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

All the Eligible UG Programs are accredited by NBA, New Delhi

B.E. – MECHANICAL ENGINEERING

REGULATIONS–2022

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates will apply the knowledge of Mechanical Engineering Sciences and innovative methods to solve real world Engineering problems.
2. Graduates will have the required attributes for a successful career in Mechanical Engineering and allied fields.
3. Graduates will exhibit the managerial skills with ethical values and team spirit.

PROGRAMOUTCOMES (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. Apply the knowledge of Mechanical Engineering Sciences to design and analyze the products and processes related to Mechanical Engineering systems.
2. Develop the practical knowledge and thorough understanding of the principles involved in different power plants and components.
3. Exhibit the ability to conduct experiments and to infer and interpret the results of the experiments related to mechanical and allied engineering and sciences.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMME OUTCOMES (POs)

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
1	✓	✓	✓	✓	✓					✓	✓	✓
2				✓	✓	✓	✓	✓				
3								✓	✓	✓	✓	✓

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
1	✓	✓	✓	✓	✓	✓						
2			✓	✓	✓	✓	✓	✓	✓			
3							✓	✓	✓	✓	✓	✓

Contribution 1: Reasonable 2: Significant 3: Strong

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REGULATIONS-2022

CHOICE BASED CREDIT SYSTEM

I-VIII SEMESTER CURRICULUM AND SYLLABI

SEMESTER – I								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES WITH LABORATORY COMPONENT								
1	22MA101	Matrices and Calculus	BSC	5	3	0	2	4
2	22PH103	Physics for Mechanical 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	22EE101	Basic Electrical, Electronics and Instrumentation Engineering	ESC	5	3	0	2	4
6	22HS101	Professional Communication	HSMC	4	2	0	2	3
LABORATORY COURSES								
7	22ME111	Product Development Lab - 1	EEC	2	0	0	2	1
MANDATORY COURSES								
8	22CH104	Environmental Sciences and Sustainability (Non Credit)	MC	2	2	0	0	0
9		Induction Program (Non Credit)	MC	3 Weeks				
			TOTAL	**33**	**19**	**0**	**14**	**24**

SEMESTER – II								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22ME201	Engineering Mechanics	ESC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
2	22MA201	Transforms and Numerical Methods	BSC	5	3	0	2	4
3	22CH103	Chemistry for Mechanical Engineering	BSC	5	3	0	2	4
4	22IT203	Data Structures and Algorithms	ESC	5	3	0	2	4
5	22CS202	Java Programming	ESC	5	3	0	2	4
LABORATORY COURSES WITH THEORY COMPONENT								
6	22ME202	Computer Aided Engineering Graphics	ESC	3	1	0	2	2
LABORATORY COURSES								
7	22ME211	Product Development Lab - 2	EEC	2	0	0	2	1
AUDIT COURSES								
8		Yoga for Stress Management	AC	1	1	0	0	0
			TOTAL	**29**	**17**	**0**	**12**	**22**

SEMESTER – III								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1		Mathematics III	BSC	3	3	0	0	3
2	22ME301	Engineering Thermodynamics	PCC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
3	22ME302	Industrial Metallurgy	ESC	4	2	0	2	3
4	22ME303	Manufacturing Processes	PCC	5	3	0	2	4
5	22ME304	Fluid Mechanics and Machinery	PCC	5	3	0	2	4
LABORATORY COURSES								
6		Communication Lab	HSMC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
7		Aptitude and Coding Skills I	EEC	2	0	0	2	1
8		Internship/Seminar*	EEC	2	0	0	2	1
AUDIT COURSES								
9		Value Education (Non Credit)	AC	2	0	0	2	0
			TOTAL	**30**	**14**	**0**	**16**	**21**

*2 weeks for one credit. Internship during 2 Semester Summer Vacation

SEMESTER – IV								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1		Mathematics IV	BSC	3	3	0	0	3
2		Professional Elective I	PEC	3	3	0	0	3
3		UHV II	HSMC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
4	22ME401	Thermal Engineering	PCC	5	3	0	2	4
5	22ME402	Strength of Materials	ESC	5	3	0	2	4
6	22ME403	Digital Manufacturing and Design	PCC	4	2	0	2	3
EMPLOYABILITY ENHANCEMENT COURSES								
7		Aptitude and Coding Skills II	EEC	2	0	0	2	1
8	22ME411	Mini Project	EEC	2	0	0	2	1
AUDIT COURSES								
9		Yoga/Personality	AC	1	0	0	1	0
			TOTAL	**28**	**17**	**0**	**11**	**22**

