheritance.

## COURSE DESCRIPTION AND OBJECTIVES:

This course is about the fundamentals of Object-Oriented Programming (OOP) Concept and OOP-based software development methodology. Java as a class-based and pure OOP language is used to demonstrate and implement appropriate concepts and techniques. The students are exposed to the concepts, fundamental syntax, and the thought processes behind object-oriented programming. By end of the course, students will acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java.

## MODULE –1

### UNIT-1

[8L+0T+8P=16 Hours]

#### CONCEPTS OF CLASSES AND OBJECTS

History of Java, Byte code, JVM, Java buzzwords, OOP principles, Data types, Variables, Scope of variables, Operators, Control statements, Type conversion and casting, Arrays.

Concepts of Classes and Objects: Introduction to methods, Method over loading, Constructors, Construct or over loading, Usage of static with data and method, Access control, this key word, Garbage collection, String class, String Tokenizer.

### UNIT-2

[16L+0T+8P=24 Hours]

#### INHERITANCE AND EXCEPTIONS

Inheritance: Type so finheritance, Member access rules, Usage of super key word, Method overriding, Usage of final, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Packages-defining, creating and accessing a package, importing packages, access control in packages.

Exception Handling: Concepts of exception handling, Types of exceptions, Usage of try, catch, throw, throws and finally keywords, Built-in exceptions, User defined exception.

#### PRACTICES:

- There is a telecommunication company called “Powered Air” who have approached you to build their Interactive Voice Response (IVR) system. write a Java program and be able to provide the following menu (given below):
- Note: User should provide an input for each menu display. Welcome to Powered Air service. What would you like to do?
  - a. Know my balance.
  - b. Know my validity date
  - c. Know number of free calls available.
  - d. More
  1. Prepaid Bill Request
  2. Customer Preferences
  3. GPRS activation
  4. Special Message Offers
  5. Special GPRS Offers
  6. 3G Activation
  7. Go back to Previous menu

You are free to display your own messages in this IVR.
- Create a class Rectangle. The class has attributes length and width. It should have methods that calculate the perimeter and area of the rectangle. It should have read Attributes method to read length and width from user.
  - o Hint: Area of rectangle = length \* width, Perimeter of rectangle = 2\*(length+width).

**SKILLS:**

- ✓ To analyse and develop algorithm for real life problems using Java.
- ✓ Experience with developing and debugging programs in different IDEs.
- ✓ Develop multi-threaded applications.
- ✓ Creating web applications.

- Implement a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (use StringTokenizer class).
- Implement a java program to print all tokens of a string on the bases of multiple separators (use StringTokenizer class).
- Using inheritance, one class can acquire the properties of others. Consider
- a class Animal that has only one method “walk”. Next, create a Bird class that also has a fly method. Finally, create a bird object that can both fly and walk.
- Using inheritance ,Write the following code in your editor :
- 1. A class named Arithmetic with a method named “add” that takes integers as parameters and returns an integer denoting their sum.
- 2. A class named Adder that inherits from a superclass named Arithmetic.
  - o Note: Your classes should not be Public.
- When a subclass inherits from a superclass, it also inherits its methods; however, it can also override the superclass methods (as well as declare and implement new ones). Consider the Sports class having methods getName()[which returns name of sport] and getNumberOfTeamMembers()[which returns noof team members] create a Soccer class that inherits from the Sports class. We can override the get Name method and return a different subclass-specific string and override getNumberOfTeamMembers method and return noof team members
- Implement a java program to create an abstract class named Shape that contains an empty method named number Of Sides ( ).Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides ( ) that shows the number of sides in the given geometrical figures.
- You are given an interface Advanced Arithmetic which contains a method signature int divisor\_sum(int n). You need to write a class called My Calculator which implements the interface. divisor\_sum function just takes an integer as input and return the sum of all its divisors. For example divisors of 6 are 1, 2, 3 and 6, so divisor\_sum should return 12. The value of n will be at most 1000.
- Implement a Java program for the following
- Creation of simple package.
- Accessing a package.
- Implement a Java program to read two numbers a,b from user and perform division a/b,if the user passes b value as zero, handle the exception using try and catch otherwise display the result.
- Create a class called Customer with data members account\_number, balance (initialize with 10000), and member functions print(), deposit(), and withdraw(). Print method display account number and balance. If withdraw amount is less than current balance while withdrawing, throw an exception “In Sufficient Funds”. If the input is 1 do print. If the input is 2 withdraw ( ). If the input is 3 deposit. If the input is 4 terminate program.
- Implement a Java program which acceptsage as input from the user and throws an exception
  - o “Not Eligible to Vote” when age is <=18 otherwise print “Eligible to Vote”.

**MODULE –2****UNIT-1****[12L+0T+8P=24 Hours]****MULTI THREDDING AND FRAMEWORK**

Multithreading: Concepts of multi threading, Differences between process and thread, Thread life cycle, Creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication.

Collection Framework: Collections Overview, Collection Interfaces - List, Set, Map, List – Array List, Linked List, Vector, Set - HashSet, TreeSet, Map - HashTable, HashMap, accessing a collection via an Iterator, comparator, comparable.

**UNIT-2****[12L+0T+8P=24 Hours]****SWINGS**

GUI Programming With Swing: Delegation event model-Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events.



Exploring Swing Controls: JLabel and Image Icon, JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.

### PRACTICES:

- **Print in Order**

Suppose we have a class:

```
public class Foo {
    public void first() { print("first"); }
    public void second() { print("second"); }
    public void third() { print("third"); }
}
```

The same instance of Foo will be passed to three different threads. Thread A will call first(), thread B will call second(), and thread C will call third(). Design a mechanism and modify the program to ensure that second() is executed after first(), and third() is executed after second().

Note:

We do not know how the threads will be scheduled in the operating system, even though the numbers in the input seem to imply the ordering. The input format you see is mainly to ensure our tests' comprehensiveness.

Example 1:

Input: nums = [1,2,3]

Output: "firstsecondthird"

Explanation: There are three threads being fired asynchronously. The input [1,2,3] means thread A calls first(), thread B calls second(), and thread C calls third(). "firstsecondthird" is the correct output.

Example 2:

Input: nums = [1,3,2]

Output: "firstsecondthird"

Explanation: The input [1,3,2] means thread A calls first(), thread B calls third(), and thread C calls second(). "firstsecondthird" is the correct output.

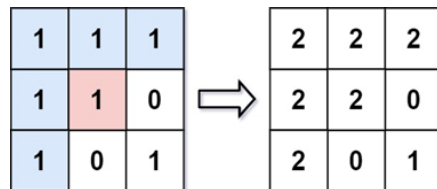
- **Flood Fill:**

An image is represented by an  $m \times n$  integer grid image where  $image[i][j]$  represents the pixel value of the image.

You are also given three integers sr, sc, and color. You should perform a flood fill on the image starting from the pixel  $image[sr][sc]$ .

To perform a flood fill, consider the starting pixel, plus any pixels connected 4-directionally to the starting pixel of the same color as the starting pixel, plus any pixels connected 4-directionally to those pixels (also with the same color), and so on. Replace the color of all of the aforementioned pixels with color.

Return the modified image after performing the flood fill.



Example 1:

Input: image = [[1,1,1],[1,1,0],[1,0,1]], sr = 1, sc = 1, color = 2

Output: [[2,2,2],[2,2,0],[2,0,1]]

Explanation: From the centre of the image with position (sr, sc) = (1, 1) (i.e., the red pixel), all pixels connected by a path of the same color as the starting pixel (i.e., the blue pixels) are colored with the new color.

Note the bottom corner is not coloured 2, because it is not 4-directionally connected to the starting pixel.



Example 2:

Input: image = [[0,0,0],[0,0,0]], sr = 0, sc = 0, color = 0

Output: [[0,0,0],[0,0,0]]

Explanation: The starting pixel is already colored 0, so no changes are made to the image.

- Count words in a given string

The input parameter is a list of strings representing lines of text.

Count how often the word occurs in the text.

If the word "kitten" occurred in a text 23 times, then its entry would be "kitten - 23\n". Return statistics as a String containing all the entries.

Omit all words which contain less than 4 letters and appear less than 10 (the words which are too small or too rare) The entries in the resulting String should be also sorted by their amount and then in alphabetical order if it is needed.

- Implement a Java program for handling mouse events when the mouse entered, exited, clicked, pressed, released, dragged and moved in the client area.
- Implement a Java program for handling key events when the key board is pressed, released, typed.
- Implement a Java swing program that reads two numbers from two separate text fields and display sum of two numbers in third text field when button "add" is pressed.
- Implement a Java program to design student registration form using Swing Controls. The form which having the following fields and button "save". Form Fields are: Name, RNO, Mail id, Gender, Branch, and Address.
- Implement a java program using swings to design a multiple choice question having three options (use radio button) ,display the message using dialog box "Your answer is wrong" if the user selects wrong option otherwise display ,"Your answer is correct."

#### COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply object oriented concepts on real time scenarios.	Apply	1	1,2
2	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes	Apply	1, 2	1,2
3	Design and develop Java applications to solve real world problems by using modern tools and collection framework	Create	2	3,5
4	Design and develop GUI based applications using swings for internet and system based applications.	Create	2	3,5

#### TEXT BOOKS:

1. Herbert Schildt, "Java the complete reference", 12th Edition, McGraw Hill, Education, 2021.
2. M.T. Somashekara, D.S. Guru, K.S. Manjunatha, "Object-Oriented Programming with Java", 1st Edition, PHI Learning, 2017.

#### REFERENCE BOOKS:

1. E. Balagurusamy, "Programming with Java", 6th Edition, McGraw Hill, 2019.
2. Mark Lassofoff, "Java Programming for Beginners: Learn the fundamentals of programming with Java", 1st Edition, Packt Publishing Limited, 2017.
3. Philip Conrod, Lou Tylee, "Learn Java GUI Applications : A JFC Swing Tutorial", 11th Edition, Kidware Software, 2019.

# 22BS206 ENVIRONMENTAL SCIENCE

Hours Per Week :

L	T	P	C
0	1	1	1

**PREREQUISITE KNOWLEDGE:** General awareness regarding environmental problems and importance of environmental protection.

## COURSE DESCRIPTION AND OBJECTIVES:

It is a multidisciplinary subject where different aspects of society and environment are dealt using a holistic approach. It is evolving to be the education for sustainable and ethical development both at a local and global level. It helps to prepare the next generation for planning appropriate strategies to address environmental issues. It identifies and creates solutions that conserve to manage ecosystem and biodiversity and helps to eliminate pollutants, toxicants, preserve air, water and soil quality. Environmental education recognizes impacts of global issues, enhances the public awareness and helps to take decisions towards environmentally responsible actions.

## MODULE-1

### UNIT – 1

[0L+4T+4P=8 Hours]

#### INTRODUCTION TO ENVIRONMENT: NATURAL RESOURCES, ECOSYSTEMS AND BIODIVERSITY

Environment and sustainable development; Natural resources- forest, water, energy and land resources; Ecosystem – basic structural components, function and interactions in ecosystem, ecological succession.

### UNIT – 2:

[0L+4T+4P=8 Hours]

#### BIODIVERSITY AND CONSERVATION

Introduction to biodiversity, types of biodiversity- species, genetic and ecosystem diversity; Threats to biodiversity - natural and anthropogenic, species extinctions, man wildlife conflicts; Biodiversity conservation - principles and strategies; in-situ and ex-situ conservation.

#### PRACTICES:

- Visit to a Biogas plant, Solar Power plant
- Visit to a local area: river/pond/lake/forest / grassland / hill /mountain and study of different
- Types of ecosystems, biodiversity study and documentation (herbarium sheet preparation).
- Case study: Renewable energy use

## MODULE-2

### UNIT-1

[0L+4T+4P=8 Hours]

#### ENVIRONMENTAL POLLUTION AND CLIMATE CHANGE

Air, water, soil, radioactive and noise pollution; Study of different pollutants (SO<sub>x</sub>, NO<sub>x</sub>, PAN, PAH etc.); Toxicity study; Climate change- greenhouse effect, acid rain, ozone layer depletion.

### UNIT-2

[0L+4T+4P=8 Hours]

#### POLLUTION CONTROL DEVICES AND WASTEWATER TREATMENT TECHNOLOGIES

Air pollution control devices - Gravitational settling chambers, cyclonic separators, electrostatic precipitators, fabric filters and bio filters, Wastewater management.PRACTICES:

**SKILLS:**

- ✓ Create a biodiversity map of any habitat/ ecosystem
- ✓ Strategize different ways of using renewable energy resources
- ✓ Design novel strategies and approaches for pollution control and waste management

**PRACTICES:**

- Visit to a sewage treatment plant and wastewater analysis
- Case study: Recycling Technologies
- Case study: Effects of contaminants on microorganisms
- Report writing: 12 principles of green chemistry for environmental sustainability
- Report writing: Environmental Impact Analysis, Local Disaster Management Plan.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic concepts of sustainable development, natural resource utilization and ecology for the purpose of environmental protection	Apply	1	4,5,6
2	Design remediation technologies for their abatement	Apply	2	3,4,5
3	Analyze the biodiversity of different ecosystems and formulate various conservation approaches	Analyze	1	4,5
4	Analyze the presence of various environmental pollutants	Analyze	2	4,5
5	Recommend various waste management approaches and their implementation strategies	Evaluate	2	2,4,5, 6

**TEXT BOOKS:**

1. Kaushik and C. P. Kaushik, "Perspectives in Environmental Studies", 5th edition, New Age International Publishers, 2016.
2. Y. Anjaneyulu, "Introduction to Environmental Science", B. S. Publications, 2015.

**REFERENCE BOOKS:**

1. B. Joseph, "Environmental Studies", 2nd edition, Mc Graw Hill Education, 2015.
2. S. Subash Chandra, "Environmental Science", New Central Book Agency, 2011.
3. Mahua Basu & S.Xavier, "Fundamentals of Environmental Studies", Cambridge University Press, 2016.
4. K. Mukkanti, "A Textbook of Environmental Studies", S. Chand Company Ltd., 2009.
5. M. Anji Reddy, "A Textbook of Environmental Science and Technology", B. S. Publications, 2008.
6. K. Joseph and R. Nagendram, "Essentials of Environmental Studies", Pearson Education Pvt. Ltd., 2007.
7. M. Chandrasekhar, "A Textbook of Environmental Studies", Hi-tech Publications, 2006. 6.
8. C. S. Rao, "Environmental Pollution Control Engineering", New Age International Publishers, 2001.

# 22BS208 BUSINESS ENGLISH COMMUNICATION - I

Hours Per Week :

L	T	P	C
0	2	2	2

**PREREQUISITE KNOWLEDGE:** Basics of grammar, Read and understand for global context, Cultural sensitivity and Basic writing skills.

## COURSE DESCRIPTION AND OBJECTIVES:

**Business English Communication-I** aims to develop the students' abilities in reading, writing skills. The course will provide students an exposure on a wide range of language use in workplace situations. It will make the students to equip with functional English and make them use it confidently in their professional and social contexts. Finally, students will strengthen their reading, writing, listening and speaking skills in Business English.

## MODULE-1

### UNIT – 1

[0L+8T+8P=16 Hours]

#### STAFF DEVELOPMENT AND TRAINING - JOB DESCRIPTION AND JOB SATISFACTION-GETTING THE RIGHT JOB

- Reading – Reading for Understanding, telephone etiquette.
- Writing – job applications- formal E-mail Writing
- Listening – Discussions – need of trainings (in house and out sourcing), job applications, interviews.
- Speaking – applying for a job, work-place culture, training, planning training.
- Vocabulary – Appropriate use of words the context, B2 Preliminary word list
- Vocabulary /Grammar – countable and uncountable nouns, adjective forms, workplace vocabulary.

### UNIT – 2

[0L+8T+8P=16 Hours]

#### MAKING CONTACT- BREAKING INTO THE MARKET -LAUNCHING A PRODUCT

- Reading –Reading for specific information and inference
- Writing – writing reports, E-mail writing- making an enquiry, answering enquiries
- Listening – short talks- advertisements, compliances, or public announcements.
- Speaking – discussing features of new products, advertising a product, designing an advertisement (role-plays)
- Vocabulary/Grammar – infinite verbs, verb+ ing, prepositions in phrases describing trends, terminology related promotion activities.

