



# R.M.K. ENGINEERING COLLEGE

(An Autonomous Institution)

R.S.M Nagar, Kavaraipettai, Gummidipoondi Taluk, Thiruvallur District, Tamil Nadu- 601206

Affiliated to Anna University, Chennai / Approved by AICTE, New Delhi/Accredited by NAAC with A+ Grade

An ISO 9001:2015 Certified Institution / All the Eligible UG Programs are Accredited by NBA, New Delhi

## **B.E. / B.TECH- ELECTRICAL AND ELECTRONICS ENGINEERING**

**REGULATIONS – 2022**

### **CHOICE BASED CREDIT SYSTEM**

#### **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

1. The graduates of the program will have strong foundation in Mathematics, Basic Sciences and Engineering fundamentals.
2. The graduates of the program will excel in profession through effective communication, team work, leadership skills and ethical behavior.
3. The graduates of the program will have competency in providing optimal solutions to societal problems with a global outlook.

#### **PROGRAM OUTCOMES (POs)**

**After the successful completion of the program, the graduates will be able to:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and

norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### PROGRAMME SPECIFIC OUTCOMES (PSOs)

**After the successful completion of the program, the graduates will be able to:**

1. Analyze the performance of complex interconnected Power system.
2. Implement latest technological developments in the field of Control and Automation.
3. Apply cutting edge technology to trouble shoot Electrical equipment.
4. Develop managerial skills to establish Start-up Company in the field of Engineering and Technology.

### MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12
I	√	√	√	√	√							
II							√	√	√	√	√	√
III	√	√	√	√	√	√	√	√	√	√	√	√

### MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAMME SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12
<b>I</b>	3	3	3	2	2							
<b>II</b>	3	3	2	2	3							
<b>III</b>	3	3	2	2	3							
<b>IV</b>	3	3	3	3	3	3	3	3	3	3	3	3

Contribution

1: Reasonable

2: Significant

3: Strong



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## **B.E. / B.TECH- ELECTRICAL AND ELECTRONICS ENGINEERING**

**REGULATIONS – 2022**

**CHOICE BASED CREDIT SYSTEM**

**I - II SEMESTER CURRICULUM AND SYLLABI**

SEMESTER – I								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY COURSES WITH LABORATORY COMPONENT</b>								
1	22MA101	Matrices and Calculus	BSC	5	3	0	2	4
2	22PH102	Physics for Electronics Engineering	BSC	5	3	0	2	4
3	22CS101	Problem Solving using C++	ESC	5	3	0	2	4
4	22CS102	Software Development Practices	ESC	5	3	0	2	4
5	22EE103	Basics of Electrical Engineering	ESC	5	3	0	2	4
6	22HS101	Professional Communication	HSMC	4	2	0	2	3
<b>LABORATORY COURSES</b>								
7	22ME111	Product Development Lab - 1	EEC	2	0	0	2	1
<b>MANDATORY COURSES</b>								
8	22CH104	Environmental Sciences and Sustainability (Non Credit)	MC	2	2	0	0	0
9		Induction Program (Non Credit)	MC	3 Weeks				
<b>TOTAL</b>				<b>33</b>	<b>19</b>	<b>0</b>	<b>14</b>	<b>24</b>

<b>SEMESTER – II</b>								
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY COURSES WITH LABORATORY COMPONENT</b>								
1	22MA201	Transforms and Numerical Methods	BSC	5	3	0	2	4
2	22CS201	Data Structures	ESC	5	3	0	2	4
3	22CH101	Engineering Chemistry	BSC	5	3	0	2	4
4	22IT202	Database Management System	ESC	5	3	0	2	4
5	22CS202	Java Programming	ESC	5	3	0	2	4
<b>LABORATORY COURSES WITH THEORY COMPONENT</b>								
6	22ME202	Computer aided Engineering Graphics	ESC	3	1	0	2	2
<b>LABORATORY COURSES</b>								
7	22ME211	Product Development Lab- 2	EEC	2	0	0	2	1
<b>AUDIT COURSES</b>								
8		Yoga for Stress Management	AC	1	1	0	0	0
<b>TOTAL</b>				<b>31</b>	<b>17</b>	<b>0</b>	<b>14</b>	<b>23</b>

**Proposed Curriculum for Semester-III to VIII**

<b>SEMESTER –III</b>								
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY COURSES</b>								
1	22MA301	Mathematics III	BSC	3	3	0	0	3
<b>THEORY COURSES WITH LABORATORY COMPONENT</b>								
2	22EE301	Circuit Theory	PCC	5	3	0	2	4
3	22EE302	Electrical Machines I	PCC	5	3	0	2	4
4	22EE303	Microcontroller and ARM Processor	PCC	4	2	0	2	3
5	22EE304	Digital Electronics	PCC	5	3	0	2	4
6	22EE305	Analog Electronics	PCC	5	3	0	2	4
<b>LABORATORY COURSES</b>								
7		Communication Lab	HSMC	4	0	0	4	2
8	22ME311	Product Development Lab- 3	EEC	2	0	0	2	1
9		Aptitude and Coding Skills I	EEC	2	0	0	2	1
		Internship/Seminar	EEC					1
<b>AUDIT COURSES</b>								
		Value Education (Non Credit)	AC					0
<b>TOTAL</b>				<b>35</b>	<b>17</b>	<b>0</b>	<b>18</b>	<b>27</b>

SEMESTER –IV								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY COURSES</b>								
1		UHV II	HSMC	3	3	0	0	3
2		Professional Elective I	PEC	3	3	0	0	3
<b>THEORY COURSES WITH LABORATORY COMPONENT</b>								
3	22EE401	Operating Systems	ESC	4	2	0	2	3
4	22EE402	Transmission and Distribution	PCC	4	2	0	2	3
5	22EE403	Electrical Machines II	PCC	5	3	0	2	4
6	22EE404	Control System Engineering	PCC	5	3	0	2	4
7	22EE405	Microprocessors	PCC	4	2	0	2	3
8		Open Elective I	OEE	3	3	0	0	3
<b>LABORATORY COURSES</b>								
9		Aptitude and Coding Skills II	EEC	2	0	0	2	1
10	22ME411	Product Development Lab- 4	EEC	2	0	0	2	1
<b>AUDIT COURSES</b>								
		Yoga / Personality	AC					0
<b>TOTAL</b>				<b>35</b>	<b>21</b>	<b>0</b>	<b>14</b>	<b>28</b>

SEMESTER –V									
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	
<b>THEORY COURSES</b>									
1		Digital Signal Processing	PCC	4	4	0	0	4	
2		Professional Elective II	PEC	3	3	0	0	3	
3		Professional Elective III	PEC	3	3	0	0	3	
4		Honors I*		3	3	0	0	3	
5		Honors II*		3	3	0	0	3	
<b>THEORY COURSES WITH LABORATORY COMPONENT</b>									
6	22EE501	Fundamentals of Networking	ESC	4	2	0	2	3	
7	22EE503	Power System Analysis	PCC	5	3	0	2	4	
8	22EE504	Embedded Systems and IoT	PCC	5	3	0	2	4	
<b>LABORATORY COURSES</b>									
9		Advanced Aptitude and Coding Skills I	EEC	2	0	0	2	1	
	22EE511	Internship / Seminar**	EEC					1	
<b>MANDATORY COURSES</b>									
10		Indian Constitution (Non Credit)	MC					0	
*Honors				<b>TOTAL</b>	<b>26 +6*</b>	<b>18 +6*</b>	<b>0</b>	<b>8</b>	<b>23 +6*</b>

SEMESTER –VI								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY COURSES</b>								
1		Management Elective	HSMC	3	3	0	0	3
2		Professional Ethics	HSMC	2	2	0	0	2
3		Professional Elective IV	PEC	3	3	0	0	3
4		Professional Elective V	PEC	3	3	0	0	3
5		Professional Elective VI	PEC	3	3	0	0	3
6		Open Elective II	OEC	3	3	0	0	3
7		Honors III*		3	3	0	0	3
<b>THEORY COURSES WITH LABORATORY COMPONENT</b>								
8	22EE601	Power System Protection and Control	PCC	4	2	0	2	3
9	22EE602	Power Electronics	PCC	5	3	0	2	4
<b>LABORATORY COURSES</b>								
10		Advanced Aptitude and Coding Skills II	EEC	2	0	0	2	1
*Honors				<b>TOTAL</b>	<b>28 +3*</b>	<b>22+ 3*</b>	<b>0 6</b>	<b>25+ 3*</b>

SEMESTER – VII								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY COURSES</b>								
1		Honors IV*		3	3	0	0	3
2		Honors V*		3	3	0	0	3
<b>LABORATORY COURSES</b>								
3	22EE711	Project Work - Phase I	EEC	4	0	0	4	2
4		Honors VI* -Project		6	0	0	6	3
<b>MANDATORY COURSES</b>								
5		Essence of Indian Knowledge Tradition (Non Credit)	MC					0
<b>*Honours TOTAL</b>				<b>4 +12*</b>	<b>6*</b>	<b>0</b>	<b>4 +6*</b>	<b>2 +9*</b>

SEMESTER – VIII								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>LABORATORY COURSES</b>								
1	20EE811	Project Work Phase-II	EEC	16	0	0	16	8
<b>TOTAL</b>				<b>16</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**PROFESSIONAL ELECTIVES / HONORS**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>EMBEDDED SYSTEM (HCL TECH-Knowledge partner)</b>	AI Based System Design	Theory of Automata & Compiler Design	Automotive Embedded Systems	Linux System Programming	Linux Kernel and Device Drivers	Project
<b>SMART GRID TECHNOLOGY</b>	AC Micro grid and its controllers	DC Micro grid and its controllers.	Hybrid Micro grid and its controllers.	Micro grid Dynamics and Control	IoT for Smart Systems	Project
<b>ELECTRIC VEHICLE TECHNOLOGY</b>	Fundamentals of Electric Vehicle	EV Architecture	Electric Drives and Controller for Electric Vehicle	Energy Storage and Battery Management System	Modeling and simulation Electric Vehicle	Project
<b>CONTROL AND AUTOMATION</b>	Advanced Control Systems	Robotics And Automation	Biomedical Instrumentation	Virtual Instrumentation	System Identification and Adaptive Control	Fiber Optics and Laser Instrumentation
<b>POWER ELECTRONICS AND DRIVES</b>	Special Electrical Machines	Electric Drives and Control	Analysis of Rectifiers	Analysis of Inverters	Power Converters for Electric Vehicles	Power Electronics for Renewable Energy Sources
<b>RENEWABLE ENERGY TECHNOLOGY</b>	Wind Energy Systems	Solar Energy Systems	Restructured Power System	Hybrid Energy Technology	Design, Modeling and Fabrication of Renewable Energy System Components	Grid Integrating Techniques and Challenges

**Credit Summary**

S. No.	Subject Area	Credits Per Semester								Credit Total	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1	HSMC	3	-	2	3	-	5	-	-	13	8
2	BSC	8	8	3	-	-	-	-	-	19	12
3	ESC	12	14	-	3	3	-	-	-	32	20
4	PCC	-	-	19	14	12	7	-	-	52	33
5	PEC	-	-	-	3	6	9		-	18	11
6	OEC	-	-	-	3	-	3	-	-	6	4
7	EEC	1	1	3	2	2	1	2	8	20	12
8	MC/AC	√	√	√	√	√	-	√	-	-	
<b>Total</b>		<b>24</b>	<b>23</b>	<b>27</b>	<b>28</b>	<b>23</b>	<b>25</b>	<b>2</b>	<b>8</b>	<b>160</b>	<b>100</b>
	Honors Credits					6	3	9		18	

**HSMC - Humanities and Social Sciences including Management Course; BSC – Basic Science Course; ESC – Engineering Science Course; PCC – Professional Core Course; PEC – Professional Elective Course; OEC – Open Elective Course; EEC – Employability Enhancement Course; MC – Mandatory Course; AC – Audit Course.**



**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Use the matrix algebra methods to diagonalize the matrix.
- CO2: Determine the evolute of the curve
- CO3: Apply differential calculus ideas on the function of several variables
- CO4: Evaluate the area and volume by applying the concept of multiple integration.
- CO5: Utilize the concept of vector calculus in evaluating integrals.

**TEXT BOOKS:**

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.
2. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.

**REFERENCES:**

1. M. K. Venkataraman, “Engineering Mathematics”, Volume I, 4<sup>th</sup> Edition, The National Publication Company, Chennai, 2003 Author, Title, Publisher, Edition, Year
2. Sivaramakrishna Dass, C. Vijayakumari, “Engineering Mathematics”, Pearson Education India, 4<sup>th</sup> Edition, 2019.
3. H. K. Dass, and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Limited, 3<sup>rd</sup> Edition, 2014.
4. B. V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, 6<sup>th</sup> Edition, New Delhi, 2008.
5. S. S. Sastry, “Engineering Mathematics”, Vol. I & II, PHI Learning Private Limited, 4<sup>th</sup> Edition, New Delhi, 2014.
6. James Stewart, “Calculus: Early Transcendentals”, Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015.