#### PRACTICES:

- E- mail writing for professional purposes
- Writing job application
- Writing short report
- Role play
- Describing new products, designing advertisement
- Comprehending different advertisements

**SKILLS:**

- ✓ Use of appropriate grammar and vocabulary with syntactic patterns in short texts.
- ✓ Read and extract the main message, global meaning, specific information, detailed comprehension, understanding of attitude, opinion and writer purpose and inference.
- ✓ Listen to understand key information, specific information, gist and detailed meaning and to interpret meaning.
- ✓ Understand questions and make appropriate responses and talk freely on everyday topics

**MODULE-2****UNIT – 1:****[0L+8T+8P=16 Hours]****A STAND AT TRADE FAIR- BEING PERSUASIVE- STARTING A BUSINESS**

- Reading – Reading for global understanding and gist.
- Writing – writing a memo, writing a proposal
- Listening – Discussion activities and listening to understand the gist of each short dialogue
- Speaking – short Talks, making choices- location, finance.
- Vocabulary / Grammar – modal verbs, time prepositions, expressions for making recommendations

**UNIT – 2:****[0L+8T+8P=16 Hours]****FINANCING A START-UP-EXPANDING INTO EUROPE- PRESENTING YOUR BUSINESS IDEA**

- Reading – reading for inference, Communicative Achievement, Organisation and Language.
- Writing – writing proposals, letter of enquiry
- Listening – listening for information, inference, presentations.
- Speaking – short presentations, business ideas, expressing - experiences, opinions, habits, etc.
- Vocabulary / Grammar – can, could., expressions for presentations

**PRACTICES:**

- Listening to understand the gist of each short dialogue
- Listening to presentations,
- Writing proposals
- Writing reports
- Writing memos, letters
- Expressing ideas, opinions, choices

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	apply to read and grasp content on a range of topics/texts related to work-place like notifications, advertisements, business reports, articles.	Apply	1,2	2,6
2	apply suitable strategies to achieve comprehension, like listening for main points and checking comprehension using contextual clues etc.	Apply	1,2	2,6
3	demonstrate vocabulary related to business English	Analyze	1, 2	2,6
4	show sufficient control of English grammar and sentence variety to coherently organise information at sentence and discourse levels	Evaluate	1,2	2,6
5	use functional English to communicate and interact effectively in work-place situations	Create	1, 2	2,6

**TEXT BOOKS:**

1. Guy Brook Hart, Bench Mark, Cambridge University Press, 2014.

**REFERENCE BOOKS:**

1. Adrian Doff and Craig Thaine, "Empower Pre intermediate", Cambridge University Press, 2015.
2. University Of Cambridge Local Examinations Syndicate, Cambridge University press, ISBN: 9780521673136, 9780521673136

# 22BS209 BUSINESS ENGLISH COMMUNICATION - II

Hours Per Week :

L	T	P	C
0	2	2	2

**PREREQUISITE KNOWLEDGE:** Basics of grammar, Read and understand for global meaning, Cultural sensitivity and Basic writing skills

## **COURSE DESCRIPTION AND OBJECTIVES:**

Business English Communication-II aims to develop the students' abilities in reading, writing skills at advance level. The course will help students to use English language for specific purpose at work place. It will make the students to equip with functional English and make them use it confidently in their professional and social contexts. Finally, students will strengthen their reading, writing, listening and speaking skills in Business English

### **MODULE-1**

#### **UNIT-1**

[0L+8T+8P=16 Hours]

#### **ARRANGING BUSINESS TRAVEL - BUSINESS CONFERENCE- BUSINESS MEETINGS**

- Reading – Reading for Understanding and inference in business conferences and meetings.
- Writing – formal E-mail Writing – arranging business travels, conferences
- Listening – conference lectures, discussions (listening for specific information)
- Speaking – conference discussions and presentations (GD, role play)
- Vocabulary /Grammar –modals, apt vocabulary for business meetings and conferences

#### **UNIT-2**

[0L+8T+8P=16 Hours]

#### **SPENDING THE SALES BUDGET- SOCIAL MEDIA AND BUSINESS - BUSINESS AND ENVIRONMENT**

- Reading –Reading reports for global understanding and information- green office,
- Writing – writing sales reports, advertising on social media, business letters
- Listening – listening to reports, social media and customers, office environment.
- Speaking –how to use social media, improving office environment (seminars, GD)
- Vocabulary/Grammar – tenses, if conditions, vocabulary for advertising on social media,

#### **PRACTICES:**

- E- mail writing for arranging business travels and conferences
- Writing sales reports
- Writing letters
- Role play
- Group discussions. Seminars,
- Designing different advertisements

### **MODULE-2**

#### **UNIT-1:**

[0L+8T+8P=16 Hours]

#### **A STAFF SURVEY - OFF SHORING AND OUTSOURCING - CUSTOMER SATISFACTION AND LOYALTY**

- Reading – Reading reports about outsourcing satisfaction and loyalty (global understanding).
- Writing – writing a survey report, writing a proposal for outsourcing, Email-writing for apologizing.
- Listening – calls to HR, customer communications.
- Speaking – discussions - staff meetings, Customer satisfaction and loyalty, short talks on outsourcing
- Vocabulary / Grammar – third if conditions, reported speech.

**SKILLS:**

- ✓ Use of appropriate grammar and vocabulary with syntactic patterns in short texts.
- ✓ Read and extract the main message, global meaning, specific information, detailed comprehension, understanding of attitude, opinion and writer purpose and inference.
- ✓ Listen to understand key information, specific information, gist and detailed meaning and to interpret meaning.
- ✓ Understand questions and make appropriate responses and talk freely on everyday topics

**UNIT-2****[0L+8T+8P=16 Hours]****COMMUNICATION WITH CUSTOMERS - CORRESPONDING WITH CUSTOMERS -BUSINESS ACROSS CULTURES**

- Reading – reading customers' correspondence- working in new culture.
- Writing – complaint letters/emails, letters/emails about introducing new service
- Listening – listening to short talk – working in China and working in Europe, customers' communications.
- Speaking – Discussions – work in foreign, launching a new service, dissatisfied customers.
- Vocabulary / Grammar – active and passive voice, expressing results,

**PRACTICES:**

- Listening to understand the gist of each short dialogue
- Listening to presentations, short talks, conference presentations
- Writing proposals
- Writing sales and survey reports
- Writing memos, letters/emails
- Expressing ideas, opinions, choices about working in new places and about products

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	apply the knowledge of writing promotion letters/ emails, and design brochures/ advertisements	Apply	1,2	2,6
2	apply suitable strategies to achieve comprehension, like listening for main points and checking comprehension using contextual clues etc.	Apply	1,2	2,6
3	demonstrate vocabulary related to business conferences, surveys, meetings and sales budgets.	Analyze	1, 2	2,6
4	show sufficient control of Business English grammar and sentence variety to coherently organise information at sentence and discourse levels	Evaluate	1,2	2,6
5	use functional English to communicate and interact effectively in multi -cultural professional settings.	Create	1, 2	2,6

**TEXT BOOKS:**

1. Guy Brook Hart, Bench Mark, Cambridge University Press, 2014.

**REFERENCE BOOKS:**

1. Adrian Doff and Craig Thaine, "Empower Pre intermediate", Cambridge University Press, 2015.
2. University Of Cambridge Local Examinations Syndicate, Cambridge University press, ISBN: 9780521673136, 9780521673136.

# 22BS210 DIFFERENTIAL EQUATIONS

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Introductory knowledge on differential equations, order and degree, elementary idea on ordinary and partial differentiation.

## COURSE DESCRIPTION AND OBJECTIVES:

The main purpose of the course is to introduce students to the theory and methods of ordinary and partial differential equations. Students should be able to implement the methods taught in the course to work associated problems, including proving results of suitable accessibility. This course is designed to prepare students to solve problems arising from many applications such as mathematical models of physical or engineering processes.

## MODULE-1

### UNIT-1

[12L+8T+0P=20 Hours]

#### FIRST ORDER DIFFERENTIAL EQUATIONS

Basic concepts and genesis of ordinary differential equations, Order and degree of a differential equation, Differential equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor, First order higher degree equations solvable for x, y and p, Clairaut's form.

### UNIT-2

[12L+8T+0P=20 Hours]

#### SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS AND APPLICATIONS

Statement of existence and uniqueness theorem for the solution of linear differential equations, General theory of linear differential equations of second order with variable coefficients, Solutions of homogeneous linear ordinary differential equations of second order with constant coefficients, Method of variation of parameters and method of undetermined coefficients.

#### PRACTICES:

- Finding order and degree of the given differential equations.
- Justification of homogeneity.
- Finding solution to linear differential equations of first order.
- Finding solution to linear differential equations of second order.

## MODULE-2

### UNIT-1

[12L+8T+0P=20 Hours]

#### FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS

Genesis of Partial differential equations (PDE), Concept of linear and non-linear PDEs, Methods of solution of simultaneous differential equations of the form:  $dx/P(x,y,z) = dy/Q(x,y,z) = dz/R(x,y,z)$ , Lagrange's method for PDEs of the form:  $P(x,y,z)p+Q(x,y,z)q=R(x,y,z)$ , where  $p=\partial z/\partial x$  and  $q=\partial z/\partial y$ ; Solutions passing through a given curve.



**SKILLS:**

- ✓ Extract information from equations to interpret the reality.
- ✓ Extract information from partial differential equations to interpret the reality.
- ✓ Know the various types of methods and their limitations

**UNIT-2****[12L+8T+0P=20 Hours]****SECOND ORDER PARTIAL DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS WITH APPLICATIONS**

Principle of superposition for homogeneous linear PDEs, Relation between solution sets of non-homogeneous linear PDEs and their corresponding homogeneous equations, Reducible and irreducible homogeneous equations and their solutions in various possible cases, Solution of non-homogeneous reducible equations using Lagrange's method for first order equations. Practices:

**PRACTICES:**

- Finding solution to homogeneous linear PDEs.
- Finding solution to sets of non-homogeneous linear PDEs.
- Finding solution to reducible and irreducible homogeneous equations.
- Finding solution to non-homogeneous reducible equations.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply some of the basic theory of linear ODEs, recognize basic types of linear ODEs	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Recognize ODEs, PDEs and system of considered equation concepts that are encountered in the real world, understand.	Apply	1	1, 2, 5, 9, 10
3	Defining different sets of generalized coordinates for a given mechanical system and the use of canonical transformations.	Analyse	2	1, 2, 3, 5, 9, 10
4	Identify the physical situations formulate mathematical models using PDEs.	Analyse	2	1, 2, 5, 9, 10, 12
5	Students are able to analyse some modern concepts and methodologies on ODEs and PDEs.	Analyse	2	1, 2, 5, 9, 10, 12

**TEXT BOOKS:**

1. J. Sinharoy, S. Padhy, A course in Ordinary and Partial Differential Equations, Kalyani Publications, New Delhi, 2018.
2. V. Venkateswara Rao, N. Krishna Murthy, A text book of B.Sc. Mathematics, Vol. I, S. Chand & Co., New Delhi, 2022.

**REFERENCE BOOKS:**

1. Erwin Kreyszig (2011). Advanced Engineering Mathematics (10th edition). J. Wiley & Sons.
2. B. Rai & D. P. Choudhury (2006). Ordinary Differential Equations - An Introduction. Narosa Publishing House Pvt. Ltd. New Delhi.
3. Shepley L. Ross (2007). Differential Equations (3rd edition). Wiley.
4. George F. Simmons (2017). Differential Equations with Applications and Historical Notes (3rd edition). CRC Press. Taylor & Francis.
5. Ian N. Sneddon (2006). Elements of Partial Differential Equations. Dover Publications.

**22BS211 STATISTICAL INFERENCE**

Hours Per Week :

L	T	P	C
3	0	2	4

**PREREQUISITE KNOWLEDGE:** Basic knowledge in mathematical calculations .**COURSE DESCRIPTION AND OBJECTIVES:**

This course provides the students a good foundation in the concepts of estimation and testing of hypothesis. Upon completion of this course, student should be able to differentiate between point estimation and interval estimation, estimate population parameters for various distributions using maximum likelihood method and can construct the confidence limits for population mean. Along with student can successfully apply parametric and non-parametric test procedures to test the statistical statements.

**MODULE-1****UNIT – 1****[12L+0T+8P = 20 Hours]****THEORY OF ESTIMATION**

Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, & sufficiency. Statement of Neyman's factorization theorem. Estimation of parameters by the methods of moments and maximum likelihood (M.L), properties of MLE's. Binomial, Poisson & Normal Population parameters estimate by ML method. Confidence intervals of the parameters of normal population.

**UNIT – 2:****[12L+0T+8P = 20 Hours]****CONCEPTS OF STATISTICAL HYPOTHESIS**

Null and alternative hypothesis, critical region, acceptance region, two types of errors, level of significance, power of a test, one-tailed, two- tailed tests, procedure for testing of hypothesis, t, F and Chi-square distributions statements and properties.

**PRACTICES:**

- Test an estimator is good estimator or not
- Estimate population parameter of Binomial by MLE
- Estimate population parameter of Poisson by MLE
- Estimate population parameters of Normal by MLE
- Test the property of efficiency of estimator

**MODULE-2****UNIT-1****[12L+0T+8P = 20 Hours]****PARAMETRIC TESTS**

**Large Sample Tests:** Large sample tests for single mean, two means, single proportion, two proportions, standard deviation of single and double samples and fisher's Z transformation.

**Small Sample Tests:** t-test for single, double and paired tests, variance ratio test (F-test), Chi-square test-independence of attributes

**UNIT-2****[12L+0T+8P=20 Hours]****NON-PARAMETRIC TESTS**

Advantages and disadvantages of non-parametric tests, two sample run test, two sample median test and two sample sign tests with applications. PRACTICES:

**SKILLS:**

- ✓ Study the characteristics of good estimator
- ✓ Calculate and interpret confidence intervals for means
- ✓ Test the statistical significance by suitable parametric and non-parametric methods
- ✓ Test the statistical association by chi-square test

**PRACTICES:**

- Applications of single mean and two means by parametric methods
- Test the significance of single proportion and two proportions
- Verify the two sample variances are same or not
- Test the data is random nature or not
- Applications of median and sign test

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply MLE methods to estimate the population parameters of various distributions	Apply	1	1,2,3
2	Calculate the critical values for different hypothesis tests	Apply	1	1,2
3	Construct confidence interval for means or a proportion's	Apply	2	1,3
4	Distinguish parametric and non-parametric methods and can effectively apply suitable test to take decision about accept or reject the hypothesis	Analyze	2	1,2,4
5	Test the hypothesis by non-parametric methods	Evaluate	2	1,2,3,4

**TEXT BOOKS:**

1. V. K. Kapoor and S. C. Gupta, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
2. Stephen Bernstein-Ruth Bernstein, Elements of Statistics I Descriptive Statistics and Probability, Schaum's Outlines, 2020.
3. K.V.S. Sarma, Statistics Made Simple: Do it yourself on PC. PHI, 2nd edition, 2010.

**REFERENCE BOOKS:**

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I, Wiley, 1971.
2. A.M. Gun, M.K. Gupta B. Dasgupta, Fundamentals of Statistics, Vol-I, the World Press, 2019.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house, 1984.

# 22BS212 OPERATING SYSTEMS

Hours Per Week :

L	T	P	C
3	0	2	4



Image Source : [https://www.123rf.com/stock-photo/operating\\_system.html](https://www.123rf.com/stock-photo/operating_system.html)

**PREREQUISITE KNOWLEDGE:** Knowledge of computers fundamentals, Computer organization & Digital logic and its design.

## COURSE DESCRIPTION AND OBJECTIVES:

This course aims at concepts and principles of Operating Systems, its overall responsibility in acting as an interface between the system's hardware components and the user. Further, it also helps students to understand the different scheduling policies, process synchronization mechanisms, deadlock handling mechanisms and memory management techniques.

## MODULE-1

### UNIT-1

[12L+0T+8P = 20 Hours]

#### LINUX FILE SYSTEM & PROCESS SCHEDULING

**Introduction to LINUX File System:** The LINUX file System, File System Hierarchy, File system Commands, File Attributes, File Permissions.

**Filters:** cmp, comm, diff, head, tail, find, cut, paste, sort, uniq.

**Regular Expressions:** grep, egrep, fgrep, Sed- line addressing, context addressing, text editing, substitution.

**Introduction to Operating System:** What Operating System do; Operating System Structure; Process concept-overview, Process Scheduling, Operations on Process; Inter Process Communication; Threads;

**Process (CPU) Scheduling-**Scheduling Criteria, Scheduling Algorithms; Multiple-Processor scheduling;

### UNIT-2

[12L+0T+8P = 20 Hours]

#### PROCESS SYNCHRONIZATION & DEADLOCKS

**Process Synchronization:** The critical-section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

**Deadlocks:** Deadlock characterization; Methods of handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery.

#### PRACTICES:

- Use the cat command to create a file containing the following data. Call it mytable.txt use tab to separate the fields.

```
1425   ravi   15.65
4320   ramu   26.27
6830   sita   36.15
1450   raju           21.86
```

- Use the cat command to display the file, mytable.txt.
- Use the vicomm and to correct any errors in the file, mytable.txt.
- Use the sort command to sort the file mytable.txt according to the first field.
- 
- Call the sorted file mytable.txt (same name)
- Print the file mytable.txt.
- Use the cut & paste commands to swap fields 2 and 3 mytable. Call it mytable.txt (same name)

**SKILLS:**

- ✓ *Manage open-source operating systems like Ubuntu, Fedora etc.*
- ✓ *Know the concepts of Processes scheduling and File Systems.*
- ✓ *Identification of different disk scheduling methodologies.*

- h. Print the new file, mytable.txt.
- Write a shell script that takes a command-line argument and reports on whether it is directory, a file, or something else.
  - Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.
  - Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
  - Write a shell script that computes the total and average marks of a student according to the following;
    - If average marks  $\geq 69$  then result is—Distinction.
    - If average marks  $\geq 59$  and  $\leq 70$  then result is—First Class.
    - If average marks  $\geq 49$  and  $\leq 60$  then result is—Second Class. If average marks  $\leq 50$  then result is—Pass.
    - Note that any subject marks  $\leq 40$  then result is—Fail.
    - Accept student name and six subject marks through the keyboard.
  - Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, have the program ask the user for the necessary information, such as the file name, new name and so on.
  - Write a shell script, which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.
  - Write a shell script that accepts a file name starting and ending line numbers as arguments and displays all the lines between the given line numbers.
  - Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.
  - Implementation of new process creation and its communications.
  - Implement of thread creation and deletion.
  - Implementation of FCFS scheduling.
  - Implementation of SJF and RR Scheduling.
  - Implementation of producer consumer problem.
  - Implementation of Banker's algorithm for Dead lock avoidance.

**MODULE-2****UNIT-1****[12L+0T+8P = 20 Hours]****MEMORY MANAGEMENT**

**Memory Management:** Basic concept of memory management, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

**Virtual Memory Management:** Demand Paging, Page Replacement: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU), Least Recently used (LRU), Allocation of Frames.

**UNIT-2****[12L+0T+8P = 20 Hours]****SECONDARY STORAGE STRUCTURE**

**Secondary Storage Structure:** Over view of mass-storage structure, disk structure, disk scheduling;

**File System Interface -** File concept, Access Methods, Directory & Disk Structure, File-System Mounting, File Sharing, Protection; File-system structure.

**File System Implementation-** Directory implementation, Allocation Methods, Free Space Management.

**PRACTICES:**

- Assume that you have a page-reference string for a process with  $m$  frames (initially all empty). The page-reference string has length  $p$ , and  $n$  distinct page numbers occur in it.
  - a) What is a lower bound on the number of page faults?
  - b) What is an upper bound on the number of page faults?

- Consider the following page-replacement algorithms. Rank these algorithms on a five-point scale from “bad” to “perfect” according to their page-fault rate. Separate those algorithms that suffer from Belady’s anomaly from those that do not.
  - a) LRU replacement.
  - b) FIFO replacement.
  - c) Optimal replacement.
  - d) Second-chance replacement.
- Consider the page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.
- How many page faults would occur for the following replacement algorithms, assuming one, two, three, four, five, six, and seven frames? Remember that all frames are initially empty, so your first unique pages will cost one fault each.
  - LRU replacement.
  - FIFO replacement.
  - Optimal replacement.
- How many page faults occur for your algorithm for the following reference string with four page frames? 1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2.
- What is the minimum number of page faults for an optimal page replacement strategy for the reference string above with four page frames?
- Consider a demand-paged computer system where the degree of multiprogramming is currently fixed at four. The system was recently measured to determine utilization of the CPU and the paging disk. Three alternative results are shown below. For each case, what is happening?
  - a) Can the degree of multiprogramming be increased to increase the CPU utilization? Is the paging helping?
  - b) CPU utilization 13 percent; disk utilization 97 percent.
  - c) CPU utilization 87 percent; disk utilization 3 percent.
  - d) CPU utilization 13 percent; disk utilization 3 percent.
- Implementation of Disk scheduling algorithm—FCFS.
- Implementation of Disk scheduling algorithm—SSTF and SCAN.

#### COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1.	Apply the concepts of file system interface and implementation.	Apply	1,2	2,5
2	Apply the concepts of process scheduling algorithms and process synchronization techniques to derive the efficiency of resource utilization.	Apply	1	1, 2, 3, 5, 12
3.	Classify the basic concepts of operating system and explore Linux ecosystem.	Analyze	1	1
4.	Analyze the requirements for attempting Operating systems principles.	Analyze	1,2	1,2,12
5.	Design the various memory management schemes For a given scenario.	Create	2	3,5

#### TEXT BOOKS:

1. Sumitabha Das, Unix concepts and applications, TMH Publications, 4th Edition, July 2017.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley & Sons Inc, 2013.

#### REFERENCE BOOKS:

1. B.A.Forouzan & R.F.Giberg, “Unix and shell Programming”, Thomson, 1st Edition, New Delhi, 2003.
2. Richard. Stevens and Stephen A Rago, “Advanced Programming in the Unix Environment”, 3rd Edition, Addison-Wesley, 2013.
3. William Stallings, “Operating Systems-Internals and Design principles” PHI, 7th Edition, 2012.
4. Gary J. Nutt. Addison-Wesley, “Operating Systems: A Modern Perspective”, Aug 2001, 2nd Edition.

# 22BS213 DESIGN AND ANALYSIS OF ALGORITHMS

Hours Per Week :

L	T	P	C
3	0	2	4

**PREREQUISITE KNOWLEDGE:** Data Structures, Programming .

## **COURSE DESCRIPTION AND OBJECTIVES:**

Upon completion of this course, students will be able to do the following:

- Analyze the asymptotic performance of algorithms.
- To solve different problems using suitable design methods such as the greedy method, divide and conquer, dynamic programming, backtracking and branch and bound.
- Understand the impact of the choice of data structures and algorithm design methods on the performance.
- Synthesize efficient algorithms in common engineering design situations.
- To understand the differences between tractable and intractable problems.

## **MODULE-1**

### **UNIT – 1**

**[12L+0T+8P = 20 Hours]**

#### **INTRODUCTION:**

Algorithm, Pseudo-code for expressing algorithms, Performance analysis - Space and Time complexity; Asymptotic notation - Big oh notation, Omega notation, Theta notation and Little oh notation; Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method, Masters theorem

#### **DIVIDE AND CONQUER**

General method, Applications - Binary search, Quick sort, Merge sort, and Stassen's matrix multiplication

### **UNIT – 2:**

**[12L+0T+8P = 20 Hours]**

#### **GREEDY METHOD**

Applications - Job sequencing with deadlines, Knapsack problem, Minimum cost spanning trees, Single source shortest path.

## **MODULE-2**

### **UNIT-1**

**[12L+0T+8P = 20 Hours]**

#### **DYNAMIC PROGRAMMING**

General method, Applications - Optimal binary search trees, Matrix chain multiplication, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.

### **UNIT-2**

**[12L+0T+8P=20 Hours]**

#### **BACKTRACKING**

General method, Applications – n-queen problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

**BRANCH AND BOUND PROBLEMS**

General method, Applications - Traveling sales person problem, 0/1 knapsack problem, LC Branch and Bound solution, FIFO Branch and Bound solution.

**PRACTICES:**

- Sort a given set of elements using the following methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
  - a. Quick sort                      b. Merge sort                      c. Bubble sort
- Search for a given set of elements using the following methods and determine the time required to search the given element. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
  - a. Linear Search                      b. Binary Search
- Implement the following:
  - a. Represent the given graph using sequential representation.
  - b. Find the degree of all the vertices.
  - c. List all the isolated vertices
- Implement the following using divide and conquer approach
  - a. To multiply two given square matrices.
  - b. To multiply two given square matrices using starssen's matrix multiplication.
- State the problem of Job sequencing with deadlines and write a program to solve it using Greedy method.
- State Knapsack problem and write a program to solve the knapsack problem using Greedy approach.
- Define minimum spanning tree and write a program to find minimum spanning tree for a given undirected graph using any algorithm of your choice.
- State all pairs shortest path problem and write a program to solve it using dynamic programming
- Explain optimal binary search tree using an example and Write a program to find optimal binary search tree using dynamic programming.
- State the problem of Matrix chain multiplication and write a program to find optimal order of matrix chain multiplication problem using dynamic programming
- State n-queens problem and write a program to solve the same using backtracking approach
- Write a program to solve knapsack problem using Branch and Bound
- State the problem of sum of subsets and write a program to solve it using backtracking approach.

**SKILLS:**

- ✓ Develop algorithms for solving problems using divide and conquer, greedy, dynamic programming and backtracking techniques.
- ✓ Analyze the given algorithm with respect to space and time complexities and compare with other algorithms.
- ✓ Application of existing algorithms to solve real world problems



**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the running times of algorithms using asymptotic analysis	Apply	1	1,2
2	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	Apply	2	1,3
3	Design the greedy algorithms and analyze them.	Analyze	2	1,2,4
4	Design dynamic programming algorithms and analyze them.	Evaluate	2	1,2,3,4

**TEXT BOOKS:**

1. Ellis Horowitz, Satraj Sahni and Rajasekharam, "Fundamentals of Computer Algorithms", 2nd edition, Galgotia publications, 2006.

**REFERENCE BOOKS:**

1. Anony Levitin, "Introduction to Design and Analysis of Algorithms", 3rd edition, Pearson Education, 2016.
2. Donald E.knuth, "The Art of Computer Programming", Volume 3, 2nd edition, Addisonwesley Longman Inc,1998.
3. Algorithms by Dasgupta, Papadimitriou, and Vazirani (McGraw-Hill, 2008)

# III YEAR

## B.Sc.

### COURSE CONTENTS

I SEM & II SEM

#### V SEMESTER

- ▶ 22BS301 - Linear Algebra
- ▶ 22BS302 - Real Analysis

---

- ▶ 22BS303 - Sampling Techniques

---

- ▶ 22BS304 - Econometrics

---

- ▶ 22BS305 - Computer Networks

---

- ▶ 22BS306 - Cyber Security

---

- ▶ 22BS307 - Software Engineering

---

#### VI SEMESTER

- ▶ \_\_\_\_\_ - Mathematics Elective IV

---

- ▶ \_\_\_\_\_ - Statistics Elective V

---

- ▶ \_\_\_\_\_ - Computer Elective VI

---

- ▶ 22BS308 - Project

---



# 22BS301 LINEAR ALGEBRA

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Basics of matrices, Determinant, relations and functions.

## COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the fundamental concepts of matrices and rank of a matrix using Echelon form, Normal forms. The methods for solving the system of linear equations using Cramer's rule, Gauss Elimination method and Gauss-Jordan method. To find the Eigen values and Eigen vectors of a square matrices and applications on it. To discuss vector space and its properties, Basis and Dimension and their applications.

## MODULE-1

### UNIT-1:

[12L+8T+0P=20 Hours]

#### MATRICES

**RANK OF A MATRIX:** Algebra of matrices, Types of matrices, Invertible matrices, Rank of a matrix, Echelon form, Normal form.

**SOLUTIONS OF LINEAR EQUATIONS:** Consistency of System of linear equations, Cramer's Rule, Gauss Elimination method, Gauss-Jordan method.

### UNIT – 2

[12L+8T+0P=20 Hours]

#### APPLICATIONS OF MATRICES

**Eigen values and Eigen vectors:** Introduction to Eigen values and Eigen vectors, Eigen values of diagonal matrix, Eigen values of triangular matrices, Properties of an Eigen values and Eigen vectors (without proofs).

**Applications of Eigen Values and Eigen Vectors:** Cayley-Hamilton theorem (without proof), Verification of Cayley-Hamilton theorem, Power of a square matrix, Spectral matrix, Diagonalization of a matrix.

#### PRACTICES:

- Determine the Rank of a matrix using the definition.
- Determine the rank of a matrix using Echelon form and Normal form.
- To find the solution of system of linear equations using Cramer's rule and Gauss Elimination method.
- To find the solution of system of linear equations (Homogeneous and Non-homogeneous) using Gauss-Jordan method.
- Determine the Eigen values and Eigen vectors of a square matrix which are either diagonal matrix or triangular matrix.
- Verification of Cayley-Hamilton theorem for square matrices.
- Examine the given square matrix is diagonalizable or not.
- Using Cayley-Hamilton theorem find the powers of a matrix.

## MODULE-2

### UNIT – 1:

[12L+8T+0P=20 Hours]

#### VECTOR SPACES

Vector Spaces, Bases and Dimension: Vector space, Subspace, Linear independence and dependence of vectors, Bases and Dimension.

**SKILLS:**

- ✓ To discuss the solution of system of linear equations using other methods.
- ✓ Find Eigen Values and Eigen Vectors.
- ✓ Apply transformation to real world problems involving linear transformations.
- ✓ Analyze Quadratic forms and its applications.

Linear Transformation: Linear transformations, Representation of linear transformations by matrices, Null space, Rank-nullity theorem.

**UNIT – 2****[12L+8T+0P=20 Hours]****INNER PRODUCT SPACES**

**Inner Product Space:** Inner product spaces, Cauchy-Schwarz's inequality, Orthogonal basis, Gram-Schmidt orthogonalization process.

**Quadratic Forms:** Introduction to Quadratic forms, Reduction of Quadratic form to symmetric matrix form and vice-versa, Positive, negative and semi definite matrices.

**PRACTICES:**

- Verify the given set of vectors is linearly dependent or not.
- Verify the given set of vectors is a basis or not.
- Examine the given transformation is a linear transformation or not.
- Verify Rank-Nullity theorem for given set problems.
- To discuss the applications of Orthogonal vectors and linearly independent.
- Find the Orthonormal basis to the given set of vectors using Gram-Schmidt Orthogonalization process.
- Discuss the Quadratic forms.
- Determine the nature of the Quadratic form.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of matrices and the methods to solve the system of equations.	Apply	1	1, 2, 4, 9,10,12
2	Apply the concepts of vector spaces, subspaces, bases, dimension.	Apply	2	1, 2, 4, 9,10,12
3	Evaluate inverse and power of a matrix by Caley Hamilton theorem.	Evaluate	1	1, 2, 4, 9,10,12
4	Determine orthogonality in inner product spaces.	Evaluate	2	1, 2, 4, 9,10,12

**TEXT BOOKS:**

1. Gilbert Strang, "Linear Algebra", Wellesley-Cambridge Press, 5th edition, 2016
2. V. Krishnamurthy, V. P. Mainra, J.I. Arora, "An introduction to linear algebra", 3rd Edition, 2014.

**REFERENCE BOOKS:**

1. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, New Delhi, 2018, 2nd Edition.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44 Edition, 2018.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, Inc, ISBN: 9780470458365.2018
4. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", S. Chand and Co., Third revised edition, 2015.

**22BS302 REAL ANALYSIS**

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** sets of numbers, real line, real functions.**COURSE DESCRIPTION AND OBJECTIVES:**

Learn the elementary concepts and basic ideas involved in REAL NUMBERS and ORDERED RELATIONS. Analyse the sequences and series of real numbers. Develop the ability to test the continuity and evaluate derivatives of real functions (by definitions). Understand the fundamental concepts of real functions

**MODULE-1****UNIT – 1****[12L+8T+0P=20 Hours]****REAL NUMBERS**

The algebraic and order properties of  $\mathbb{R}$ , Absolute value and Real line, Completeness property of  $\mathbb{R}$ , Applications of supremum property; intervals (Review).

Real Sequences: Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence.

The Cauchy's criterion, properly divergent sequences, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit Point of Sequence, Sub sequences and the Bolzano-Weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence theorem.

**UNIT – 2****[12L+8T+0P=20 Hours]****INFINITE SERIES**

**Series:** Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

1. P-test, Cauchy's nth root test or Root Test, D'Alembert's Test or Ratio Test.
2. Alternating Series – Leibnitz Test.

Absolute convergence and conditional convergence, semi convergence.

**PRACTICES:**

- To test sequences for convergence
- To test the series for convergence.
- To test an alternating series for convergence
- To test absolute convergence of series
- To test conditional convergence of series.

**MODULE-2****UNIT-1****[12L+8T+0P=20 Hours]****CONTINUITY**

**Limits:** Real valued Functions, Boundedness of a function, Limits of functions. Some extensions of the limit concept, Infinite Limits. Limits at infinity. (Review only)

**Continuous functions:** Continuous functions, Combinations of continuous functions, Continuous Functions on intervals, uniform continuity.

**SKILLS:**

- ✓ Be able to grasp nature of sequences and series
- ✓ Demonstrate understanding of continuity and differentiability.
- ✓ Use of mean value theorems.

**UNIT-2****[12L+8T+0P=20 Hours]****DIFFERENTIATION AND MEAN VALUE THEOREMS**

The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, mean value Theorems; Role's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem.

**PRACTICES:****Problems on BST – Level 1**

- To test continuity of a function at a point.
- To identify discontinuities.
- To test derivability of a function
- To Prove mean value theorem.
- To test uniform continuity at a point.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various properties and apply for different real sets.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Identify the nature of a sequence	Apply	1, 2	1, 2, 5, 9, 10
3	Analyse infinite series	Analyze	1, 2	1, 2, 3, 5, 9, 10
4	Inspect continuity of a function	Analyze	2	1, 2, 5, 9, 10, 12
5	Evaluate the derivatives of various functions.	Evaluate	1, 2	1, 2, 3, 4, 5, 9, 10, 12

**TEXT BOOKS:**

1. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, Published by S. Chand & Co., New Delhi, 2021.
2. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisingkania S. Chand & Co., New Delhi, 2021.

**REFERENCE BOOKS:**

1. Walter Rudin, Principle of Mathematical Analysis (3rd edition) McGraw-Hill Kogakusha, 1976, International Student Edition.
2. K. Knopp, Theory and Application of Infinite Series.
3. T. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
4. H. L., Royden, Real Analysis, 4th Edition, Macmillan, 1993.
5. E. Hewitt and K. Stromberg, Real and Abstract Analysis, Springer, 1969.

# 22BS303 SAMPLING TECHNIQUES

Hours Per Week :

L	T	P	C
2	0	2	3

**PREREQUISITE KNOWLEDGE:** Basic knowledge in probability and estimation.

## COURSE DESCRIPTION AND OBJECTIVES:

To discuss various sampling techniques that can be used to select potential respondents to a survey. The objective of a descriptive survey study is simply to obtain certain information about a population of interest. The objective of an analytical survey study is to make comparisons between different subgroups of a population.

## MODULE-1

### UNIT-1

[8L+0T+8P = 16 Hours]

#### SAMPLING THEORY

Sampling Theory: Principal steps in a sample survey, censuses versus sample survey, sampling and non-sampling errors. Types of sampling - subjective, probability and mixed sampling methods. Simple Random Sampling: Meaning of Samples and methods to draw, estimation of population means,

### UNIT-2

[8L+0T+8P = 16 Hours]

#### SIMPLE RANDOM SAMPLING

Variances in SRSWR & SRSWOR. Simple random sampling of Attributes, size of simple random sample for specified precision.

#### PRACTICES:

- Describing and reviewing the steps in a sample survey
- Classifying sampling errors
- Estimating the population mean from the suitable data
- Estimation of population Mean, variance by SRSWOR.
- Estimation of population Mean, variance by SRSWR.
- Comparison of proportional, optimum allocations with SRSWOR.

## MODULE-2

### UNIT-1

[8L+0T+8P = 16 Hours]

#### STRATIFIED RANDOM SAMPLING

Stratified random sampling: Advantages and Disadvantages of above methods of sampling. Systematic sampling: Systematic sampling when  $N = nk$  comparison of their relative efficiencies

### UNIT-2

[8L+0T+8P = 16 Hours]

#### SYSTEMATIC SAMPLING

Variances in Proportional and optimum allocation of sample sizes in stratification. Systematic sampling Vs Stratified random sampling. Systematic sampling in the presence of general linear trend. Merits and Demerits of Systematic sampling, circular systematic sampling.



**SKILLS:**

- ✓ Conduct a sample survey and assess the errors
- ✓ Discuss different sampling techniques for different purposes
- ✓ Differentiating the sample size required in two allocation schemes in stratified technique.
- ✓ Drawing systematic samples for an application.

**PRACTICES:**

- Differentiating optimum and proportional allocation techniques
- Differentiating stratified and systematic sampling techniques
- Finding the efficiencies between the techniques
- Advantages and disadvantages in systematic sampling
- Systematic Sampling.

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Design sample surveys for a particular purpose	Apply	1	1,2,3
2	Estimate the variances of the samples in different schemes	Apply	1	1,2
3	Apply the concepts of conducting sample surveys	Apply	1	1,3
4	Distinguish between the different sampling schemes	Analyze	2	1,2,4

**TEXT BOOKS:**

1. Prof.K.Srinivasa Rao, Dr D.Giri. Dr A.Anand, Dr V.Papaiah Sastry, BA/BSc III year paper - III Statistics - Applied Statistics - Telugu academy, 2019.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI, 2020.

**REFERENCE BOOKS:**

1. Fundamentals of applied statistics: VK Kapoor and SC Gupta,
2. Indian Official statistics - MR Saluja.
3. Anuvarthita Sankyaka Sastram - Telugu Academy.

# 22BS304 ECONOMETRICS

Hours Per Week :

L	T	P	C
2	2	0	3

**PREREQUISITE KNOWLEDGE:** Basic knowledge in economics, statistics, and mathematics

## COURSE DESCRIPTION AND OBJECTIVES:

The main objective of this course is to provide the knowledge to the students about the basics of econometrics, two-variable linear and dummy variable regression models, multicollinearity, and heteroscedasticity.

### MODULE-1

#### UNIT-1

[8L+8T+0P = 16 Hours]

#### SINGLE-EQUATION REGRESSION MODELS

The Nature of Regression Analysis, Two-Variable Regression Analysis: Some Basic Ideas, Two-Variable Regression Model: The Problem of Estimation, Classical Normal Linear Regression, Model (CNLRM), Two-Variable Regression: Interval Estimation and Hypothesis Testing,

#### UNIT-2

[8L+8T+0P = 16 Hours]

#### CALIBRATION OF INSTRUMENTS

Extensions of the Two-Variable, Linear Regression Model, Multiple Regression Analysis: The Problem of Estimation, Multiple Regression Analysis: The Problem of Inference Dummy Variable Regression Models.