**LIST OF EQUIPMENTS:**

1. **SCILAB : Open Source.**

	<b>PHYSICS FOR ELECTRONICS ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22PH102</b>	(For First Year B.E. –Electrical and Electronics Engineering and Electronics and Communication Engineering)	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

**The course will enable the learners to:**

Educate the fundamental important concepts in Physics and to apply the knowledge in solving scientific and Engineering problems. Impart the basic concepts of light propagation in waveguides, conducting materials, semiconducting materials, opto and nano electronic devices and photovoltaic technology

**UNIT I LASER AND FIBRE OPTICS 15**

Population of energy levels – Einstein’s A and B coefficients derivation - Resonant cavity - Optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction- Engineering applications of lasers in data storage (qualitative).

Fibre optics: Principle and propagation of light through optical fibre - V-number - Types of optical fibres (Material, refractive index and mode) - Losses in optical fibre - Fibre optic communication - Fibre optic sensors (pressure and displacement).

1. Determination of divergence of laser beam
2. Determination of acceptance angle and numerical aperture of an optical fibre

## **UNIT II ELECTRON THEORIES OF MATERIALS**

**15**

Introduction to Classical, Quantum and Zone theories - Classical free electron theory - Expressions for electrical conductivity and thermal conductivity - Wiedemann-Franz law - Success and failures of CFT- Effect of temperature on Fermi function- Density of energy states and average energy of electron at 0 K - Energy bands in solids.

1. Determination of thermal conductivity of a bad conductor by Lee's disc method.
2. Measurement of the internal resistance using potentiometer.

## **UNIT III SEMICONDUCTING MATERIALS**

**15**

Intrinsic Semiconductors – E-k diagram -Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors- Band gap determination-Extrinsic semiconductors - Carrier concentration in n-type and p-type semiconductors -Electrical conductivity of intrinsic and extrinsic semiconductors -Variation of Fermi level with temperature and impurity concentration - Hall effect and its applications.

1. Bandgap determination of intrinsic semiconductor.
2. Determination of wavelength of semiconductor laser

## **UNIT IV OPTO AND NANO ELECTRONIC DEVICES**

**15**

Carrier generation and recombination processes in semiconductors (concepts only) –LED-Organic LED- Photodetectors– Electron density in bulk material (qualitative) -Size dependence of Fermi energy- Band gap of nanomaterial -Quantum confinement-Quantum Structures-Density of states in quantum well, quantum wire and quantum dot structures - Quantum dot lasers.

1. Synthesis of nanoparticles by sol-gel method
2. Determination of particle size using laser source
3. Determination of bandgap of an LED

## **UNIT V PHOTOVOLTAICS**

**15**

Photovoltaic effect- Solar Cell-Parameters of Solar Cells -Solar Cell Technology -Effect of Conversion Efficiency-Input Light- Solar Cell Area, Angle of Light Falling on Solar Cell-Solar Cell Operating Temperature, photovoltaic thermal collectors, organic solar cells-dye sensitized solar cell.

1. Solar cell characteristics

**TOTAL: 75 PERIODS**

### **OUTCOMES:**

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

- CO1: Discuss the basic principles of working of laser and their applications in fibre optic communication
- CO2: Summarize the classical and quantum electron theories and energy band structures
- CO3: Describe the conductivity in intrinsic and extrinsic semiconductors and importance of Hall effect measurements
- CO4: Associate the properties of nanoscale materials and their applications in quantum computing
- CO5: Explain the concepts of photovoltaic technology and its applications.

### **TEXTBOOKS:**

1. **M.N. Avadhanulu and P.G. Kshirsagar**, A text book of Engineering Physics, S. Chand and Company, New Delhi, 2014.
2. **Kasap, S.O.** Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.

3. **Wahab, M.A.** Solid State Physics: Structure and Properties of Materials|. Narosa Publishing House, 2009.
4. **Nelson, J**, The physics of Solar Cells, Imperial College Press, 2003.
5. **Jui Sheng Hsieh**, Solar Energy Engineering, Prentice Hall, 2007.

## REFERENCES:

1. **R.K. Gaur and S.L. Gupta**, Engineering Physics, Dhanpat Rai Publications (P) Ltd., Eight New Delhi, 2001.
2. **Hanson, G.W.**, Fundamentals of Nanoelectronics, Pearson Education, 2009
3. **R. A. Serway and J.W. Jewett**, Physics for Scientists and Engineers, Ninth Edition. Cengage Learning, 2014.
4. **Rogers, B., Adams, J. & Pennathur, S.** Nanotechnology: Understanding Small Systems| CRC Press, 2014
5. **A. Marikani**, Materials Science, PHI Learning Private Limited, Eastern Economy Edition 2017.
6. **R. Wolfson**, Essential University Physics, Volume 1 and 2 with Mastering Physics, Global Edition, 3rd Edition, Pearson 2017.
7. **B.K. Pandey and S. Chaturvedi**, Engineering Physics, Cengage Learning India, 2012.
8. **J. Singh**, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc., 1995.
9. **Garg, H.P.**, Treatise on Solar Energy, John Wiley & Sons, 2006.

## LIST OF EQUIPMENTS:

1. Semiconductor Laser
2. Determination of optical fibre parameters
3. Lee's disc apparatus
4. Potentiometer
5. Bandgap determination set up
6. Synthesis of Nanoparticles
7. Bandgap of an LED
8. Solar cell characteristics

<b>22CS101</b>	<b>PROBLEM SOLVING USING C++</b> (Common to All Branches)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

## OBJECTIVES:

### The Course will enable learners to:

- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs using exceptions.

## UNIT I PROBLEM SOLVING AND PROGRAMMING FUNDAMENTALS 15

Computational thinking for Problem solving – Algorithmic thinking for Problem solving - Building Blocks - Problem Solving and Decomposition - Dealing with Error – Evaluation.

Overview of C – Data types – Identifiers – Variables – Storage Class Specifiers – Constants – Operators - Expressions – Statements – Arrays and Strings – Single-Dimensional – Two-Dimensional Arrays – Arrays of Strings – Multidimensional Arrays.

**List of Exercise/Experiments:**

1. Write C/C++ programs for the following:
  - a. Find the sum of individual digits of a positive integer.
  - b. Compute the GCD of two numbers.
  - c. Find the roots of a number (Newton's method)
2. Write C/C++ programs using arrays:
  - a. Find the maximum of an array of numbers.
  - b. Remove duplicates from an array of numbers.
  - c. Print the numbers in an array after removing even numbers.
3. Write C/C++ programs using strings:
  - a. Checking for palindrome.
  - b. Count the occurrences of each character in a given word.

**UNIT II POINTERS AND FUNCTIONS****15**

Pointers -Variables – Operators – Expressions – Pointers and Arrays – Functions - Scope Rules – Function Arguments – return Statement – Recursion – Structures – Unions – Enumerations.