#### PRACTICES:

- Basic ideas of two-variable regression analysis
- two-variable regression model
- Interval Estimation
- Hypothesis testing

### MODULE-2

#### UNIT- 1

[8L+8T+0P = 16 Hours]

#### MULTICOLLINEARITY

The Nature of Multicollinearity, Estimation in the Presence of Perfect Multicollinearity, Estimation in the Presence of "High" but "Imperfect" Multicollinearity, Practical Consequences of Multicollinearity, and Detection of Multicollinearity.

#### UNIT- 2

[8L+8T+0P = 16 Hours]

#### HETEROSCEDASTICITY

The Nature of Heteroscedasticity, OLS Estimation in the Presence of Heteroscedasticity, The Method of Generalized Least Squares (GLS): Difference between OLS and GLS, Consequences of Using OLS in the Presence of Heteroscedasticity, Detection of Heteroscedasticity: Informal Methods Formal Methods.

#### PRACTICES:

- Presence of Perfect Multicollinearity
- Practical Consequences of Multicollinearity,

**SKILLS:**

- ✓ Applications of two-variable regression, non-linear regression, and dummy variable regression
- ✓ Meaning of Detection of Heteroscedasticity and consequences of Heteroscedasticity
- ✓ Nature of Multicollinearity and identify the methods of detecting Multicollinearity

- Detection of Multicollinearity.
- Nature of Heteroscedasticity
- Difference between OLS and GLS
- Detection of Heteroscedasticity

**COURSE OUTCOMES:**

By the end of this course, it is expected that the student will be able to learn the following aspects :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Understand the applications of two variable regression models and estimation and testing of parameters.	Apply	1	1,2
2	Understand the applications of multiple linear regression and dummy variable regression	Apply	1	1,2
3	Analyze the concept of multicollinearity and practical implications	Analyze	2	1,2,3
4	Evaluate the consequences of Heteroscedasticity	Evaluate	2	1,2,4
5	Evaluate the practical consequences of multicollinearity and methods of Detection of Heteroscedasticity	Evaluate	2	1,4,5

**TEXTBOOKS:**

1. Damodar N. Gujarati, Dawn C. Porter. (2009). Gujarati: Basic Econometrics, 5th edition. McGraw-hill.
2. Goldberger, Arthur S(1991). A Course in Econometrics. Cambridge, MA: Harvard University Press.

**REFERENCEBOOKS:**

1. Holly, S., Weale, M., & Corby, B. (Eds.). (2000). Econometric modelling: Techniques and applications (Vol. 41). Cambridge University Press.
2. Intrilligator, MD(1980): Econometric Models, Techniques and Applications, PHI.

**22BS823 COMPUTER NETWORKS**

Hours Per Week :

L	T	P	C
3	0	2	4



Source: <https://snabaynetworking.com/what-is-computer-network-and-its-types/>

**PREREQUISITE KNOWLEDGE:** JAVA programming and UNIX commands.

**COURSE DESCRIPTION AND OBJECTIVES:**

This course focuses on imparting knowledge about various protocols involved in LANs and WANs. In addition, it gives a good foundation on different protocols such as data link protocols, internet protocols, and transport protocols present in the respective layers of the data communication system.

**MODULE –1****UNIT-1****[8L+0T+6P = 14 hours]****INTRODUCTION TO COMPUTER NETWORKS AND INTERNET**

Understanding of network and Internet, the network edge, the network core, Understanding of Delay, Loss and Throughput in the packet switching network, protocols layers and their service model, History of the computer network.

**UNIT-2****[16L+0T+10P = 26 hours]****APPLICATION LAYER & TRANSPORT LAYER :**

Principles of computer applications, Web and HTTP, E-mail, DNS, Socket programming with TCP and UDP.

Introduction and transport layer services, Multiplexing and Demultiplexing, Connectionless transport (UDP), Principles of reliable data transfer, Connection-oriented transport (TCP), Congestion control.

**PRACTICES:**

- Install Network Simulator 2/3. Create a wired network using dumbbell topology. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.
- Create a static wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.
- Create a mobile wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.
- Implementation of one-way and two-way communication using TCP / UDP.
- Hello command is used to know whether the machine at the other end is working or not. Echo command is used to measure the round trip time to the neighbour. Implement Hello and Echo commands using JAVA.

**MODULE –2****UNIT-1****[12L+0T+8P = 20 hours]****NETWORK LAYER**

Introduction to forwarding and routing, Network Service models, Virtual and Datagram networks, study of router, IP protocol and addressing in the Internet, Routing algorithms, Broadcast and Multicast routing.

**UNIT-2****[12L+0T+8P = 20 Hours]****THE LINK LAYER AND LOCAL AREA NETWORKS**

Introduction to link layer services, error detection, and correction techniques, Multiple access protocols, addressing, Ethernet, switches, and VLANs.

**SKILLS:**

- ✓ Establish local area networks with different topologies.
- ✓ Design of new routing protocols.
- ✓ Network troubleshooting such as installing network interface card drivers, setting IP addresses, subnet masking, etc.

**PRACTICES:**

- Find all the IP addresses on your network using Unicast, Multicast, and Broadcast on your network.
- Use Packet tracer software to build network topology and configure using Distance vector routing and Link State routing protocols.
- Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect two or more systems.
  - a. Use a crimping tool to connect jacks.
  - b. Use a LAN tester to connect the cables.
  - c. Install and configure Network Devices: HUB, Switch and Routers (Consider both manageable and non-manageable switches. Perform logical configuration of the system and set the bandwidth of different ports).
  - d. Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both ad-hoc and infrastructure modes of operation.
- Apply the commands such as Ping, Tracert, Ipconfig, pathping, telnet, FTP, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslookup to solve various problems.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Build the basic concepts of Network hardware, software and reference models.	Apply	1	1, 2, 12
2	Demonstrate various protocols involved in data link layer operations.	Apply	2	1,2, 5
3	Implement various protocols with modern tools.	Apply	1	1, 2, 3, 5, 12
4	Evaluate different physical layer media and switching methods.	Evaluate	1	1, 2, 5, 12
5	Apply different protocols to perform end-to-end delivery and interaction with users.	Analyze	2	1, 2, 12
6	Analyze various design issues, protocols and functionalities of network layer.	Analyze	2	1, 2, 12

**TEXT BOOKS:**

1. Kurose and Ross, "Computer Networking- A Top-Down approach", 6th Edition, Pearson, 2017.
2. Behrouz Forouzan, "Computer Networks- A Top-Down approach", McGraw Hill, 2014.

**REFERENCE BOOKS:**

1. Andrew S. Tanenbaum, "Computer Networks", 5th edition. Pearson Education, 2014.
2. Behrouz A. Forouzan, "Data communications and Networking", 5th edition, TMH, 2017.
3. William Stallings, "Data and Computer Communications", 10th edition, Pearson Education, 2017.
4. Fred Halsall, "Computer Networking and the Internet", 5th edition, Addison Wesley, 2005.

# 22BS306 CYBER SECURITY

Hours Per Week :

L	T	P	C
2	2	0	3

**PREREQUISITE KNOWLEDGE:** Computer Networks.

## **COURSE DESCRIPTION AND OBJECTIVES:**

This course covers the fundamental aspects of information security. It will look at the attacks, services, security process, security maintenance as well as various techniques used by hackers. Other topic covered includes operating system security, E-Commerce services and architecture used in E-Commerce applications.

### **MODULE –1**

#### **UNIT-1**

[8L+8T+0P = 16 Hours]

#### **INFORMATION SECURITY BASICS:**

Defining Information Security, Brief History of Security, Security as a Process, Not Point Products, CIA in Information Security Information Security Process: Introduction to Assessment, Conduct an Assessment, Importance of Policy, Types of Policy-Information Policy, Security Policy, Computer Use Policy, Internet Use Policy, Creating Appropriate Policy, Develop a Policy, Implement Security, Conduct Awareness Training, Conduct Audits.

#### **UNIT-2**

[8L+8T+0P = 16 Hours]

#### **SECURITY ATTACKS, SERVICES:**

Introduction- Security Attacks, Types of attacks-Access attacks, Modification Attacks, Denial of service Attack, Repudiation Attacks Information Security Services: Confidentiality, Integrity, Availability, Accountability. Hacker Techniques: Introduction- Identify Hackers Motivation, Historical Hacking Techniques, Advanced techniques, Malicious Code, Methods of the Targeted Hacker, Untargeted Hacker.

### **MODULE –2**

#### **UNIT-1**

[8L+8T+0P = 16 Hours]

#### **OPERATING SYSTEM SECURITY:**

Introduction-Operating system Security, Unix Security Issues, Windows NT Security Issues, Windows 2000 Security Issues, System Access Threats- Intruders, Buffer Overflow, Access control, Operating System Hardening, Security maintenance.

#### **UNIT-2**

[8L+8T+0P = 16 Hours]

#### **E-COMMERCE SECURITY NEEDS :**

Introduction-E-Commerce Services, Understand the Importance of Availability, Implement Basic Security -Client-Side Security, Server-Side Security, Application Security, Database Security, Develop E-Commerce Architecture.

#### **PRACTICES:**

- Learn about the CIA Triad
- Understand the most common security frameworks in use today
- Learn the basics of the ISO 27000 series framework
- Key aspects of risk management including risk identification, risk mitigation, and risk controls
- Obtain a foundational understanding of cyberattacks and cybersecurity

**SKILLS:**

- ✓ *Develop security awareness program.*
- ✓ *Understand the information security aspects and find out the various security services to counter the attacks.*
- ✓ *Design and analyze of E-commerce model services.*
- ✓ *Study in consistence and vulnerabilities in computer systems.*

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyse the security aspects needed for information	Analyse	1	1,2,3
2	Implement security attacks and various services provided to enhance the security system	Analyse	1	1,2,3
3	Analyze the operating systems security.	Analyse	2	1,2,3
4	Design and develop e-commerce architecture by understanding e-commerce security needs	Analyse	2	1,2,3

**TEXT BOOKS:**

1. Eric Maiwald "Fundamentals of Network Security" McGraw Hill, 2010.
2. William Stallings, "Operating Systems Internals and Design Principles", Pearson education, Eighth Edition, 2018

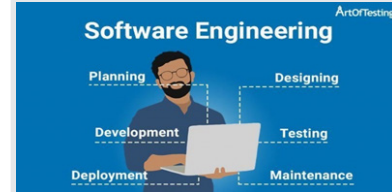
**REFERENCE BOOKS:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

**22BS307 SOFTWARE ENGINEERING**

Hours Per Week :

L	T	P	C
2	2	0	3



<https://artoftesting.com/software-engineering>

**PREREQUISITE KNOWLEDGE:** Data Base Management Systems, OOPS through Java.

**COURSE DESCRIPTION AND OBJECTIVES:**

This course focuses on the concepts of software life cycle, role of process models and methods to prepare software requirement specification document. In addition to that, it also imparts knowledge of design, development, and testing of software. The objective of this course is to enable the student to develop efficient, cost effective, feasible software as per user requirements.

**MODULE-1****UNIT-1****[8L+8T+0P=16 hours]****INTRODUCTION**

**Introduction to Software Engineering:** Introduction to Software and Software engineering, Software characteristics, Software project, Software myths, Project Planning, Scheduling and Management.

**Generic View of Process:** Software Engineering - A layered technology, A process framework, Software Development Life Cycle (SDLC), The Capability Maturity Model Integration (CMMI).

**Process Models:** Conventional Model, Agile process models - Unified process model, Extreme Programming, Scrum.

**UNIT-2****[8L+8T+0P=16 hours]****REQUIREMENTS ENGINEERING**

**Requirements Engineering:** Functional and Non-functional requirements, User requirements, System requirements, Requirement engineering tasks, formal requirements specification and verification, Feasibility Study.

**BUILDING THE ANALYSIS MODEL**

Data modeling - Data objects, Attributes, Relationships, Cardinality and modality. Class based modeling - Identify analysis classes, specify attributes and Define operations.

**DESIGN ENGINEERING**

Design model, Design concepts. Creating an Architectural Design-Architectural styles and patterns.

**PERFORMING USER INTERFACE DESIGN**

Golden rules; User interface analysis and design.

**PRACTICES:**

Laboratory session of this course is designed in such a way that the student should complete three projects of the given type by performing the below experiments.

- Development of software requirements specification using Mind-Map tool.
- Project planning using Gantt charts.



**SKILLS:**

- ✓ Know the software requirements and find out various ways to gather and specify them.
- ✓ Choose a process model for developing software solutions without schedule/ effort overruns and good quality.
- ✓ Analyse and model (diagrammatical representations) a software product.

- Project estimation using metrics.
- Capture Use Case Scenarios and model UML Use Case Diagrams.
- Model the UML state chart and Activity diagrams.
- Model the UML Class and Sequence diagrams.

**MODULE-2****UNIT-1****[8L+8T+0P=16 hours]****TESTING**

**Testing Strategies:** A strategic approach to software testing, Unit testing, Integration testing, Validation testing, System testing,

**Testing Tactics:** Black-Box and White-Box testing techniques, Art of debugging.

**Product Metrics:** Metrics for analysis model; Metrics for design model, Metrics for source code; Metrics for testing; Metrics for maintenance.

**UNIT-2****[8L+8T+0P=16 hours]****RISK AND QUALITY MANAGEMENT**

**Risk Management:** Software risks, Risk identification; Risk projection; Risk refinement, Reactive vs Proactive risk strategies, RMMM.

**Quality Management:** Quality concepts, Formal technical reviews, Statistical Software Quality Assurance.

**Computer-Aided Software Engineering (CASE):** Use of appropriate CASE tools- Requirement engineering tools, Project planning tools, Testing tools.

**PRACTICES:**

Laboratory session of this course is designed in such a way that the student should complete three projects of the given type by performing the below experiments.

- Estimate the test coverage and Structural complexity of product using metrics.
- Develop the test cases for all the functional requirements of projects selected.
- Perform the functional testing using Selenium tool.

**LIST OF PROJECTS:**

**Project-1:** A Point-Of-Sale (PoS) System: A POS system is a computerized application used to record sales and handle payments; it is typically used in a retail store, it includes hardware components such as a computer and bar code scanner, and software to run the system. It interfaces to various service applications, such as a third-party tax calculator and inventory control. These systems must be relatively fault tolerant; that is, even if remote services are temporarily unavailable they must still be of capturing sales and handling at least cash payments. A POS system must support multiple and varied client-side terminals and interfaces such as browser, PDAs, touch-screens.

**Project-2:** Online Bookshop Example: Following the model of amazon.com or bn.com, design and implement an online bookstore.

**Project-3:** A Simulated Company: Simulate a small manufacturing company. The resulting application will enable the user to take out a loan, purchase a machine, and over a series of monthly production runs, follow the performance of their company.

**Project-4:** A Multi-Threaded Airport Simulation: Simulate the operations in an airport. Your application should support multiple aircrafts using several runways and gates avoiding collisions/ conflicts. Landing: an aircraft uses the runway, lands, and then taxis over to the terminal. Take-Off: an aircraft taxis to

the runway and then takes off.

**Project-5:** An Automated Community Portal: Business in the 21st Century is above all BUSY. Distractions are everywhere. The current crop of “enterprise intranet portals” is often high noise and low value, despite the large capital expenditures it takes to stand them up. Email takes up 30 - 70% of an employee’s time. Chat and Instant Messaging are either in the enterprise or just around the corner. Meanwhile, management is tasked with unforeseen and unfunded leadership and change-agent roles as well as leadership development and succession management. What is needed is a simplified, repeatable process that enhances communications within an enterprise, while allowing management and peers to self-select future leaders and easily recognize high performance team members in a dynamic way. Additionally, the system should function as a general-purpose content management, business intelligence and peer-review application. Glasscode’s goal is to build that system.

**Project-6:** Content Management System: The goal is to enable non-technical end users to easily publish, access, and share information over the web, while giving administrators and managers complete control over the presentation, style, security, and permissions. Features: Robust Permissions System, Templates for easy custom site designs, Total control over the content, Search engine friendly URL’s, Role based publishing system, Versioning control, Visitor profiling.

**Project-7:** An Auction Application: Several commerce models exist and are the basis for several companies like eBay.com, priceline.com etc. Design and implement an auction application that provides auctioning services. It should clearly model the various auctioneers, the bidding process, auctioning etc.

**Project-8:** A Notes And File Management System: During one’s student years and professional career one produces a lot of personal notes, documents. All these documents are usually kept on papers or individual files on the computer. Either way the bulk of the information is often erased corrupted and eventually lost. The goal of this project is to build a distributed software application that addresses this problem. The system will provide an interface to create, organize and manage personal notes through the Internet for multiple users. The system will also allow users to collaborate by assigning permissions for multiple users to view and edit notes.

**Project-9:** Library Management System(LMS): The goal is to enable students and librarians to easily access and manage the library and run it smoothly. Each physical library item - book, tape cassette, CD, DVD, etc. could have its own item number. To support it, the items may be barcoded. The purpose of barcoding is to provide a unique and scannable identifier that links the barcoded physical item to the electronic record in the catalog. Barcode must be physically attached to the item, and barcode number is entered into the corresponding field in the electronic item record. Barcodes on library items could be replaced by RFID tags. The RFID tag can contain item’s identifier, title, material type, etc. It is read by an RFID reader, without the need to open a book cover or CD/DVD case to scan it with barcode reader.

**Project-10:** Hospital Management System: Simulate to show and explain hospital structure, staff, and relationships with patients, and patient treatment terminology

**Project-11:** Draft Software Requirement Analysis for the following Problem Statement: Fuel Delivery System: An unattended petrol (gas) pump system that includes a credit card reader. The customer swipes the card through the reader and then specifies the amount of fuel required. The fuel is delivered,

and the customer's account debited.

**COURSE OUTCOMES:**

The students will be able to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Use basic concepts of software engineering for de-signing software product	Apply	1	1, 11
2	Apply different testing techniques to ensure bug free software and metrics to measure the software size, complexity, and budget etc	Apply	2	4, 5, 11
3	Compare different process models and identify appropriate process model based on project re-quirements	Evalu-ate	1	2, 4
4	Build Software Requirement Specification (SRS) document for any software product	Create	1	3, 5
5	Design of solutions using UML diagrams like Use case, Sequence diagrams etc	Create	1	3, 4, 5
6	Create an appropriate architecture for a given pro-ject that meets all quality constraints	Create	2	5

**TEXT BOOKS:**

1. Roger S. Pressman, "Software Engineering, A practitioner's Approach", 6th Edition, McGrawHill International Edition, 2008.
2. Booch G., Rumbaugh J. and Jacobsons I, "The Unified Modeling Language User Guide", 2nd Edition, Addison Wesley, 2005.

**REFERENCE BOOKS:**

1. Simon Sennet, Steve McRobb and Ray Farmer, "Object Oriented Systems Analysis and Design, 2nd edition, 2004.
2. Dr. Pankaj Jalote "Software Engineering: A Precise Approach" –edition 2010

# ELECTIVES

## B.Sc.

- ▶ 22BS801 - Analytical Geometry
- ▶ 22BS802 - Graph Theory
- ▶ 22BS803 - Numerical Analysis
- ▶ 22BS804 - Complex Analysis
- ▶ 22BS805 - Number Theory
- ▶ 22BS806 - Integra I Transforms
- ▶ 22BS811 - Design of Experiments
- ▶ 22BS812 - Statistical Analysis through SPSS/R
- ▶ 22BS813 - Advanced Probability
- ▶ 22BS814 - Operations Research
- ▶ 22BS815 - Applied Statistics
- ▶ 22BS821 - Formal Language and Automata Theory
- ▶ 22BS822 - Machine Learning
- ▶ 22BS823 - Web Technologies
- ▶ 22BS824 - Python Programming

### COURSE CONTENTS

I SEM & II SEM



# 22BS801 ANALYTICAL GEOMETRY

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Basic idea on shapes, geometrical structures and their equations. Introductory knowledge on arithmetic operations and numerical ability.

## COURSE DESCRIPTION AND OBJECTIVES:

The objective of the course is to make student acquainted with some important concepts of geometry with various structures such as plane, line, sphere, cones and cylinders. This course also deals with many significant applications of various geometric structures that are found in engineering science, industry and other real time environments

## MODULE –1

### UNIT-1

[12L+8T+0P=20 Hours]

#### THE PLANE

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

### UNIT-2

[12L+8T+0P=20 Hours]

#### THE LINE WITH APPLICATIONS

Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line.

#### PRACTICES:

- Finding equation of planes.
- Evaluating angle between planes.
- Justification of planes and their orthogonality.
- Evaluating length of the lines.
- Evaluation of distance between two straight lines.
- Evaluation of Length of the perpendicular from a given point to a given line.

## MODULE –2

### UNIT-1

[12L+8T+0P=20 Hours]

#### SPHERE AND CONES

Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle;

Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; Enveloping cone of a sphere; Equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone; Condition that a cone may have three mutually perpendicular generators;

**SKILLS:**

- ✓ Determining tangent plane.
- ✓ Determining plane of contact.
- ✓ Radical plane; Coaxial system of spheres.

**UNIT-2****[12L+8T+0P=20 Hours]****CYLINDERS WITH APPLICATIONS**

Definition of a cylinder; Equation to the cylinder whose generators intersect a given conic and are parallel to a given line; Enveloping cylinder of a sphere; The right circular cylinder; Equation of the right circular cylinder with a given axis and radius.

**PRACTICES:**

- Finding equation of spheres.
- Evaluation of intersections of two spheres.
- Evaluation of intersections of two spheres and lines.
- Finding the equation of a cone, right circular cone.
- Finding enveloping cone of a sphere.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Able to apply the concepts of equations of lines.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Understand and apply the concepts of planes.	Apply	1	1, 2, 5, 9, 10
3	Able to understand and apply the concepts of finding equation of a cylinder, Equation to the cylinder whose generators intersect a given conic and are parallel to a given line, Enveloping cylinder of a sphere, The right circular cylinder, Equation of the right circular cylinder with a given axis and radius.	Apply	2	1, 2, 5, 9, 10, 12
4	Understand and analyse the concepts of spheres.	Analyse	2	1, 2, 3, 5, 9, 10
5	Able to find equation of a cones as well as right circular cones, understand to determine enveloping cone of a sphere etc.	Analyse	2	1, 2, 5, 9, 10, 12

**TEXT BOOKS:**

1. Analytical Solid Geometry by Shanti Narayan and P. K. Mittal, S. Chand & Co., 7th Edition, 2015.
2. A text book of Mathematics for BA/B.Sc. Vol 1, by V Krishna Murthy & Others, S. Chand & Co., New Delhi, 2014.

**REFERENCES BOOKS:**

1. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, Wiley Eastern Ltd., 1999.
2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman, Tata-McGra-Hill Publishers Company Ltd., New Delhi.

# 22BS802 GRAPH THEORY

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Mathematical proof technique (induction, proof by contradiction), and linear algebra (determinants, eigenvalues).

## COURSE DESCRIPTION AND OBJECTIVES:

The objective of the course is to apply graph theory-based tools in solving practical problems, to develop the geometric duals in Planar Graphs, to apply the concept of matrices in graphs like Incidence matrix, Adjacency matrix, Cycle matrix etc. and to introduce the idea of coloring in graphs.

## MODULE - 1

### UNIT-1

[12L+8T+0P=20 Hours]

#### GRAPHS

Origin of graph theory, Graphs and Graph models, Graph terminology and special types of graphs, representing graphs and Graphs isomorphism.

### UNIT-2

[12L+8T+0P=20 Hours]

#### TYPES OF GRAPHS

**Types of Graphs:** Complete graph, cycle graph, wheel graph, bipartite graph, star graph, Path graph. Walks: Trail, Path, Length of the path, cycle and circuits. Connectivity, Euler and Hamiltonian Paths, distance in graphs

#### PRACTICES:

- Draw various types of graphs and graph models.
- Explore the different types of graph terminology and determine the different types of graphs.
- Take real time situation as a graph model and represent as adjacent matrix and incidence matrix, verify these matrices are symmetric or not.
- When two or more graphs are given, verify whether these graphs are isomorphic or not and prepare isomorphic graph models.
- Explore different types of paths and give the connection between these graphs.
- Identify the difference between Euler graphs and Hamiltonian graphs.
- Find the shortest path distances in graphs.

## MODULE-2

### UNIT-1

[12L+8T+0P=20 Hours]

#### TREES

Trees, Forests, distance in trees, rooted and binary tree, spanning trees, minimal Spanning trees, Prim's algorithm to find minimal spanning tree.

### UNIT-2

[12L+8T+0P=20 Hours]

#### APPLICATIONS OF GRAPHS

Operations on graphs: union and intersection of graphs. Colouring, Chromatic number, Chromatic polynomial



**SKILLS:**

- ✓ Prepare a graph model using our college blocks and class rooms.
- ✓ Identify isomorphic graphs using algorithms.
- ✓ Identify Euler and Hamiltonian paths in bus routes of our college from different places.
- ✓ Take a graph and find the different spanning trees.
- ✓ Take India map and color the states with different color and find the chromatic number.

**PRACTICES:**

- Explore trees and forests; determine the difference between trees and forests.
- Identify the difference between rooted and binary trees.
- Determine the differences between spanning trees and minimal spanning trees.
- Find the minimal spanning trees using prim's algorithm.
- Find the operations on graphs, apply these operations on two or more graphs, and observe the properties of graphs before and after operations.
- Find the relation between coloring and chromatic number.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various types of paths and Apply isomorphism in graphs.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Identify the Euler and Hamiltonian graphs and find the chromatic number of any given graph.	Apply	1, 2	1, 2, 5, 9, 10
3	Analyse the spanning trees and shortest paths.	Analyze	1, 2	1, 2, 3, 5, 9, 10
4	Inspect four colour theorems.	Analyze	2	1, 2, 5, 9, 10, 12
5	Evaluate the properties of various trees and different types of graphs.	Evaluate	1, 2	1, 2, 3, 4, 5, 9, 10, 12

**TEXT BOOKS:**

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", DOVER PUBLICATIONS, 2016.
2. C L Liu, D P Mohapatra, "Elements of Discrete Mathematics-A computer Oriented Approach", Tata McGraw Hill, Third Edition, 2011.
3. J.L. Mott, A. Kandel, T.P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", Pearson, 2015.

**REFERENCE BOOKS:**

1. Singh. S.B., Jai Kishore, Ekata, "Discrete Structures", Third edition, 2011.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Fifth Edition. TMH, 2016.
3. Malik & Sen, "Discrete Mathematical structures Theory and application", Cengage, 2016.
4. Bondy. J.A and Murthy. U. S. R, "Graph theory with applications", Department of Combinatorics and Optimization, University of Waterloo, Ontario, Canada, 2019.

# 22BS803 NUMERICAL ANALYSIS

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Basics of Integration, differentiation and polynomials.

## COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a base for Numerical methods, which are the basic algorithms underpinning computer predictions in modern systems science. Such methods include techniques for simple optimisation, interpolation from the known to the unknown, linear algebra underlying systems of equations, ordinary differential equations to simulate systems, and stochastic simulation under random influences

## MODULE - I

### UNIT-1

[12L+8T+0P=20 Hours]

#### ROOT FINDING METHODS, SYSTEM OF LINEAR EQUATIONS AND INTERPOLATION

Absolute error, order of Convergence, Geometrical Description, method of successive approximation, Bisection method, Regula- Falsi method, Newton's Method. Gauss Seidal method, Crouts method, Triangularization method, Relaxation method.

Interpolation- Finite differences, interpolation, Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae (with proof), errors in interpolation formula.

### UNIT-2

[12L+8T+0P=20 Hours]

#### APPLICATIONS

Finding positive, negative and real root of algebraic and transcendental equation, Solution of simultaneous linear algebraic equation. nth difference of a polynomial, finding missing terms in a sequence, sum of n terms in a series, finding polynomial using a given set of data, estimated values of a function inside and outside the given intervals of data

#### PRACTICES:

- Finding positive, negative and real root of algebraic and transcendental equation
- Solution of simultaneous linear algebraic equation
- Estimating values of a function inside and outside the given intervals of data.

## MODULE-2

### UNIT-1

[12L+8T+0P=20 Hours]

#### NUMERICAL DIFFERENTIATION, INTEGRATION AND DIFFERENTIAL EQUATION

**Numerical Differentiation:** Newton's forward and Backward formulas to compute up to second order differentiation of a function.

**Numerical Integration:** Trapezoidal and Simpson's 1/3 and 3/8 rules.

**ODE:** Picard's approximation, Milne's Predictor Corrector formulas.

**PDE:** Liebman's Iteration Process, Bender Schmidth.

**SKILLS:**

- ✓ Analyze the types and occurrence of roots.
- ✓ Interpolate the unknown values of function.
- ✓ Develop a difference equation.
- ✓ Gain the knowledge to solve an ODE numerically.
- ✓ Gain the knowledge to solve an ODE numerically.

**UNIT-2****[12L+8T+0P=20 Hours]****APPLICATIONS**

Finding maxima and minima of a function, population growth, acceleration, area bounded by the curve, Solution of ODE, Solution of Elliptic, Parabolic and Hyperbolic PDE.

**PRACTICES:**

- Finding maxima and minima of a function
- Solve ODE numerically and plot the curve.
- Classify the PDE
- Solve PDE numerically and plot the curve.
- Developing difference equations from ODE and PDE.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply numerical methods to find roots	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Evaluate the unknown values using interpolation	Apply	1	1, 2, 5, 9, 10
3	Develop a finite difference scheme	Analyze	2	1, 2, 3, 5, 9, 10
4	Apply numerical methods to solve ODE and PDE and analyse graphically	Analyze	2	1, 2, 5, 9, 10, 12

**TEXT BOOKS:**

1. S. S. Sastry, "Introductory methods of numerical analysis", 5th ed, PHI learning, 2012.
2. M K Jain, "Numerical Methods for Scientific and Engineering Computation", New Age international, 2003.

**REFERENCE BOOKS:**

1. P Kandasamy, "Numerical Methods", S Chand, 2nd ed, 2015.
2. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics", 6<sup>th</sup> Edition, 2. McGraw-Hill Book Co., New York, 1995.
3. Gupta C.B., Singh S.R. and Mukesh Kumar: "Engineering Mathematics for Semester I & II", Mc-Graw Hill Education (India) Pvt. Ltd., 2015.

# 22BS804 COMPLEX ANALYSIS

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Complex numbers, Set theory, calculus of real functions, algebra of complex numbers, Basics of Integration, and differentiation.

## COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the fundamental concepts of the complex variables. The course is designed as an introduction to the theory and applications of complex analysis. On successful completion of the course students will be able to study the techniques of complex variables and functions together with their derivatives, Contour integration and transformations. Able to understand the fundamental concepts of complex variable theory and skill of contour integration to evaluate complicated real integrals via residue

## MODULE-1

### UNIT-1

[12L+8T+0P=20 Hours]

#### COMPLEX PLANE :

Complex numbers and their representation, algebra of complex numbers; Complex plane, Open set, Domain and region in complex plane; Complex functions and their limits including limit at infinity; Continuity.

### UNIT-2

[12L+8T+0P=20 Hours]

#### ANALYTIC FUNCTIONS

Complex functions and their limits including limit at infinity; Continuity, differentiability and analyticity; Cauchy Riemann equations, Harmonic functions, Sufficient conditions for differentiability and analyticity, Analyticity and zeros of exponential, trigonometric and logarithmic functions.

#### PRACTICES :

- Determine whether differentiability implies analyticity or not.
- Compute the differentiation of arbitrary complex functions.
- Use sufficient conditions to check differentiability and analyticity of complex functions.
- Suppose that a complex function is given, find zeros of exponential functions.

## MODULE -2

### UNIT-1

[12L+8T+0P=20 Hours]

#### ELEMENTARY TRANSFORMATIONS AND POWER SERIES

Elementary Transformations – Bilinear Transformations, Cross ratio, fixed points of Bilinear Transformation – Some special bilinear transformations.

Series expansions – Taylor's Series – Laurent's Series.

### UNIT-2

[12L+8T+0P=20 Hours]

#### COMPLEX INTEGRATION

Zeros of an analytic function, Singularities, Nature of singularities, Residues, Cauchy's Residue Theorem, Evaluation of integrals using Cauchy integral formula and Cauchy's Residue theorem.

**SKILLS:**

- ✓ Analyze the given function and check the existence of Analyticity.
- ✓ Ability to find the limit of complex valued function.
- ✓ Choose the various power series to expand complex function.
- ✓ Able to apply Cauchy's integral formula to evaluate integral value.

**PRACTICES :**

- Compute the fixed points of bilinear transformation.
- Use Taylor's series to expand a complex function.
- Determine the nature of singularities.
- Use Cauchy's residue theorem to compute Definite integrals
- Suppose that a complex function is given, Use Laurent's series to expand.

**COURSE OUTCOMES :**

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply Cauchy's integral formula to evaluate integral value.	Apply	2	1, 2, 4, 5, 9, 10, 12
2	Apply problem-solving using complex analysis techniques applied to diverse situations in physics, engineering and other mathematical contexts.	Apply	1,2	1, 2, 5, 9, 10
3	Analyse the analyticity of complex valued function.	Analyse	1	1, 2, 3, 5, 9, 10
4	Analyse the nature of singularities.	Analyse	2	1, 2, 5, 9, 10, 12

**TEXT BOOKS:**

1. Arumugam.S, Thangapandi Isaac. A & Somasundaram.A, Complex Analysis, SciTech Publications (India) Pvt. Ltd, Chennai, 2017.
2. Sharma.J.N, Functions of a Complex Variable, Krishna Prakashan Media (P) Ltd,13th Edition, 1996-97.

**REFERENCE BOOKS:**

1. Lars V. Alfords , Complex Analysis ,McGraw-Hill Education, 3rd edition, 2017.
2. Joseph Bak & Donald J. Newman, Complex Analysis, Springer, 3rd edition, 2010.
3. James Ward Brown & Ruel V. Churchill, Complex Variables and Applications, McGraw-Hill Education, 9th edition, 2009.

**22BS805 NUMBER THEORY**

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Knowledge on divisibility, prime numbers, fundamental arithmetic functions..

**COURSE DESCRIPTION AND OBJECTIVES**

This course aims at building a durable base on the concepts of counting function, number theorem, congruence relation and its properties thereby, this course intended to develop skills on the concepts of modulo arithmetic, primitive arithmetic roots, composite number and Euler's criterion. Further, it encompasses many important theorems and results such as Chinese remainder theorem, Fermat's theorem, Wilson's theorem, Mobius inversion formula, Euler's Phi-function, Legendre symbol, quadratic reciprocity and congruencies etc. Moreover, this course covers some important applications on encryption and decryption

**MODULE-1****UNIT-1****[12L+8T+0P=20 Hours]****DISTRIBUTION OF PRIMES AND THEORY OF CONGRUENCIES**

Linear Diophantine equation, Prime counting function, Prime number theorem, Goldbach conjecture, Fermat and Mersenne primes, Congruence relation and its properties, Linear congruence and Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

**UNIT-2****[12L+8T+0P=20 Hours]****NUMBER THEORETIC FUNCTIONS**

Number theoretic functions for sum and number of divisors, Multiplicative function, The Mobius inversion formula, the greatest integer function. Euler's phi-function and properties, Euler's theorem.

**PRACTICES:**

- Determine primes and divisibility.
- Find the primitive roots and quadratic reciprocity.
- Evaluate the sum and the number of divisors.
- Use multiplicative function to determine the sum and the number of divisors.
- Use greatest integer function to find the number of divisors.

**MODULE-2****UNIT- 1****[12L+8T+0P=20 Hours]****PRIMITIVE ROOTS**

Modulo arithmetic, the order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, and Euler's criterion.

**UNIT-2****[12L+8T+0P=20 Hours]****QUADRATIC RECIPROCITY LAW AND PUBLIC KEY ENCRYPTION**

The Legendre symbol and its properties, Quadratic reciprocity, Quadratic congruencies with composite module.

**Applications:** Public key encryption, RSA encryption and decryption.

**SKILLS:**

- ✓ Analyze the given function and check the existence of divisors.
- ✓ Ability to Find the primitive roots and quadratic reciprocity.
- ✓ Ability to perform divisibility tests and to find the primitive roots and quadratic reciprocity.
- ✓ Able to verify Euler's theorem for the given number theoretic function.