**List of Exercise/Experiments:**

1. Generate salary slip of employees using structures and pointers. Create a structure Employee with the following members:  
EID, Ename, Designation, DOB, DOJ, Basicpay  
Note that DOB and DOJ should be implemented using structure within structure.
2. Compute internal marks of students for five different subjects using structures and functions.

**UNIT III CLASSES AND OBJECTS****15**

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program - Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory Allocation for Objects - Static Data Members - Static Member functions - Array of Objects - Objects as function arguments - Returning objects - friend functions – Const Member functions - Constructors – Destructors.

**List of Exercise/Experiments:**

1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

**UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM****15**

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes.

Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – Pure Virtual Functions – Polymorphism.

**List of Exercise/Experiments:**

1. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance are supported:

- a) Single inheritance b) Multiple inheritance c) Multi level inheritance d) Hierarchical inheritance.

## **UNIT V I/O, FILES AND EXCEPTIONS**

**15**

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

### **List of Exercise/Experiments:**

1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.
4. Mini project.

**TOTAL: 45+30 = 75 PERIODS**

### **OUTCOMES:**

**At the end of this course, the students will be able to:**

**CO1:** Solve problems using basic constructs in C.

**CO2:** Implement C programs using pointers and functions.

**CO3:** Apply object-oriented concepts and solve real world problems.

**CO4:** Develop C++ programs using operator overloading and polymorphism.

**CO5:** Implement C++ programs using Files and exceptions.

### **TEXT BOOKS:**

1. Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2015.
2. E Balagurusamy, "Object Oriented Programming with C++", 4th Edition, Tata McGraw-Hill Education, 2008.

### **REFERENCES:**

1. Karl Beecher, "Computational Thinking: A beginner's guide to problem-solving and programming", BCS Learning & Development Ltd, 2017. (Unit 1)
2. Nell Dale, Chip Weems, "Programming and Problem Solving with C++", 5<sup>th</sup> Edition, Jones and Bartlett Publishers, 2010.
3. John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.
4. Yashavant P. Kanetkar, "Let us C++", BPB Publications, 2020
5. ISRD Group, "Introduction to Object-oriented Programming and C++", Tata McGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design", Third Edition, Thomson Course Technology, 2007.
7. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01297200240671948837\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01297200240671948837_shared/overview)

### **LIST OF EQUIPMENTS:**

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

**OBJECTIVES:****The Course will enable learners to:**

- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

**UNIT I AGILE SOFTWARE DEVELOPMENT AND Git and GitHub 15**

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

Introduction to Git –Setting up a Git Repository - Recording Changes to the Repository - Viewing the Commit History - Undoing Things - Working with Remotes -Tagging - Git Aliases - Git Branching - Branches in a Nutshell - Basic Branching and Merging - Branch Management - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

**List of Exercise/Experiments:**

1. Form a Team, Decide on a project:
  - a) Create a repository in GitHub for the team.
  - b) Choose and follow a Git workflow
    - Each team member can create a StudentName.txt file with contents about themselves and the team project
    - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
    - Team members can now create a Pull request to merge the branch to master branch or main development branch.
    - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
    - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.
3. Form a Team, Decide on a project:
  - c) Create a repository in GitHub for the team.
  - d) Choose and follow a Git workflow
    - Each team member can create a StudentName.txt file with contents about themselves and the team project
    - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
    - Team members can now create a Pull request to merge the branch to master branch or main development branch.
    - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updation.
    - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
4. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.



## OUTCOMES:

At the end of this course, the students will be able to:

**CO1:** Apply agile development methods in software development practices.

**CO2:** Set up and create a GitHub repository.

**CO3:** Develop static and dynamic webpages using HTML.

**CO4:** Design interactive personal or professional webpages using CSS.

**CO5:** Develop web pages using Java script with event-handling mechanism.

## TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International Edition, Ninth Edition, 2020.
2. Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
3. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.

## REFERENCES:

1. Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1st Edition, 2010.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
4. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
5. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India, 2014.
6. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_013382690411003904735\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview)
7. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_0130944214274703362099\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944214274703362099_shared/overview)

## LIST OF EQUIPMENTS:

Systems with either Netbeans or Eclipse

Java/JSP/ISP Webserver/Apache

Tomcat / MySQL / Dreamweaver or

Equivalent/ Eclipse, WAMP/XAMP

**22EE103**

**BASICS OF ELECTRICAL ENGINEERING**

L	T	P	C
3	0	2	4

## OBJECTIVES:

The Course will enable learners to:

- To understand basic circuits and domestic wiring
- To comprehend magnetic circuits
- To impart knowledge on the concepts of electromagnetics.
- To develop knowledge on working principle of measuring instruments.
- To study the structure of electric power generation and distribution systems.

## UNIT I BASIC CIRCUITS AND DOMESTIC WIRING

**15**

Electrical circuit elements (R, L and C)- Ohm's Law Kirchhoff's laws - phasors – RMS-average values-sinusoidal steady state response of simple RLC circuits. types of wiring system and wiring accessories, domestic wiring, specification of wires, earthing, need and methods, protective devices, fuses and circuit breakers, energy tariff calculation for domestic loads.



**TEXT BOOKS:**

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, McGraw Hill publishers, edition, New Delhi, 2019.
2. J. B. Gupta, ‘A Course in Electronic and Electrical Measurements’, S. K. Kataria & Sons, Delhi, 2016.
3. C.L.Wadhwa, ‘Electrical Power Systems’, New Academic Science Ltd, sixth edition 2016.

**REFERENCES:**

1. Chakrabarti A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, seventh edition, 2017.
2. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum’s series, McGraw- Hill, New Delhi, 2010.
3. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 5th Edition, 2017.
4. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, New Delhi, 2019.
5. V K Mehta, ” Principles of power system”, S .Chand and company limited. 5<sup>th</sup> Edition 2018.
6. The Electrical Engineering Handbook, Richard C. Dorf, CRC / IEEE, 1997.
7. Power Engineer’s Handbook, TNEBEA, sixth edition, 2011.

**LIST OF EQUIPMENTS:**

<b>S. No</b>	<b>Name of the Equipment</b>	<b>Range</b>	<b>Quantity</b>
1	Single Phase Energy Meter	230 V/30A	2
2	DC Ammeters	0-5/10	2
3	DC Ammeters	0-1/2	2
4	DC Voltmeter	0-220 V	2
5	Regulated Power Supply	0-30 V	5
6	Function Generator	0-10 A MI	2
7	PV Panels	100W 24V	1
8	Micro Wind Energy Generator Module	-	1
9	Cathode Ray Oscilloscope	30Mhz	2
10	Electric Heater	-	1
11	Thermometer	-	1
12	Thermistor RTD	-	1
13	30 Psi Pressure Chamber with Air Foot Pump	-	1
14	LVDT	-	1
15	Optical Sensor	-	1
16	Strain Gauge Kit	-	1
17	100 Gm Weights	-	10
18	Flow Measurement Trainer Kit	-	1
19	Fan	-	1
20	Iron Box	-	1
21	Multimeter	-	2

**OBJECTIVES:**

The Course will enable learners to:

- Strengthen basic **reading and writing** skills.
- Comprehend **listening contexts** competently.
- Inculcate **reading habit** and develop **effective reading** skills.
- Improve **active and passive vocabulary**.
- Acquire speech clarity with right pronunciation.
- Develop **vocabulary** of a general kind and enhance **grammatical accuracy**.
- Imbibe Content and Language Integrated Learning (CLIL).