**PRACTICES:**

- Use Mobius inversion formula to analyze the sum and the number of divisors.
- Evaluate divisors, common divisors.
- Perform divisibility tests.
- Determine congruences and check digits.
- Verification of Euler's theorem for the given number theoretic function.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Acquire knowledge on Linear Diophantine equation.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Determine divisors, quotients, prime counting and multiplicative functions.	Apply	1, 2	1, 2, 5, 9, 10
3	Analyse the concepts of Euler's theorem and Mobius inversion formula.	Analyse	1, 2	1, 2, 3, 5, 9, 10
4	Analyse the concepts composite numbers, primitive roots, quadratic residue and Euler's criterion.	Analyse	2	1, 2, 5, 9, 10, 12
5	Determine multiplicative inverse, modulo n, Legendre symbol, quadratic reciprocity and congruencies.	Analyse	1, 2	1, 2, 5, 9, 10, 12

**TEXT BOOKS:**

1. N. P. Bali, "A Text Book on Number Theory", Golden Series of Mathematics, Laxmi Publications, New Delhi.
2. David M. Burton, "Elementary Number Theory", 7th edition, 2007, McGraw-Hill.

**REFERENCE BOOKS:**

1. Gareth A. Jones & J. Mary Jones, "Elementary Number Theory", 2005, Springer.
2. Neville Robbins, "Beginning Number Theory", 2nd edition, 2007, Narosa.

# 22BS806 INTEGRAL TRANSFORMS

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Complex numbers, Basics of Integration, and differentiation..

## COURSE DESCRIPTION AND OBJECTIVES

The goal of this course is to build a grasp of the fundamental concepts of the Laplace transforms and Fourier transforms. The course is designed as an introduction to the theory and applications of integral transforms to problems in linear differential equations, to boundary and initial value problems in partial differential equations. On successful completion of the course students will be able to recognize the different methods of finding Laplace transforms and Fourier transforms of different functions. They apply the knowledge of Laplace Transform and Fourier Transforms in finding the solutions of differential equations, initial value problems and boundary value problems.

### MODULE-1

#### UNIT-1

[12L+8T+0P=20 Hours]

#### LAPLACE TRANSFORMATIONS

Introduction, Definition, Sufficient condition of Existence, transforms of elementary functions, Properties, transforms of derivatives and integrals, Inverse Laplace Transforms, Inverse Laplace transform by partial fraction method, Convolution Theorem, Inverse Laplace transform by convolution theorem.

#### UNIT-2

[12L+8T+0P=20 Hours]

#### APPLICATION OF LAPLACE TRANSFORM TO DIFFERENTIAL EQUATIONS

Applying Laplace transforms to solve differential equations with constants co-efficient, simultaneous ordinary differential equations with constant coefficients, partial differential equations.

#### PRACTICES:

- Determine whether Laplace transform exist or not for the given arbitrary function.
- Compute the Laplace transforms of arbitrary functions.
- Use the Laplace transform to compute the convolution between the functions.
- Use tables to compute inverse Laplace transforms.
- Suppose that a differential equation with boundary values given, Use Laplace transforms as a technique for solving differential equations.

### MODULE-2

#### UNIT-1

[12L+8T+0P=20 Hours]

#### FOURIER TRANSFORMS

Introduction, Definition, Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier transforms, Fourier sine and cosine transforms, properties of Fourier transforms, Inverse transforms.

#### UNIT-2

[12L+8T+0P=20 Hours]

#### APPLICATIONS OF FOURIER TRANSFORMS

Convolution theorem for Fourier transforms, Parseval's Identity, Applications of Fourier transforms to boundary value problems.



**SKILLS:**

- ✓ Analyze the given function and check the existence of Integral transforms.
- ✓ Ability to solve problems by converting them from one domain where the solution is done through a complex mathematical procedure to another domain where simple algebraic methods can solve them.
- ✓ Choose the various transforms and their applications in the analysis of real valued and complex valued functions.
- ✓ Able to apply transforms to solve problems in many areas of mathematics and engineering.

**PRACTICES:**

- Compute the Fourier transforms of arbitrary functions.
- Use the Fourier transform to compute the convolution between the functions.
- Compute the integral value by using Parseval's identity.
- Use tables to compute inverse Fourier transforms.
- Suppose that a differential equation with boundary values given, Use Fourier transforms as a technique for solving differential equations.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply Fourier transform to solve differential equations which will be converted to algebraic equation.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Apply Integral transform techniques to solve research problems of signal processing, data analysis and processing, image processing, in scientific simulation algorithms etc.	Apply	1, 2	1, 2, 5, 9, 10
3	Analyse the real-world problems of sciences and engineering and use Integral transforms to solve it.	Analyze	1, 2	1, 2, 3, 5, 9, 10
4	Analyse the characteristics and properties of Laplace & Fourier transforms.	Analyze	2	1, 2, 5, 9, 10, 12

**TEXT BOOKS:**

1. Jain R.K., Iyengar S. R. K., "Advanced Engineering Mathematics", Narosa Publishers, Reprint 2019.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna publishers, 44th Edition, 2017.

**REFERENCE BOOKS:**

1. Goyal, J. K. & Gupta K. P., "Integral Transforms", Meerut: Pragati Prakashan.
2. Vasistha, A. R. & Gupta R. K., "Integral Transforms", Meerut: Krishna Prakashan.
3. Sreenadh, S., "Fourier Series and Fourier transform", S. Chand & Co Private Limited, New Delhi.

# 22BS811 DESIGN OF EXPERIMENTS

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Basic Mathematics and Probability.

## COURSE DESCRIPTION AND OBJECTIVES

The objective of Design of Experiments (DOE) is to establish optimal process performance by finding the right settings for key process input variables. Design of Experiments is a way to intelligently form frameworks to decide which course of action you might take.

### MODULE - 1

#### UNIT – 1

[12L+8T+0P=20Hours]

#### INTRODUCTION TO ANOVA

Definition, Assumptions, statement of Cochran's theorem, differences between Fixed and random effects model. Design of Experiments: Principles of experimentation in Designs.

#### UNIT – 2

[12L+8T+0P=20Hours]

#### ANALYSIS OF VARIANCE

Analysis of One way with equal and unequal classifications and two-way classifications. Analysis of completely randomized design (CRD), Randomized block design (RBD) and Latin square design (LSD) including one missing observation. efficiency of these designs.

#### PRACTICES:

- ANOVA-CRD.
- ANOVA - LSD with one missing observation.

### MODULE – 2

#### UNIT – 1

[12L+8T+0P=20Hours]

#### BIBD

Factorial Experiment, confounding of factorial designs, balanced incomplete block design(BIBD), Incomplete block design, parameters of BIBD, Symmetric BIBD, Efficiency of BIBD, Resolvable design, split plot design

#### UNIT – 2

[12L+8T+0P=20Hours]

#### FACTORIAL DESIGNS

Analysis of  $2^2$ ,  $2^3$   $2^n$  factorial design, Statistical analysis of split plot design, advantages and disadvantages of split plot design, Analysis of BIBD, efficiency of BIBD with RBD.

#### PRACTICES:

- ANOVA - RBD with one missing observation.
- Analysing one way and two way classified data
- Applying the principles of design to various experiments
- Choosing local control in experiments to isolate the treatment effects
- Designing  $2^n$  factorial experiments
- Analysing balanced incomplete design- BIBD

**SKILLS:**

- ✓ Design the experiments with principles of design
- ✓ Carry out the analysis for the design of experiments
- ✓ Construction of BIBD
- ✓ Analysing factorial designs and split plot designs

**COURSE OUTCOMES:**

After the completion of the course, the student will be able to achieve the following outcomes:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Conducting analysis of one way or two way classified data	Analyze	1	1,2
2	Apply principles of design to the experiments	Apply	1	1,2
3	Identifying the situations where factorial experiments can be implemented	Analyze	2	1,2,3
4	Implement balanced incomplete block designs in various experimental situations	Apply	2	1,2,4
5	Conducting factorial designs for various experimental situations	Apply	2	1,4,5

**TEXT BOOKS:**

1. Telugu Academy BA/BSc III year paper - III Statistics - applied statistics - Telugu academy by prof.K.Srinivasa Rao, Dr D.Giri. Dr A.Anand, Dr V.Papaiah Sastry, 2009.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI,2010.

**REFERENCE BOOKS:**

1. Fundamentals of applied statistics : VK Kapoor and SC Gupta,2014.
2. Indian Official statistics - MR Saluja,1972.
3. Anuvarthita Sankyaka Sastram - Telugu Academy,1998.

# 22BS812 STATISTICAL ANALYSIS THROUGH SPSS/R

Hours Per Week :

L	T	P	C
2	0	4	4

**PREREQUISITE KNOWLEDGE:** Knowledge in various statistical concepts.

## COURSE DESCRIPTION AND OBJECTIVES:

Students learn the basics of statistical inference in order to understand and compute p-values and confidence intervals, all while analysing data with R. We provide R programming examples in a way that will help make the connection between concepts and implementation. Problem sets requiring R programming will be used to test understanding and ability to implement basic data analyses. We will use visualization techniques to explore new data sets and determine the most appropriate approach. We will describe robust statistical techniques as alternatives when data do not fit assumptions required by the standard approaches. By using R scripts to analyse data, you will learn the basics of conducting reproducible research.

## MODULE-1

### UNIT-1

[8L+0T+16P = 24 Hours]

#### INTRODUCTION TO R

Introduction to R, Vectors, factors, lists, Matrix, Data frames in R- Descriptive statistics using R.

### UNIT-2

[8L+0T+16P = 24 Hours]

#### DATA VISUALIZATION USING R

Data Visualization using R, Scatter plot, adding colors, Histogram, Box and Whisker plot, time series plot, Plotting Normal Distribution Using R Functions. Descriptive Statistics - Mean, Mode, Median, Skew, Kurtosis – Correlation and Regression analysis.

#### PRACTICES:

- Presenting the fundamentals of R package
- Describing the given data using R package
- Using visualization packages drawing different diagrams to present the data

## MODULE - 2

### UNIT-1

[8L+0T+16P = 24 Hours]

#### PLOTTING

Plotting Binomial Distribution Using R Functions, Plotting Poisson Distribution Using R Functions, R Functions for Normal Distribution - rnorm, pnorm, qnorm and dnorm, p-value.

### UNIT-2

[8L+0T+16P = 24 Hours]

#### DISTRIBUTION USING R

Plotting Normal Distribution, Binomial Distribution Using R Functions and Poisson Distribution using rpois, ppois, qpois and dpois, Poisson Distribution using Visualize Package, Inferential Statistics - One and two sample z, t, Chi Square, F Tests, ANOVA, Tukey HSD

#### PRACTICES:

- Put all library() calls and any hard-coded variables at the top of the script
- Use RStudio projects to organize your scripts, data, and output
- Modularize your code

**SKILLS:**

- ✓ *Analyse the characteristics and visualization of a given data.*
- ✓ *Perform hypothesis tests, interpret statistical results (e.g., p-values), and report the results of your analysis to clients*
- ✓ *Fit, examine, utilize regression models to examine relationships between multiple variables*

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Draw a suitable visualization for the given data	Apply	1	1,2,3
2	Applying appropriate technique to Analyze the data	Apply	1	1,2
3	Carryout ANOVA using R package	Apply	2	1,3
4	Carryout the testing of hypothesis problems	Analyze	2	1,2,4
5	Obtaining expected frequencies for given probability distribution	Evaluate	2	1,2,3,4

**TEXT BOOKS:**

1. "An Introduction to Statistical Learning with Applications in R", Springer Texts in Statistics, 1st ed. 2013, Corr. 7th printing 2017 Edition
2. The Art of R Programming, Norman Matloff, 5/e, Cengage Learning, 2011.

**REFERENCE BOOKS:**

1. R Cookbook, Paul Teetor, 5/e, Oreilly, 2011.
2. R in Action, Rob Kabacoff, 2/e, Manning, 2015.
3. R for Everyone, Lander, 4/e, Pearson, 2014.

**22BS813 ADVANCED PROBABILITY**

Hours Per Week :

L	T	P	C
3	2	0	4

**PRE-REQUISITE KNOWLEDGE:** Basic knowledge in Probability and mathematics**COURSE DESCRIPTION AND OBJECTIVES:**

It provides the advanced concepts to the students on probability. The students try to know and measure the chance of happening different events and their occurrence numerically. The probability on the infinite series, like strong and weak laws and convergence will be discussed in this course.

**MODULE - 1****UNIT-1****[12L+8T+0P = 20 Hours]****CONVERGENCE OF SEQUENCES**

Sequences of random variables: Measure-theoretic preliminaries, Convergence of sequences of random variables, Independence and Kolmogorov's zero-one law, the strong law of large numbers Ergodicity and stationarity, Measure preservation, invariance and ergodicity, Criteria for measure preservation and ergodicity Stationary processes and the law of large numbers.

**UNIT-2****[12L+8T+0P = 20 Hours]****WEEK LAW OF LARGE NUMBERS**

Weak convergence, Weak convergence and convergence of measures, Weak convergence and distribution functions, Weak convergence and convergence in probability, Weak convergence and characteristic functions, Central limit theorems, Asymptotic normality, Higher dimensions.

**PRACTICES:**

- Convergence of random variables
- Practical application of Kolmogorov's zero-one law
- Establishment of Weak convergence in Probability
- Application of central limit theorem

**MODULE - 2****UNIT-1****[12L+8T+0P = 20 Hours]****MARTINGALES**

Signed measures and conditioning, Decomposition of signed measures, Conditional Expectations given a  $\sigma$ -algebra, Conditional expectations given a random variable, Martingales, Introduction to martingale theory, Martingales and stopping times

**UNIT-2****[12L+8T+0P = 20 Hours]****BROWNIAN MOTION**

The martingale convergence theorem, Martingales and uniform integrability, The martingale central limit theorem, The Brownian motion, Definition and existence, Continuity of the Brownian motion, Variation and quadratic variation, The law of the iterated logarithm

**SKILLS:**

- ✓ Applications of Kolmogorov's zero-one law in real time data
- ✓ Decomposition of signed measures, Conditional Expectations given a  $\sigma$ -algebra
- ✓ Application of martingale convergence theorem, Martingales and uniform integrability, The martingale central limit theorem
- ✓ Meaning of Brownian motion and detection of the existence and variations

**PRACTICES:**

- Decomposition of signed measures
- Application of Martingale theorem
- Application of martingale central limit theorem
- Existence of Brownian motion

**COURSE OUTCOMES:**

By the end of this course, it is expected that the student will be able to learn the following aspects :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Understand the applications of convergence of sequences of random variables and Kolmogorov's zero-one law	Apply	1	1,2
2	Understand the applications of Weak convergence and distribution functions, Weak convergence in probability	Apply	1	1,2
3	Analyze the concept of martingale convergence theorem, Martingales and uniform integrability, The martingale central limit theorem	Analyze	2	1,2,3
4	Evaluate the uniform integrability	Evaluate	2	1,2,4
5	Evaluate the Continuity of the Brownian motion, Variation and quadratic variation	Evaluate	2	1,4,5

**TEXT BOOKS:**

1. Advanced Probability, Alexander Sokol Anders Rønn-Nielsen, Copyright 2013 Alexander Sokol & Anders Rønn-Nielsen, ISBN 978-87-7078-999-8
2. An Introduction to probability theory and mathematical statistics by V K Rohatgi, John Wiley

**REFERENCES:**

1. Kingman J F C and Taylor S J, Introduction to Measure and Probability, Cambridge university Press
2. Feller, W Introduction to Probability Theory and its applications, Vol. II Wiley
3. Cramer H. Mathematical methods of Statistics, Princeton University Press.

# 22BS814 OPERATIONS RESEARCH

Hours Per Week :

L	T	P	C
3	2	0	4

**PREREQUISITE KNOWLEDGE:** Basic Mathematics and Probability.

## COURSE DESCRIPTION AND OBJECTIVES:

The objective of the course is to introduce some of the tools that facilitate better understanding about the operations in a quantitative form and help them in taking right decision about the business through mathematical approach.

### MODULE-1

#### UNIT-1

[12L+8T+0P = 20 Hours]

#### INTRODUCTION TO LPP

Linear Programming: Introduction to Operations Research- Linear Programming – Formulation of LPP- Graphical Solution-Dual Problem-Primal-Dual Relationships-Transportation Problem-Definition-Introduction to Game Theory-Two Person Zero Sum Game-Pure Strategies-Saddle Point-Mixed Strategies.

#### UNIT-2

[12L+8T+0P = 20 Hours]

#### TRANSPORTATION PROBLEM AND GAME THEORY

Transportation problem, Solution to the Transportation Problem-Balanced and Unbalanced Transportation Problem- Assignment Problem-Travelling Salesman Problem-Solution methods of Games without Saddle Point-Algebraic, matrix and arithmetic Methods-Graphical solution of 2 X m, m X 2 Games-Dominance method.

### MODULE-2

#### UNIT-1

[12L+8T+0P = 20 Hours]

#### DECISION THEORY

Decision Making Process-Steps in the decision Making-Decision making with an active Opponent-Definitions-Decision making Environment-Criteria for Decision under uncertainty and risk.

#### UNIT-2

[12L+8T+0P = 20 Hours]

#### PERT AND CPM

PERT & CPM: Definitions, various terms used in Network Scheduling-Drawing Networks-Identifying Critical Path-Probability of completing the project within Time-Decision Trees-Graphic displays of decision Making-Problems in CPM / PERT –Problems in Decision making under uncertainty and risk-problems in decision trees.

#### PRACTICES:

- Obtain the graphical solution to the Linear programming problem.
- Compute the objective functions in an LPP and transportation problem.
- Compute the optimum and mixed strategies of different games.
- Finding the critical paths in various project assignments.
- Quantifying the possible decisions in various decision environments.



**SKILLS:**

- ✓ Supply chain applications.
- ✓ Job assignment.
- ✓ Drawing network diagram for a project and identify the critical path.
- ✓ Computation of earliest expected time and latest allowable time for events in a project.
- ✓ Decision making in different environments.

**COURSE OUTCOMES:**

Upon the completion of the course, the students will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify situations in which linear programming techniques can be applied	Apply	1	1,2,7
2	Recognise and formulate a transportation problem and obtain the solutions	Apply	1	1,2,3,4
3	Understand how optimal strategies, are formulated in conflict and competitive environment	Analyse	2	1,2,3,4,5,8
4	Understand the steps of decision making process, make decision under various decision-making environments, determine the expected monetary value, ex-pected opportunity loss, and construct decision trees for making decisions	Analyse	2	1,2,3,4,6,7

**TEXT BOOKS:**

1. J K Sarma, "Operations Research: Theory and Applications", 1st Edition, Macmillan India, 2007.
2. S.D. Sarma "Operations Research", 11th ed., Kedarnath, Ramanath & Co., 2012.

**REFERENCE BOOKS:**

1. Barry Render, Raiph M. Stair, Jr. Michael E. Hanna, "Quantitative Analysis for Management", 9th Edition, PHI Pvt Ltd, New Delhi, 2007
2. Pannerselvam. R, "Operations Research", 2nd ed., PHI
3. Operations Research, Kranthi Swaroop, P. K. Gupta and Manmohan, 4th ed., Sultan & Sons, 1976.

**22BS815 APPLIED STATISTICS**

Hours Per Week :

L	T	P	C
3	0	2	4

**PREREQUISITE KNOWLEDGE:** Basic Mathematics and Probability.**COURSE DESCRIPTION AND OBJECTIVES:**

Communicate and present statistical ideas clearly in oral and written forms using appropriate technical terms and deliver data analysis results to non-statistical audience. Students will demonstrate their ability to apply statistics in other fields at an appropriate level and demonstrate their ability to apply knowledge acquired from their major to real world models. To present statistical systems in India and different organizations deals data. To make a proficient in collection, organization, design, and drawing inferences from data using appropriate statistical methodology and problem-solving skill with different statistical techniques.

**MODULE –1****UNIT-1****[12L+0T+8P = 20 Hours]****ANALYSIS OF TIMES SERIES**

Analysis of times series: Components of times series: meaning and examples, trend by least squares (straight line and parabola) methods and moving average methods. Seasonal indices by simple averages, ratio to moving average, ratio to trend and link relative methods.

**UNIT-2****[12L+0T+8P = 20 Hours]****INDEX NUMBERS**

Index numbers: Meaning, problems involved in the construction of index numbers, simple and weighted index numbers. Criteria of good index numbers. Fixed base and chain base index numbers. Cost of living index numbers, wholesale price index numbers, Base shifting, splicing and deflation of index numbers.

**PRACTICES:**

- Fitting of first and second degree polynomial equations
- Calculation of seasonal variation Indices
- Calculation of wholesale price Index numbers

**MODULE –2****UNIT-1****[12L+0T+8P = 20 Hours]****OFFICIAL STATISTICS**

Official Statistics: Functions and organization of CSO and NSSO. Agricultural, area, yield of statistics, national income and its computation.

**UNIT-2****[12L+0T+8P = 20 Hours]****VITAL STATISTICS**

Vital statistics: Meaning, Definition, uses, sources of vital statistics, various Death rates-CDR, ASDR, STDR and Birth rates -CBR, ASFR, TFR. Reproduction Rates: Measurement of population growth, crude rate of natural increase, Pearle's vital index, Gross Reproduction Rate [GRR], Net Reproduction Rates[NRR], Life tables, construction uses of life tables and abridged life Tables.

**SKILLS:**

- ✓ Can study the trends of business data with time series and its components
- ✓ Construct a cost of living index for a group of people
- ✓ Calculate statistical measures relating to vital events
- ✓ Describe anatomy of Statistical system in India

**PRACTICES:**

- Memorise the functions of CSO, NSSO
- Calculation of CDR, ASDR, CBR, ASFR, TFR
- Finding GPR, NPR
- Creating life tables

**COURSE OUTCOMES:**

After the completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Students will have a solid foundation of mathematical processes.	Analyze	1	1,2
2	Apply different statistical techniques for a given data using Time series	Analyze	1	1,2
3	Assess cost of living for a group of people with index numbers	Analyze	2	1,2,3
4	Discuss different demographic measures for analysis	Apply	2	1,2,4
5	Give the Statistical system in India	Evaluate	2	1,4,5

**TEXT BOOKS:**

1. VK Kapoor and SC Gupta, "Fundamentals of applied Statistics", S. Chand Publishers, 2009
2. Prof.K.Srinivasa Rao, Dr D.Giri. Dr A.Anand, Dr V.Papaiah Sastry." Applied Statistics", 2009

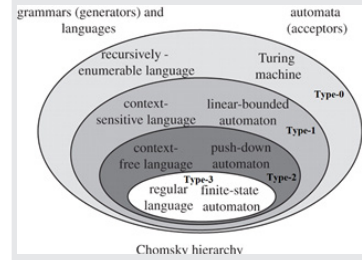
**REFERENCE BOOKS:**

1. MR Saluja , "Indian Official statistics", 1978
2. "Anuvarthita Sankyaka Sastram", Telugu Academy, 2008.
3. III Statistics, Telugu academy, BA/BSc III year paper, 2007

# 22BS821 FORMAL LANGUAGES AND AUTOMATA THEORY

Hours Per Week :

L	T	P	C
3	2	0	4



<https://sameer9247.wordpress.com/2016/11/15/theory-of-computation/>

**PREREQUISITE KNOWLEDGE:** Knowledge of graphs, trees and logic .

## COURSE DESCRIPTION AND OBJECTIVES:

This course aims to teach the student to identify different formal language classes and their relationships, strong theoretical foundation for designing compilers. In addition to this the student will be able to learn the techniques for information processing, design different grammars, automata and recognizers for different formal languages

## MODULE-1

### UNIT-1:

[12L+8T+0P=20 Hours]

#### INTRODUCTION

Alphabets, Strings and languages, Automata and Grammars, Regular languages, Chomsky hierarchy of languages, Deterministic finite automata (DFA)-Formal definition, Simplified notation, State transition graph, Transition table, Language of DFA; Nondeterministic finite automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of finite automata, FA with output - Moore and Mealy machine, Equivalence of Moore and Mealy machine, Applications and Limitation of FA.

### UNIT - 2:

[12L+8T+0P=20Hours]

#### REGULAR EXPRESSIONS

Regular Expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular Expressions, Kleen's Theorem, Regular Expression to FA, DFA to regular expression, Arden theorem, non regular languages, pumping lemma for regular languages (proofs not Required), Application of pumping lemma, Closure properties of regular languages, Decision properties of regular languages.

Grammar Formalism: Regular Grammars-Right linear and left linear grammars, Equivalence between regular linear grammar and FA;

#### PRACTICES:

- Design DFA and NFA which accepts the following languages over the alphabet  $\{0,1\}$ . And also convert NFA to DFA. Give separate Automata for each and also write RE for the obtained automata.
  - a) The set of all strings ends with 00.
  - b) With three consecutive 0's.
  - c) With 011 as a substring.
  - d) Either begin or ends with 01.
  - e) Strings whose fourth symbol from the right end is 1.
  - f) Even number of 0's.
  - g) number of 1 's is divisible by three.
- Design NFA to recognize the following set of strings.
  - a) abc, abd, and aacd: Assume the alphabet is  $\{a,b,c,d\}$ .
  - b) 0101,101 and 011: Assume the alphabet is  $\{0,1\}$ .
  - c) ab, bc and ca: Assume the alphabet is  $\{a,b,c\}$ .

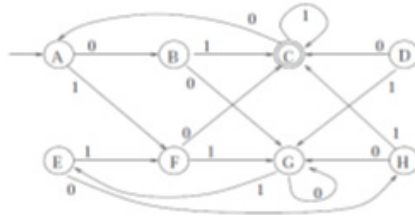
**SKILLS:**

- ✓ Investigate syntax and semantics of a regular and context free languages.
- ✓ Develop the problem understanding solving ability.
- ✓ Design optimized solutions for a language.

- Convert epsilon NFA to DFA.



- Minimize the following DFA.



- Construct Mealy and Moore Machines and equivalent them for the residue (remainder) mod 3 of binary input.
- Construct Finite Automata for the following Regular Expressions.
  - (a)  $RE=ab(a+b)^*$
  - (b)  $RE=(a+ab)(ab+ab)^*$
- Prove that the following languages are not Regular.
  - (a)  $L= \{ap \mid p \text{ is a prime number}\}$
  - (b)  $L= \{bn \mid n=i^2 \text{ and } i>1\}$
  - (c)  $L= \{WWR \mid W \text{ is } (a,b)^*\}$
  - (d)  $L= \{anbn+1 \mid n\geq 1\}$

**MODULE-2**

**UNIT-1**

[12L+8T+0P=20Hours]

**CONTEXT FREE GRAMMAR**

Definition, Examples, Derivation, Derivation trees, Ambiguity in grammar, Inherent ambiguity, Ambiguous to unambiguous CFG, Useless symbols, Simplification of CFGs; Normal forms for CFGs - CNF and GNF, CFLs; Closure properties of Decision properties of CFLs-Emptiness, Finiteness and membership, pumping lemma for CFLs (proofs not Required), Application of pumping lemma. Small Sample Tests: t-test for single, double and paired tests, variance ratio test (F-test), Chi-square test-independence of attributes

**UNIT-2**

[12L+8T+0P=20Hours]

**PDA AND T**

**Push Down PDA AND TM Automata (PDA):** Description and definition, Instantaneous description, Language of PDA, Acceptance by final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, two stack PDA.

**Turing Machines (TM):** Basic model, Definition and representation, Instantaneous Description, Language acceptance by TM, Computable functions, Types of Turing Machines, Universal TM, Recursive and Recursively Enumerable Languages, undecidability, Church Turing Thesis, Universal Turing Machine, The universal and diagonalization languages, Reduction between languages and Rice's Theorem.

**PRACTICES:**

- Construct CFG for the following:
  - a)  $L=\{anbn \mid n>1\}$
  - b)  $L= \{WWR \mid W \text{ is } (a,b)^*\}$
  - c)  $L= \{ap \mid p \text{ is a prime}\}$

- Derive the strings 10001 using left most derivation and right most derivation and parse tree by using the following grammar. And show that grammar is ambiguous.  
 $S \rightarrow T000T$   
 $T \rightarrow 0T \mid 1T$
- Convert the following CFG to CNF.  
 $S \rightarrow ABC \mid Aa$   
 $A \rightarrow a$   
 $B \rightarrow d$   
 $C \rightarrow Aab \mid a$
- Convert the following CFG to GNF.  
 $S \rightarrow AA \mid 0$   
 $A \rightarrow SS \mid 1$
- Prove that the following are not CFL.  
 (e)  $L = \{a^p \mid p \text{ is a prime number}\}$   
 (f)  $L = \{b^n \mid n = i^2 \text{ and } i > 1\}$   
 (g)  $L = \{WWR \mid W \text{ is } (a,b)^*\}$   
 (h)  $L = \{a^n b^{n+1} \mid n \geq 1\}$
- Convert the following language or PDA to CFG.  
 (a)  $L = \{a^n b^n \mid n \geq 1\}$  and  
 (b)  $\delta(q, 0, z) = \{(q, xz)\}$   
 $\delta(q, 0, x) = \{(q, xx)\}$   
 $\delta(q, 1, x) = \{(q, x)\}$   
 $\delta(q, \cdot, x) = \{(p, \cdot)\}$   
 $\delta(p, 1, x) = \{(p, xx)\}$   
 $\delta(p, \cdot, x) = \{(p, \cdot)\}$   
 $\delta(p, 1, z) = \{(p, \cdot)\}$
- Construct PDA for the following Languages.  
 a)  $L = \{0^n 1^m \mid n \geq m\}$   
 b)  $L = \{a^n b^n \mid n \geq 1\}$   
 c)  $L =$   
 d)  $L = \{w \mid na(w) > nb(w)\}$   
 e)  $L = \{0^n 1^{2n} \mid n > 0\}$   
 f)  $L =$  Where  $wR$  is reverse of  $w$   
 g)  $L =$  Where  $wR$  is reverse of  $w$
- Construct PDA for the following Languages.  
 a)  $L = \{a^n b^n c^n \mid n > 1\}$   
 b)  $L = \{a^n b^m a^n \mid n, m \geq 1\}$
- Construct Turing Machine for the following Languages.  
 a)  $L = \{a^n b^n \mid n \geq 1\}$   
 b)  $L = \{0^2 n^1 n \mid n > 0\}$   
 c)  $L = \{wwr \mid w \text{ is } (0+1)^*\}$   
 d)  $L = \{a^n b^n c^n \mid n \geq 1\}$ .  
 e) Well balanced Parenthesis for example:  $()()$

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to achieve the following outcomes :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Design abstract models of computing, including Deterministic Finite Automata (DFA), non-deterministic Finite Automata (NFA), Push Down Automata (PDA) and Turing Machine (TM) models and their power to recognize the languages.	Apply	1,2	1,2,3
2	Design different finite state machines to perform various operations.	Analyze,	1,2	1,2,3
3	Analyze, the given language is regular or not regular, CFL or not, Ambiguous unambiguous, Recursive and Recursive Enumerable.	Analyze	1,2	2
4	Design Regular grammar and context free grammars for a language.	Design	1,2	1,3

**TEXT BOOKS:**

1. Hopcroft and Ullman, "Introduction to Automata Theory, Languages and Computation", 2nd Edition, Pearson/ Prentice Hall India, 2007.

**REFERENCE BOOKS:**

1. Zed A Shaw, Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C), Addison Wesley, 2015
2. Christoph Dürr, Sorbonne University, Jill-Jênn Vie, Inria, Competitive programming in Python, Cambridge University Press, 2020
3. Michael Sipser, "Introduction to Theory of Computation", 3rd Edition, Course Technology, 2012.

**22BS822 MACHINE LEARNING**

Hours Per Week :

L	T	P	C
3	0	2	4



<https://www.forbes.com/sites/kalevleertaru/2019/01/15/why-machine-learning-needs-semantics-not-just-statistics/>

**PREREQUISITE KNOWLEDGE:** Probability & Linear Algebra, Python language.

**COURSE DESCRIPTION AND OBJECTIVES:**

This course provides a broad introduction to various machine learning concepts including Supervised learning (parametric/non-parametric algorithms, support vector machines, kernels, neural networks) and Unsupervised learning (clustering, dimensionality reduction) methods. Students will get an understanding of various challenges of Machine Learning and will be able to decide on model complexity. Numerous case studies introduced in this course allow the students to apply machine-learning algorithms in computer vision, medical imaging, audio, and text domains. Laboratory experiments of this course will introduce students to advanced Machine Learning Python libraries such as Scikit-Learn, Matplotlib, and many other recent ML-related APIs. The course is designed such that the students get enough hands-on experience with a major focus on the practical implementation of theoretical concepts.

**MODULE - 1****UNIT-1****[14L+0T+8P=22 Hours]****INTRODUCTION**

What is machine learning? Machine learning applications; Types of Learning: Supervised learning; Un-supervised learning; Reinforcement learning.

**Model Training Essentials:** Re-sampling methods: Bias-Variance Trade-off. Hypothesis Testing and Variable Selection, Sub sampling and Up-sampling, SMOTE; Cross Validation (validation set, Leave-One-Cut (LOO), k-fold strategies) and bootstrap; Evaluation measures-Error functions, Confusion Matrix, Accuracy, Precision and Recall, F1 Score.

**Regression Analysis:** Linear Regression, Simple and Multiple Linear Regression, Polynomial Regression, Logistic Regression, Multi nominal Regression. Ordinary Least Squares Method, Model Shrinkage-Ridge, and LASSO regression.

**UNIT-2****[10L+0T+8P=18 hours]****FEATURE SELECTION**

**Feature Selection Strategies:** Problem statement and Uses, Filter methods, Wrapper methods, Embedded methods. Branch and bound algorithm, Sequential forward/backward selection algorithms.

**Dimensionality Reduction:** Singular value decomposition, matrix factorization, Linear discriminant analysis, Principal components analysis.

**PRACTICES:**

- Apply the following tasks to any given dataset:
  - a. Load and visualize data.
  - b. Check out and replace missing values.
  - c. Encode the Categorical data.
  - d. Splitting the dataset into Training and Test set.
  - e. Splitting the dataset into k-folds.
  - f. Feature scaling.



**SKILLS:**

- ✓ *Statistical data analysis.*
- ✓ *Classify / Cluster data.*
- ✓ *Tool usage for developing ML applications.*

- House price prediction:
  - a. Create a model that predicts a continuous value (price) from input features (square footage, number of bedrooms and bathrooms).
  - b. Implement a univariate Model using Least Squares and plot best-fit line.
  - c. Implement a multivariate Model using Least Squares and plot best-fit line.
  - d. Retrieve model error and model coefficients.
  - e. Observe Variance Inflation Factor (VIF).
  - f. Implement Ridge regression model.
  - g. Implement LASSO regression model.
  - h. Report your observations on the above models for house prediction.
- Heart disease prediction:
  - a. Implement a logistic regression model to predict whether an individual is suffering from heart disease or not.
  - b. Evaluate and compare model performance using the following validation approaches:
    - i. Validation set approach.
    - ii. K-fold cross validation.
    - iii. Stratified K-fold cross validation.
    - iv. LOO strategy.
  - c. Plot Confusion matrix.
  - d. Report performance of the model in terms of the following metrics:
    - i. Accuracy.
    - ii. Precision-Recall.
    - iii. F1 Score.
  - e. Report your observations and explain when to use what type of measures.
- Perform effective feature selection in a given dataset using any one of the feature selection techniques.
- Dimension Reduction:
  - a. Load a dataset and Implement Bayes classification model.
  - b. Apply dimension reduction using:
    - i. Principal Component Analysis
    - ii. Linear Discriminant Analysis
  - c. Apply the model on data with reduced dimension.
  - d. Compare and contrast model performance in each case.

**MODULE - 2****UNIT-1****[16L+0T+8P=24 hours]****CLASSIFICATION**

**Classification:** Binary, Multi-class and Multi-label Classification; K-Nearest Neighbours, Support Vector Machines, Decision Trees, The Naïve Bayes' Classifier, Class Imbalance, Perceptron ANN model.

**Ensemble Methods:** Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking.

**UNIT-2****[8L+0T+8P=16 hours]****CLUSTERING**

**Clustering:** Different distance functions and similarity measures, K-means clustering, Medoids, Hierarchical Clustering-Single linkage and Complete linkage clustering, Graph based Clustering -MST, DBSCAN, Spectral clustering.