**UNIT I FORMAL AND INFORMAL COMMUNICATION 12**

**Listening:** Short Texts, Short Formal and Informal Conversations

**Speaking:** Self-Introduction, Exchanging Personal Information

**Reading:** Practice in Skimming, Scanning and Predicting, Reading Comprehension

**Writing:** Free Writing, Hints Development

**Grammar:** Parts of Speech, Prepositions.

**Vocabulary:** Compound Nouns, Technical Words.

**List of Exercise/Experiments**

1. Familiarization of Vowel Sounds-Monophthongs, Diphthongs and Consonant Sounds
2. Listening to Formal Conversations in British and American Accents
3. Guided Writing

**UNIT II GRAMMAR AND LANGUAGE DEVELOPMENT 12**

**Listening:** Telephonic Conversations.

**Speaking:** Sharing information of a personal kind - Greetings – Taking leave.

**Reading:** Short comprehension passages - Pre-reading and Post-reading (multiple choice questions, short questions / open and close ended questions)

**Writing:** Instructions, Recommendations, Checklists

**Grammar:** Tenses, Framing 'Wh' & 'Yes' or 'No' questions

**Vocabulary:** Numerical Adjectives, Collocations

**List of Exercise/Experiments**

1. Communication Etiquettes
2. Self -Introduction using SWOT Analysis

**UNIT III BASIC TECHNICAL WRITING AND STUDY SKILLS 12**

**Listening:** Listening to longer texts and filling up the tables

**Speaking:** Asking about routine actions and expressing opinions

**Reading:** Short texts (Cloze Test)

**Writing:** Formal letters, E-mail writing, Interpretation of Charts and Graphs

**Grammar:** Cause and Effect expressions, Conditional Clauses

**Vocabulary:** Often misspelled and confusing words

**List of Exercise/Experiments**

1. Mechanics of Reading Skills
2. News Reading–Cloze Tests

**UNIT IV GROUP DISCUSSION AND JOB APPLICATIONS 12**

**Listening:** Listening to recorded dialogues of conversations and completing exercises based on them

**Speaking:** Discussion on Social issues.

**Reading:** Reading text from magazines

**Writing:** Purpose Expressions, Letter of Application, Minutes of Meeting.

**Grammar:** Modal Verbs, Subject-Verb agreement

**Vocabulary :** Sequence Words

**List of Exercise/Experiments**

1. Group Presentation, Group Discussion: Do's and Don'ts of Group Discussion
2. Discussions on failure and success in interviews of famous personalities
3. Spotting Errors

**UNIT V ART OF REPORTING**

**12**

**Listening:** Listening to TED talks

**Speaking:** Debate & Presentations

**Reading:** Biographies

**Writing:** Definitions (Single line & Extended), Report Writing (Industrial visit, Accident and Feasibility reports)

**Grammar:** Reported speech

**Vocabulary :** Verbal Analogies

**List of Exercise/Experiments**

1. Writing based on listening to academic lectures and discussions
2. Leadership skills, Negotiation skills
3. Mechanics of Report Writing

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Comprehend conversations and short talks delivered in English

CO2: Participate efficiently in informal conversations and develop an awareness of the self and apply well-defined techniques

CO3: Read articles of a general kind in magazines and newspapers efficiently

CO4: Write short general essays, personal letters and E-mails in English

CO5: Develop vocabulary of a general kind by enriching reading skills

**TEXT BOOKS:**

1. **Kumar, Suresh E, & Sreehari, P.** Communicative English. Orient Black Swan, 2007.
2. **Richards, Jack C.** Interchange Students' Book-2 New Delhi: CUP,2015

**REFERENCES:**

1. **Bailey, Stephen.** Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. **Dhanavel, S P.** English and Soft Skills, Volume Two, Orient Black Swan. Author, Title, Publisher, Edition, Year

## Laboratory Courses:

<b>22ME111</b>	<b>PRODUCT DEVELOPMENT LAB – 1</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	(Common to all Branches)	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

The students may be grouped into 3 to 4 and work under a project supervisor. The device/system/component/prototype Idea to be developed by the students and a final presentation to be done by the students about the idea generated at the end of the semester.

### OBJECTIVES:

**The Course will enable learners to:**

- Understand the functionalities and limitation of various machine/equipment
- Demonstrate various operations that can be performed to machines
- Summarize the basic principles of machines to convert their ideas into products

### LIST OF EXPERIMENTS:

- I 1. Study of Manufacturing Processes (Carpentry, Plumbing, Machines and Welding).  
2. Study of fundamental operations of 3D Printer and Scanner with Software.  
3. Study of Smart Machining (CNC and Laser cutting) and Engraving Techniques.
- II 1. Study of Fundamental of Circuit Design.  
2. Study of PCB Milling Machine.  
3. Study of Soldering and Desoldering.
- III 1. Study of Computer Peripheral Devices (Processing Information Devices)
- IV 1. Present the Product Idea Presentation - Phase – I.

**TOTAL: 30 PERIODS**

### Note:

The students can select the prototype to be made of their choice after learning the above exercises.

### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- CO1: Understand the concept of manufacturing processes.  
CO2: Describe the working of the machine element.  
CO3: Discuss the various applications of engineering materials.  
CO4: Summarize the basics of core engineering concepts.  
CO5: Describe the process for converting ideas into products.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Equipment Name	Quantity
1.	CNC Router	1 No
2.	3D Printer	1 No
3.	3D Scanner	1 No
4.	Laser cutting Machine	1 No
5.	Centre lathe	2 Nos
6.	Arc welding transformer with cables and holders	2 Nos
7.	Plumbing tools	2 Sets
8.	Carpentry tools	2 Sets
9.	Multimeter	10 Nos
10.	Drilling Machine	1 No
11.	Solder Stations	5 Sets
12.	Desoldering Machine	1 No
13.	PCB Milling Machine	1 No
14.	Variable Power Supply	1 No
15.	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	10 Sets
16.	Personal Desktop Computers	30 Nos

## Mandatory Course:

22CH104	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to all the Branches)	L	T	P	C
		2	0	0	MC

### OBJECTIVES:

#### The Course will enable learners to:

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment.

### UNIT I NATURAL RESOURCES 07

Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - Types - Forest resources: Use and over-exploitation, deforestation and its impacts, Food resources: effects of modern agriculture, organic farming, Renewable energy sources - Solar, Wind, Geothermal, Tidal, OTE and Biomass.

**Field activity -Tree plantation**

### UNIT II POLLUTION AND WASTE MANAGEMENT 07

Pollution - Definition –causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards - nuclear accidents and holocaust - Role of an individual in prevention of pollution –Case studies.

**Waste management-** Municipal solid wastes, e- waste, plastic waste.

**Field study – Solid waste management of the institution**

### UNIT III BIODIVERSITY AND ITS CONSERVATION 06

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: In-situ and ex-situ method.

**Field study – Biodiversity of the institution**

### UNIT IV SUSTAINABILITY AND MANAGEMENT 05

Sustainability-concept, needs and challenges- Circular economy - Sustainable Development Goals- Concept of Carbon footprint, Environmental Impact Assessment, Clean Development Mechanism, solutions.

**Field study – Carbon footprint of the institution**

### UNIT V HUMAN POPULATION 05

Introduction - Population growth, variation among nations, population explosion, Environment and human health – endemic/epidemic/pandemic – Role of information technology in environment and human health.

**Case Study – Pandemics of 21<sup>st</sup> century**

**TOTAL: 30 PERIODS**

### OUTCOMES:

**Upon completion of the course, the students will be able to:**

CO1: Investigate and use conservational practices to protect natural resources.

CO2: Identify the causes of pollutants and illustrate suitable methods for pollution

abatement.

CO3: Adapt the values of biodiversity and its conservation methods.

CO4: Recognize suitable sustainable development practices and apply it in day-to-day life.

CO5: Assess the impacts of human population and suggest suitable solutions.

#### **TEXT BOOKS:**

1. Anubha Kaushik and C.P. Kaushik, "Perspectives in environmental studies", New Age International Publishers, 2<sup>nd</sup> edition, 2021.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, 1<sup>st</sup> edition, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 3<sup>rd</sup> edition, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Universities Press(I) Pvt. Ltd., Hyderabad, 3<sup>rd</sup> Edition, 2021.

#### **REFERENCES:**

1. William P. Cunningham & Mary Ann Cunningham Environmental Science: A Global Concern, McGraw Hill, 14<sup>th</sup> edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 3<sup>rd</sup> edition, 2015.
3. G. Tyler Miller and Scott E. Spoolman, —Environmental Science, Cengage Learning India Pvt, Ltd., Delhi, 14<sup>th</sup> edition, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 1<sup>st</sup> edition, 2012.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning, 1<sup>st</sup> edition, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022

## SEMESTER – II

### Theory Courses with Laboratory Component

<b>22MA201</b>	Transforms and Numerical Methods (Common to All Branches except CSBS)	<b>L</b> 3	<b>T</b> 0	<b>P</b> 2	<b>C</b> 5
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#### OBJECTIVES:

The Course will enable learners to:

- Introduce the concepts of Laplace transforms and Z-transforms.
- Illustrate the application of transforms in solving differential and difference equations.
- Explain the Numerical methods for handling algebraic and transcendental equations.
- Introduce the numerical techniques for interpolation, differentiation and integration.

#### **UNIT I LAPLACE TRANSFORMS 15**

Laplace transforms – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions – Derivatives and integrals of transforms – Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (Statement only).

##### *Experiments using SCILAB:*

1. Finding Laplace transform of a function.
2. Finding inverse Laplace Transforms.
3. Determine the input for given output function of Laplace Transform.

#### **UNIT II Z – TRANSFORMS 15**

Z-transforms – Elementary properties – Inverse Z-transforms – partial fractions method – residues method – Convolution theorem.

##### *Experiments using SCILAB:*

1. Finding Z –transform of a sequence.
2. Finding convolution of two sequences.
3. Plotting the input and output function of Z transform.

#### **UNIT III SOLUTION OF DIFFERENTIAL AND DIFFERENCE EQUATIONS 15**

Solution of linear ordinary differential equation of second order with constant coefficients and first order simultaneous equations with constant coefficients using Laplace transform. Formation of difference equations – Solution of first and second order difference equations with constant coefficients using Z-transform.

##### *Experiments using SCILAB:*

1. Solving second order Ordinary Differential Equation.
2. Finding the Laplace transform and its inverse of a function numerically.
3. Finding the Z-transform numerically

#### **UNIT IV SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 15**

Solution of algebraic and transcendental equations by Newton Raphson method - Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Gauss Seidel Iterative method– Eigenvalues of a matrix by Power method.

**Experiments using SCILAB:**

1. Finding the real roots of algebraic and transcendental equations using Newton Raphson method.
2. Finding the largest Eigenvalue by power method.
3. Solving system of linear equations using Gauss Seidel Method.

**UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION 15**

Finite differences – Forward and Backward differences – Interpolation – Newton’s forward and backward interpolation formulae - Lagrange’s interpolation for unequal intervals - Numerical Differentiation - Newton’s and Lagrange’s formulae - Numerical integration using Trapezoidal and Simpson’s 1/3 rules – Evaluation of double integrals by Trapezoidal and Simpson’s 1/3 rules.

**Experiments using SCILAB:**

1. Finding approximately the missing value using Lagrange interpolation.
2. Evaluating line integrals by trapezoidal rule.
3. Evaluating line integrals by Simpson’s rule.

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Determine Laplace transform and inverse transform of simple functions.

CO2: Determine Z-transform and inverse transform of simple functions.

CO3: Solve ordinary differential equations using Laplace transform and difference equation using Z-transform.

CO4: Compute the solutions of algebraic, transcendental and the system of equations.

CO5: Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

**TEXT BOOKS:**

1. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
2. Grewal, B.S., and Grewal, J.S., “Numerical Methods in Engineering and Science”, Khanna Publishers, 10<sup>th</sup> Edition, New Delhi, 2015.

**REFERENCES:**

1. Erwin. Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.
2. Jain R.K. and Iyengar S. R. K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
3. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics”, Tata McGraw Hill Education Pvt. Ltd, 6<sup>th</sup> Edition, New Delhi, 2012.
4. Mathews, J.H. “Numerical Methods for Mathematics, Science and Engineering”, 2<sup>nd</sup> Edition, Prentice Hall, 1992.
5. Sastry S.S., “Introductory Methods of Numerical Analysis”, PHI Learning Pvt. Ltd, 5<sup>th</sup> Edition, 2015.