**PRACTICES:**

- Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
- Implement the naïve Bayesian classifier for a sample training data set stored as a.csv file. Compute the accuracy of the classifier, considering few test data sets.
- Assuming a set of spam or not-spam mails that need to be classified, use the naïve Bayesian classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
- Implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.
- Demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample?
- Build a model using SVM with different kernels.
- Implement and build models using the following Ensemble techniques.
  - a. Bagging.
  - b. Boosting: Adaboost, Stacking.
- Build a model to perform Clustering using K-means after applying PCA and determining the value of K using the Elbow method.
- Unsupervised Modelling:
  - a. Cluster the data using the following models:
    - i. Spectral Clustering.
    - ii. K-medoids.
    - iii. DBSCAN.
    - iv. Hierarchical Clustering.
  - b. Compare and contrast model performance in each case.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply a wide variety of learning algorithms such as Probabilistic, Discriminative and Generative algorithms for a given application.	Apply	1, 2	1
2	Analyze and evaluate the performance of various machine learning models approaches on different kinds of data.	Analyze	2	2
3	Design an end-to-end Machine-learning model to realize solutions for real-world problems.	Create	1	3
4	Implement various machine learning models using advanced ML tools.	Create	1, 2	5

**TEXT BOOKS:**

1. Ethem Alpaydin, "Introduction to Machine Learning", 3rd Edition, The MIT Press, 2014.
2. Flach, Peter. "Machine learning: the art and science of algorithms that make sense of data". Cambridge University Press, 2012.

**REFERENCE BOOKS:**

1. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.
2. Aurélien Géron, "Hands-on Machine Learning with Scikit Learn and Tensor Flow", O'reilly, 2017.
3. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2013. (ISLR).

# 22BS823 WEB TECHNOLOGIES

Hours Per Week :

L	T	P	C
2	0	4	4

**PREREQUISITE KNOWLEDGE:** OOPs through JAVA..

## COURSE DESCRIPTION AND OBJECTIVES:

This course offers the concepts of web development like static and dynamic web page design and provides internet programming knowledge, web servers, application servers, and design methodologies using object-oriented concepts. The objective of this course is to build web applications using JSP, PHP, Angular JS, and Node JS with a client and server-side scripting technologies that span multiple domains.

## MODULE-1

### UNIT-1

[8L+0T+16P=24 hours]

#### INTRODUCTION

**TML:** Creating structured documents, Links and navigation, Tables, Forms, and Frames.

**HTML 5:** Introduction to HTML5, The HTML5 Canvas, HTML5 audio and Video;

**CSS:** Cascading Style Sheets, CSS Properties.

**Java Script:** Learning Java Script- how to add scripts to your page, DOM, variables, operators, functions, conditional statements, Looping, Events, Built-in objects, form and regular expression validation.

### UNIT-2

[8L+0T+16P=24 hours]

#### JDBC AND JSP

**JDBC:** What is JDBC, system requirements, types of JDBC Drivers, creating database tables, connecting to a database, executing SQL statements, processing result sets, and making changes to a result set.

**JSP:** JSP Processing, Generating Dynamic Content using Scripting Elements, Implicit JSP Objects, Sharing Data between JSP pages, JSP application design with JDBC.

#### PRACTICES:

- Design a webpage having four frames named a)Top, b)Center, c)Bottom, and d) Left. The top frame should contain the company logo and title. The bottom frame should contain copyright information. The left frame should contain various links like Home, Products, Services, Branches, About, etc., When clicked on respective links, the content should display on the center frame.
- Design a catalog page that should contain the details of all the books available on the website in a table. The details should contain the following: a) Snapshot of Cover Page b) Author Name c) Publisher. d) Price. e) Add to cart button.
- Design a timetable schedule for your current semester using the Table tag.
- Design a HTML page for Student Registration Form using Form Elements that includes Form, input-text, password, radio, checkbox, hidden, button, submit, reset, label, textarea, select, option and file upload.
- Design a HTML web page with at least two <h1>, two images, two buttons, and appropriate CSS to display,
  - o All<h1>withfont-size12pt, and bold in Verdana font using In line CSS.
  - o All<img>withbordercoloryellow,thickness10pxusingDocumentLevelCSS.
  - o All<inputtype='button'>shouldchangebackgroundcolortoredonmouseoverthemusing External CSS.

Source : <https://www.dreamstime.com/web-development-coding-programming-internet-technology-business-concept-web-development-coding-programming-internet-technology-image121903546>

- Design a HTML page having a text box and four buttons viz Factorial, Fibonacci, Prime and Palindrome. When a button is pressed an appropriate java script function should be called to display the following:
  - Factorial of that number.
  - Fibonacci series up to that number.
  - Prime numbers up to that number.
  - Is it palindrome or not?
- Design a web page that contains a color pallet, when the user moves the mouse to the particular area, then it changes the background color of the web page.
- Design a registration page to validate the following fields using Java Script.
  - Make sure the user name starts with an upper case letter
  - The user name must have at least one digit
  - Ensure that Email is valid
  - Ensure that the password length is between 8 to 20 characters
  - Make sure the password contains at least one upper case letter, one lower case, and one special character exclude [ . (dot), ,(comma), ;(semicolon), : (colon)].
- Design a web page to display the videos on-page, on user selection using frames and HTML5 tags.
- Design a web page to display different types of objects using HTML5 Canvas.
- Design a web application to validate entered username and password through JDBC connection program and display user information on successful login and provide profile editing option to the user. Else display an error message.
- Develop a JSP application to create a user on successful signup and update user information on successful login and display user information on the home screen and provide a logout button.
- Make an HTML form that collects the last name. Send the name to JSP page. If there is an employee with that last name, show full details of him or her (just show the first employee if there are multiple people with the same name). If there is no employee with that last name, say “no employee records available.”

## MODULE-2

### UNIT-1

**[8L+0T+16P=24 hours]**

#### PHP

**PHP:** Introduction to PHP, Expressions, and control flow in PHP, functions and objects, Arrays, Accessing MySQL using PHP, Form Handling, Cookies, Sessions, and Authentication.

### UNIT-2

**[8L+0T+16P=24 hours]**

#### ANGULAR AND NODE JS

**Angular JS:** Introduction, Expressions, Modules, Directives, Controllers, Filters, Events, Forms, Form Validation.

**Node JS:** Introduction, Setup Dev Environment, Modules, Node Package Manager, Creating Web server, File System, Events, Express.js, Accessing MySQL from Node.js.

#### PRACTICES :

- Design a web page using PHP, upload image into web page and display image, when user clicking on view button.
- Design a personal Information form, Submit & Retrieve the form data using \$\_GET(), \$\_POST() and \$\_REQUEST() Variables.
- Design a login page to validate username and password through MySQL. If login is successful display user information on home page and modify user information on edit page using sessions. When user logged out, destroy all user-related sessions.

**SKILLS:**

- ✓ Perform client-side validation using Java Script and Angular JS.
- ✓ Store and retrieve data using Node JS.
- ✓ Generate dynamic web pages using JSP and PHP.
- ✓ Develop a web application or website for any real-time requirements.

- Design a web page to accept payment data from user and do the payment, on successful payment display details on the screen. A Session should be set while doing payment up to 10 minutes after that link/payment page should be destroyed irrespective of user payment.
- Design a web application to validate user registration page using Angular JS.
- Design a search engine using Angular JS. On key press, display data on web page.
- Design a web page to validate user name and password using: Node.js and PHP. When user clicks on login button, server checks the data availability in data base. If the data matches a successful login page is returned. Otherwise, a failure message is shown to the user.
- Design a web application to display the active duration of the user, i.e., time between login and logout.

**COURSE OUTCOMES :**

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Usage of HTML, HTML5, CSS, Java Script, and PHP in web application development.	Apply	1, 2	1
2	Apply Angular JS features for form validation and Node JS, and JDBC concepts to perform database operations from web pages.	Apply	1,2	1
3	Analyse the suitability of Node JS and JSP technologies to build solutions for real-world problems.	Analyse	2	2
4	Design and develop three tier web applications using JSP, Node JS, Angular JS, and PHP.	Create	2	3

**TEXT BOOKS:**

1. Jon Duckett, "Beginning Web Programming with HTML, XHTML, and CSS", 2nd Edition, Wiley Publishing, Inc, 2008.
2. Robin Nixon, "Learning PHP, MySQL & JavaScript WITH JQUERY, CSS & HTML5", 4th Edition, O'Reilly, 2015.

**REFERENCE BOOKS:**

1. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web How to Program", 5th Edition, Pearson Education, 2012.
2. Kishori Sharon, "Java APIs, Extensions and Libraries with JavaFX, JDBC, jmod, jlink, Networking and the process API", 2nd Edition, Apress, 2018.
3. Brad Dayley, Brendan Dayley, and Caleb Dayley, "Node.js, Mongo DB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications," 2nd Edition, Pearson Education, 2018.
4. ManuelKiessling, "The Node Craftsman Book", Packt Publisher, 2017.
5. Adrian W. West and Steve Prettyman, "Practical PHP 7, MySQL 8, and MariaDB Website Databases: A Simplified Approach to Developing Database-Driven Websites", 1st edition, A Press, 2018.

**22BS824 PYTHON PROGRAMMING**

Hours Per Week :

L	T	P	C
2	2	2	4



Source: <https://www.hitalent.co/blog/2019/12/tech-jobs-python-programming-language-and-aws-skills-demand-has-exploded>

**PREREQUISITE KNOWLEDGE** : Prior knowledge of any programming language and object-oriented concepts is helpful but not mandatory..

**COURSE DESCRIPTION AND OBJECTIVES:**

This course offers sufficient knowledge required to understand the fundamental concepts of Python programming language. This course enables students to choose appropriate data structures (lists, dictionaries, tuples, sets, strings) for the given problem. In addition, the students will be able to create reliable, modular and reusable applications using Object- Oriented Programming approaches. At the end they will get an idea of how to access database using python programming, develop web applications, and using web Services using python Programming.

**MODULE-1****UNIT-1****[6L+6T+6P=18 Hours]****INTRODUCTION**

Introduction to python, Variables, Assignment, Keywords, Built-in functions, Indentation, Comments, Basic data types - integers, float, complex, Boolean, strings; Python program development, running python using REPL shell, Python scripts.

**Operators and Expressions:** Operators- arithmetic operators, comparison (relational) operators, assignment operators, logical operators, bitwise operators, membership operators, identity operators; Expressions and order of evaluations.

**Control Structures:** Conditional control structures - if, elif, else; Loop control structures - for, while, for... else, while...else, nested loops, break, continue, pass.

**UNIT-2****[10L+01T+10P=30 Hours]****PYTHON DATA STRUCTURES AND FUNCTIONS**

**Data Structures:** Lists, Tuples, Sets, Strings, Dictionary - creation, accessing, basic operators and methods; List comprehensions.

**Functions:** Defining functions, calling functions, Passing arguments - keyword arguments, default arguments, positional arguments, variable-length arguments; Types of functions- anonymous functions, fruitful function, recursive functions; Scope of the variables- global and local variables, Development of recursive and non-recursive functions.

**PRACTICES**

- A. Given an integer N, write a program to find its 1's complement.
- B. Given two integers N1 and N2, write a program to find their product without using multiplication (\*\*) operator and loops.
- C. Given two integers N1 and N2 having same value, write a program to check whether N1 and N2 points to the same object or not.
- A. Given an Integer N, write a program to check whether given number is even or odd without using modulus operator.
- B. Given a number N, number of bits K and starting position P, write a program to extract K bits from a position P (from right) in the binary representation of N. Convert the extracted bits in decimal number.

**SKILLS:**

- ✓ *Installation and usage of python libraries.*
- ✓ *Working with varieties of data structures.*
- ✓ *Improved analytical and problem-solving abilities.*
- ✓ *Developing structured modular and Object-oriented programming solutions.*

- Given coordinates of centre of a circle, radius and a point coordinate, write a program to check whether the given point lies inside or on the circle, or outside the circle.
- Write a program to find the sum of digits in a given integer.
- Given an integer N as an input, decides the geometrical figure for which the area has to be calculated, for example N=1 for circle, N=2 for rectangle, and N=3 for triangle. Write a program to display the area of the respective figure.
- A semi prime number is an integer which can be expressed as a product of two distinct primes. For example,  $15 = 3 \times 5$  is a semi prime number but  $9 = 3 \times 3$  is not. For a Given an integer number N, write a program to find whether it can be expressed as a sum of two semi-primes or not (not necessarily distinct).
- Given an integer amount X, write a program to find the minimum number of currency notes \$ (500, 100, 50, 20, 10, 5, 2, 1) required for the given amount.

**Input:**

575

Where input is the amount for which we have to calculate the number of currency notes.

**Output: 4**

**Explanation:** Total amount = 1(500 dollar note) + 1(50 dollar note) + 1(20 dollar note) + 1(5 dollar note) = 575, hence the minimum number of notes required is 4.

- For a given a string S and width W, write a program to wrap the string S into a paragraph of width W.

**Example:**

Input:

ABCDEFGHIJKLMNOQRSTUVWXYZ

4

Output:

ABCD EFGH IJKL IMNO QRST UVWX YZ

- Write a program to Measure the required time to access the first element, nth element and n/2 element stored in list and tuple data structure.
- Given a list L of N numbers (integers), Write a program to find the sum of the elements of given list L with the corresponding elements of the reverse of list L. If list L has elements [1,2,3], then reverse of the list L will be [3,2,1] and the resultant list should be [4,4,4].
- Given a positive integer number n. Write a program to generates a dictionary d which contains (i, i\*i\*i) such that i is the key and i\*i\*i is its value, where i is from 1 to n (both included). Print the content of the dictionary d.
- Write a program to create a data structure to store student information such as regd no, name, percentage of marks, phone number and display the student details based on the order of percentage of marks.
- For a Given a string, design and implement functions to perform the following:
  - a) remove vowels in the given string.
  - b) count number of uppercase and lowercase letters.
  - c) remove all special characters.
  - d) check whether it is a palindrome or not.
  - e) swap case of each letter.
- Create a function that receives 3 numbers and returns the median, i.e. the number that is not the min and not the max, but the one in between.
- Given two lists of integer numbers, write a function to perform the following operations.
  - a. print elements that are common in both the lists. (Print without duplicates).
  - b. print elements that are present in the first list and not present in second list.
  - c. print elements that contain the first element of the first list and last element of the second list.
  - d. print elements that contain sum of elements of first list and sum of elements of second list.
  - e. print largest number of both the lists.
  - f. print smallest number of both the lists.



**MODULE-2****UNIT-1****[8L+8T+8P=24 Hours]****MODULES**

**Creating modules**, Import Statement, From...Import Statement, Name Spacing, Creating user defined modules

**Standard Modules**: sys, math, date, time, os, random and itertools modules.

**Packages**: Numpy, Pandas, Matplotlib, Requests, Nltk.

**File Processing**: Reading and writing files -creating a new file, writing to a file, reading text files, opening and closing files, reading, writing, tell (), seek (), rename ().

**UNIT-2****[8L+8T+8P=24Hours]****ERRORS AND EXCEPTIONS**

Introduction to Exceptions, Handling Exception, Try Except Else and Finally Block, Raising Exceptions.

Simple Graphics and Image Processing: Overview of Turtle Graphics, Two Dimensional Shapes, Colours and RGB System and Image Processing,

**PRACTICES :**

- Given a string 'S', find all possible permutations of the string S in lexicographic sorted order. Each Permutation size is "2" or "3".

Sample Input:

HACK

Expected Output: AC AH AK CA CH CK HA HC HK KA KC KH

- Write a program that finds area of the pentagon when length from center of a pentagon to vertex are given, the formula for computing the area of pentagon is  $\frac{3}{2} s^2$ , where s is the length of the side, the side can be computed using formula  $s = 2r \sin \pi/5$ , where r is the length from the center of a pentagon to vertex.

Given X as a date. Write a program to find what the day is on that date.

Sample Input: 08 05 2015

Expected Output: Wednesday

- Arun is working in an office which is N blocks away from his house. He wants to minimize the time it takes him to go from his house to the office. He can either take the office cab or he can walk to the office. Arun's velocity is  $V_1$  m/s when he is walking. The cab moves with velocity  $V_2$  m/s but whenever he calls for the cab, it always starts from the office, covers N blocks, collects Arun and goes back to the office. The cab crosses a total distance of N meters when going from office to Arun's house and vice versa, whereas Arun covers a distance of  $(2 - \sqrt{N})(2\sqrt{N})$  while walking. Help Arun to find whether he should walk or take a cab to minimize the time.

**Input Format:**

A single line containing three integer numbers N,  $V_1$ , and  $V_2$  separated by a space.

Example-1:

**Input:**

5 10 15

**Output:**

Cab

- Create a binary NumPy array (containing only 0s and 1s) and convert a binary NumPy array in to a Boolean NumPy array
- Convert the first column of a Data Frame as a Series by using suitable packages.

**Sample Input:****Original Data Frame**



```

col1 col2 col3
0  1  4  7
1  2  5  5
2  3  6  8
3  4  9  12
4  7  5  1
5  11 0  11

```

Sample Output:

```

0  1
1  2
2  3
3  4
4  7
5  11

```

- Create two text files and read data from two text files. Display a line from first file followed by the corresponding line from the second file.
- Define the following functions that are more robust to erroneous input data
  - a) To divide two numbers (To handle Zero Division Error).
  - b) To read two integer numbers and display them (To handle Value Error).
  - c) To display elements of a list (To handle Index Error).
  - d) To open a file and display file contents (To handle File Not Found Error)
- Write a python program to handle multiple exceptions using raise keyword.
- Draw the spiral hexagon, where we use turtle to create a spiral structure. The final shape is a hexagon and there are various colors used in producing the sides of the hexagon.
- Implement a program to print it in a counterclockwise spiral form for a given square matrix.

**Sample Input:**

```

4
25 1 29 7
24 20 4 32
16 38 29 1
48 25 21 19

```

- **Sample Output:**

```

25 24 16 48 25 21 19 1 32 7 29 1 20 38 29 4

```

- Write a function that finds the nearest prime number of a given number.

#### COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to :

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1.	Make use of different data types to design programs involving decisions, loops, and functions.	Apply	1	1, 2, 5
2.	Analyze the usage of different data structures for practical and contemporary applications for a given problem.	Analyze	1	1, 2, 3, 5

3	Develop functional, reliable and User-friendly Python programs for given problem statement and constraints.	Apply	2	1, 2, 3,5
4	Installing the python environment and related packages that are required for practical and contemporary applications.	Apply	2	1, 2,3,5

**TEXT BOOKS:**

1. Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 2011.
2. Mark Lutz, "Learning Python", 5th edition, Orielly Publishers, 2013.

**REFERENCE BOOKS:**

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
2. James Payne, "Beginning Python using Python 2.6 and Python 3", Wrox publishing.
3. Paul Gries, "Practical Programming: An Introduction to Computer Science using Python 3", The Pragmatic Bookshelf, 2nd edition, 4 Oct. 2013.
4. Allen B. Downey, "Think Python", 1st edition, Orielly publishing.