**LIST OF EQUIPMENTS:**

1. **SCILAB : Open Source**

22CS201

**DATA STRUCTURES**  
(Common to CSE, CSD, EEE, ECE, IT and ADS)

**L T P C**  
**3 0 2 4**

**OBJECTIVES:**

**The Course will enable learners to:**

- To understand the concepts of List ADT.
- To learn linear data structures – stacks and queues ADTs.
- To understand and apply Tree data structures.
- To understand and apply Graph structures.
- To analyze sorting, searching and hashing algorithms.

**UNIT I LINEAR DATA STRUCTURES – LIST 15**

Algorithm analysis - running time calculations - Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists - circularly linked lists - doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

**List of Exercise/Experiments:**

3. Array implementation of List, Stack and Queue ADTs.
4. Linked list implementation of List, Stack and Queue ADTs.
5. Applications of List – Polynomial manipulations

**UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 15**

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT – Queue Model - Implementations: Array and Linked list - applications of queues - Priority Queues – Binary Heap – Applications of Priority Queues.

**List of Exercise/Experiments:**

3. Applications of Stack – Infix to postfix conversion and expression evaluation.
4. Implementation of Heaps using Priority Queues.

**UNIT III NON-LINEAR DATA STRUCTURES – TREES 15**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT– AVL Tree.

**List of Exercise/Experiments:**

3. Implementation of Binary Trees and operations of Binary Trees.
4. Implementation of Binary Search Trees.

**UNIT IV NON-LINEAR DATA STRUCTURES - GRAPHS 15**

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Applications of graphs – BiConnectivity – Euler circuits.

**List of Exercise/Experiments:**

3. Graph representation and Traversal algorithms.

**UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 15**

Searching- Linear Search - Binary Search - Sorting - Bubble sort - Selection sort - Insertion sort – Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

**List of Exercise/Experiments:**

1. Implement searching and sorting algorithms.

**TOTAL: 75 PERIODS**

## OUTCOMES:

At the end of this course, the students will be able to:

- CO1: Implement abstract data types for list.
- CO2: Solve real world problems using appropriate linear data structures.
- CO3: Apply appropriate tree data structures in problem solving.
- CO4: Implement appropriate Graph representations and solve real-world applications.
- CO5: Implement various searching and sorting algorithms.

## TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4<sup>th</sup> Edition, Pearson Education, 2014.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.

## REFERENCES:

1. Rajesh K. Shukla, "Data Structures using C and C++", Wiley India Publications, 2009.
2. Narasimha Karumanchi, "Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles", CareerMonk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, "An Introduction to Data Structures with Application", McGraw-Hill, 2017.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", Third Edition, Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, "Fundamentals of Data Structures in C++", Second Edition, Silicon Press, 2007.
7. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01350157816505139210584/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01350157816505139210584/overview)

## LIST OF EQUIPMENTS:

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

22CH101

**ENGINEERING CHEMISTRY**  
(Common to all except CE, ME and CB)

L	T	P	C
3	0	2	4

## OBJECTIVES:

The Course will enable learners to:

- To understand the water quality criteria and interpret its applications in water purification.
- To gain insights into the basic concepts of electrochemistry and implement its applications in chemical sensors.
- To acquire knowledge on the fundamental principle of energy storage devices and relate it to electric vehicles.
- To identify the different types of smart materials and explore their applications in Engineering and Technology.
- To assimilate the preparation, properties and applications of nanomaterials in various fields.

## UNIT I WATER TECHNOLOGY

15

Sources of water – Impurities - Drinking water quality parameters – Hardness and its types, problems - Municipal water treatment and disinfection (chlorination - break-point chlorination,

UV, Ozonation). **Boiler troubles** - Scales and sludges, Boiler feed water: Requirements - Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning). External treatment – Ion exchange demineralization - Principle, process and fouling.

**Desalination of brackish water:** Reverse osmosis – principle -types of membranes, process and fouling.

List of Experiments

1. Determination of total, temporary and permanent hardness of water by EDTA method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of alkalinity in water sample.
4. Estimation of iron content of the water sample using spectrophotometer (1,10-phenanthroline/thiocyanate method)

## **UNIT II ELECTROCHEMISTRY AND SENSORS**

**15**

Introduction- Conductance- factors affecting conductance – Electrodes – origin of electrode potential – single electrode potential, standard electrode potential – measurement of single electrode potential –over voltage - reference electrodes (standard hydrogen electrode, calomel electrode)-ion selective electrode- glass electrode - Nernst equation (derivation), numerical problems, Electrochemical series and its applications.

**Chemical sensors** – Principle of chemical sensors – Breath analyzer – Gas sensors – CO<sub>2</sub> sensors- Sensor for health care – Glucose sensor.

List of Experiments

1. Determination of the amount of NaOH using a conductivity meter.
2. Determination of the amount of acids in a mixture using a conductivity meter.
3. Determination of the amount of given hydrochloric acid using a pH meter.

## **UNIT III ENERGY STORAGE DEVICES AND ENERGY SOURCES**

**15**

**Batteries** – Primary alkaline battery - Secondary battery - Pb-acid battery, Fuel cell - H<sub>2</sub> – O<sub>2</sub> fuel cell.

**Batteries used in E- vehicle:** Ni-metal hydride battery, Li-ion Battery, Li-air Battery

**Nuclear Energy** – Nuclear fission, fusion, differences, characteristics – nuclear chain reactions – light water nuclear reactor – breeder reactor.

List of Experiments

1. Determination of single electrode potential of the given electrode.
2. Estimation of the iron content of the given solution using a potentiometer.
3. Determination of electrochemical cell potential (using different electrodes/ different concentrations of electrolytes)

## **UNIT IV SMART MATERIALS FOR ENGINEERING APPLICATIONS**

**15**

**Polymers** – Definition – Classification – smart polymeric materials - Preparation, properties and applications of Piezoelectric polymer - Polyvinylidene fluoride (PVDF), Electroactive polymer- Polyaniline (PANI) and Biodegradable polymer - Polylactic acid (PLA).

**Polymer composites:** Definition, Classification – FRP's – Kevlar.

**Shape Memory Alloys:** Introduction, Shape memory effect – Functional properties of SMAs – Types of SMA - Nitinol (Ni-Ti) alloys - applications.

**Chromogenic materials:** Introduction – Types - applications.

## List of Experiments

1. Determination of the molecular weight of polymer using Ostwald viscometer.
2. Application of polymeric fibers in 3D printing.

## UNIT V NANOCHEMISTRY

15

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) – properties of nanomaterials – types – nanotubes -carbon nanotubes, applications of CNT - nanocomposites – General applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

### List of Experiments

1. Determination of concentration of BaSO<sub>4</sub> nanoparticles by conductometric titrations.
2. Preparation of ZnO nanocrystal by precipitation method.

**TOTAL: 75 PERIODS**

## OUTCOMES:

**Upon completion of the course, the students will be able to:**

CO1: Interpret the water quality parameters and explain the various water treatment methods.

CO2: Construct the electrochemical cells and sensors.

CO3: Compare different energy storage devices and predict their relevance in electric vehicles.

CO4: Classify different types of smart materials, their properties and applications in Engineering and Technology.

CO5: Integrate the concepts of nano chemistry and enumerate its applications in various fields.

## TEXT BOOKS:

1. P. C. Jain and Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 17<sup>th</sup> Edition, 2022.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Second reprint, 2012

## REFERENCES:

1. S.S. Dara and S.S. Umare, “A Textbook of Engineering Chemistry”, S. Chand & Company, New Delhi, 12<sup>th</sup> Edition, 2013.
2. V.R. Gowarikar, Polymer Science, New Age International Publishers, 2<sup>nd</sup> edition, 2021.
3. J. C. Kuriacose and J. Rajaram, “Chemistry in Engineering and Technology”, Volume -1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.
4. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, “Nanotechnology: A Chemical Approach to Nanomaterials”, 2<sup>nd</sup> Edition, RSC publishers, 2015.
5. Prasanna Chandrasekhar, “Conducting polymers, fundamentals and applications– Including Carbon Nanotubes and Graphene”, Springer Science & Business Media, New York, 2<sup>nd</sup> Edition, 2019.
6. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, “Vogel’s Quantitative Chemical Analysis”, Pearson Education Pvt. Ltd., 6<sup>th</sup> edition, 2019.

## LIST OF EQUIPMENTS:

1. Conductivity meter
2. pH meter
3. Potentiometer



of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

2. Design a Java interface for ADT Stack. Implement this interface using array and built-in classes. Provide necessary exception handling in both the implementations.
3. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the area of the given shape and Number of sides() that prints the number of sides of the given shape.
4. Write a Java program to apply built-in and user defined exceptions.

### **UNIT III MULTITHREADING, I/O AND GENERIC PROGRAMMING 15**

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

#### **List of Exercise/Experiments:**

1. Write a Java program that correctly implements producer consumer problem using the concept of inters thread communication.
2. Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

### **UNIT IV STRING HANDLING AND COLLECTIONS 15**

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

#### **List of Exercise/Experiments:**

1. String Manipulation:
  - a. Reversing a set of words and count the frequency of each letter in the string.
  - b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should not be any other character except 0 in the [0] sequence in a given binary string.
  - c. Remove all the occurrences of string S2 in string S1 and print the remaining.
  - d. Find the longest repeating sequence in a string
  - e. Print the number of unique string values that can be formed by rearranging the letters in the string S.
2. Collections:
  - a. Write a program to perform string operations using ArrayList. Write functions for the following
    - i. Append - add at end
    - ii. Insert – add at particular index
    - iii. Search
    - iv. List all string starts with given letter
  - b. Find the frequency of words in a given text.

### **UNIT V JDBC CONNECTIVITY 15**

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update, Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

**List of Exercise/Experiments:**

1. Mini Project (using JDBC)

**TOTAL: 75 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:****CO1:** Understand the object oriented programming concepts and fundamentals of Java.**CO2:** Develop Java programs with the packages, interfaces and exceptions.**CO3:** Build Java applications with I/O streams, threads and generics programming.**CO4:** Apply strings and collections in developing applications.**CO5:** Implement the concepts of JDBC.**TEXT BOOK:**

1. Herbert Schildt, “Java: The Complete Reference”, 11<sup>th</sup> Edition, McGraw Hill Education, 2019.

**REFERENCES:**

1. Cay S. Horstmann, Gary Cornell, “Core Java Volume – I Fundamentals”, 11<sup>th</sup> Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.
5. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_29959473947367270000\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview)

**LIST OF EQUIPMENTS:**

1. Systems with either Netbeans or Eclipse, JDK 1.7 and above, Linux and MySQL

**Laboratory Course with Theory Component:**

		L	T	P	C
<b>22ME202</b>	<b>COMPUTER AIDED ENGINEERING GRAPHICS</b> (Common to CE, CSE, CSD, ECE, EEE, ME, IT and ADS)	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**OBJECTIVES:****The Course will enable learners to:**

- Help students understand universal technical drawing standards.
- Provide training on drafting software to draw part models.
- Demonstrate the concepts of orthographic and isometric projections.
- Use drawing skills for communicating concepts, ideas for engineering product design.
- Use pictorial views to visualize and draw the isometric view of the objects.

**UNIT I INTRODUCTION TO CONVENTIONS IN ENGINEERING DRAWING AND CONIC SECTIONS (3+6)**

Introduction to Engineering Drawing - Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Conic curves - Ellipse, Parabola and Hyperbola by Eccentricity method.

**List of Exercise/Experiments**

1. Drawing of a title block with necessary text, projection symbol and lettering using drafting software.



## REFERENCES:

1. Bhatt N.D. "Engineering Drawing", Charotar Publishing House, 53rd edition , 2019.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2019.
3. Engineering Drawing Practice for Schools and Colleges BIS SP46:2003 (R2008), Published by Bureau of Indian Standards (BIS), 2008.
4. Parthasarathy. N.S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2019.
5. Gopalakrishna. K.R., Engineering Drawing Vol. 1 & 2, Subhas Publications, 27th Edition, 2017.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity
1.	Computer nodes or systems with suitable graphics facility	30 No
2.	Software for Drafting and Modelling	30 No
3.	Laser Printer or Plotter to print / plot drawings	1 No

## Laboratory Course:

<b>22ME211</b>	<b>PRODUCT DEVELOPMENT LAB – 2</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	(Common to all Branches)	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The student batches should study the device/system/component and will do literature review to develop prototype idea. Further at the end of the semester they will make a final presentation to exhibit the conceptual design skills and the process to develop a product.

## OBJECTIVES:

### The Course will enable learners to:

- Use the innovative design methodology to articulate the product concepts.
- Summarize the requisite Engineering Principles for transforming concepts into products.
- Conduct basic tests to extract the qualitative and quantitative performance factors.

## LIST OF EXPERIMENTS:

1. Study of Basic Engineering Design Concepts.
2. Conduct a literature survey on the implementation of the design concepts.
3. Prepare the design concepts for an identified literature gap.
4. Present the Product Idea Presentation – Phase II.

**TOTAL: 30 PERIODS**

## OUTCOMES:

### Upon completion of the course, the students will be able to:

CO1: Understand the working and capacity of various engineering systems.

CO2: Infer the outcomes in the product development process.

CO3: Perform basic engineering and material characterization tests.

CO4: Demonstrate the ability to provide conceptual design strategies for a product.

CO5: Implement the Science, Engineering, Technology and Mathematics (STEM) for product design.