SEMESTER – V								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22ME501	Design of Machine Elements	PCC	3	3	0	0	3
2		Professional Elective II	PEC	3	3	0	0	3
3		Professional Elective III	PEC	3	3	0	0	3
4		Open Elective I	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
5	22ME502	Mechanics of Machines	PCC	**5**	3	0	2	**4**
6	22ME503	Fundamentals of Product Life Cycle Management	PCC	**5**	3	0	2	**4**
EMPLOYABILITY ENHANCEMENT COURSES								
7		Advanced Aptitude and Coding Skills I	EEC	2	0	0	2	1
8	22ME511	Internship/Seminar*	EEC	2	0	0	2	1
MANDATORY COURSES								
9		Indian Constitution (Non Credit)	MC	2	2	0	0	0
			TOTAL	**28**	**20**	**0**	**8**	**22**

*2 weeks for one credit. Internship during 4 Semester Summer Vacation

SEMESTER – VI								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22ME601	Design of Transmission Systems	PCC	3	3	0	0	3
2		Management Elective	HSMC	3	3	0	0	3
3		Professional Elective IV	PEC	3	3	0	0	3
4		Professional Elective V	PEC	3	3	0	0	3
5		Open Elective II	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
6	22ME602	Heat and Mass Transfer	PCC	5	3	0	2	4
7	22ME603	Advanced Product Life Cycle Management	PCC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
8		Advanced Aptitude and Coding Skills II	EEC	2	0	0	2	1
			TOTAL	**27**	**21**	**0**	**6**	**24**

SEMESTER – VII								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1		Professional Ethics	HSMC	2	2	0	0	2
2		Professional Elective VI	PEC	3	3	0	0	3
3		Open Elective III	OEC	3	3	0	0	3
4		Open Elective IV	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
5	22ME701	Finite Element Analysis	PCC	5	3	0	2	4
6	22ME702	Industrial Automation	PCC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
7	22ME711	Comprehension	EEC	2	0	0	2	1
MANDATORY COURSES								
8		Essence of Indian Knowledge Tradition (Non Credit)	MC	2	2	0	0	0
			TOTAL	**25**	**19**	**0**	**6**	**20**

SEMESTER – VIII								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
EMPLOYABILITY ENHANCEMENT COURSES								
1	22ME811	Project Work	EEC	16	0	0	16	8
			TOTAL	**16**	**0**	**0**	**16**	**8**

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	-	3	2	-	13	7.98
2	BSC	8	8	3	3	-	-	-	-	22	13.50
3	ESC	12	13	3	4	-	-	-	-	32	19.63
4	PCC	-	-	11	7	11	11	8	-	48	29.45
5	PEC	-	-	-	3	6	6	3	-	18	11.04
6	OEC	-	-	-	-	3	3	6	-	12	7.36
7	EEC	1	1	2	2	2	1	1	8	18	11.04
	Total	24	22	21	22	22	24	20	8	163	100

HSMC – Humanities and Social Sciences including Management courses; **BSC** – Basic Science Courses; **ESC** – Engineering Science Courses including workshop, drawing, basics of electrical/mechanical/computer etc.; **PCC**– Professional Core Courses; **PEC** – Professional Elective Courses relevant to chosen specialization/branch; **OEC** – Open Subjects–Electives from other technical and/or emerging subjects **EEC** – Project Work, Seminar and Internship in Industry or elsewhere.

PROFESSIONAL ELECTIVE – I (SEMESTER IV)								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	22ME901	Engineering Metrology and Measurements	PEC	3	3	0	0	3
2	22ME902	Materials for Energy Applications	PEC	3	3	0	0	3
3	22ME903	Composite Materials	PEC	3	3	0	0	3
4	22ME904	Smart Materials and Intelligence Systems	PEC	3	3	0	0	3
5	22ME905	Tool and Die Design	PEC	3	3	0	0	3
6	22ME906	Advanced Welding Processes	PEC	3	3	0	0	3
7	22ME907	Flexible Manufacturing Systems	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – II (SEMESTER V)								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22ME908	Additive Manufacturing	PEC	3	3	0	0	3
2	22ME909	Applied Hydraulics and Pneumatics	PEC	3	3	0	0	3
3	22ME910	Automotive Technology	PEC	3	3	0	0	3
4	22ME911	Optimization Techniques in Engineering	PEC	3	3	0	0	3
5	22ME912	Design of Automotive Systems	PEC	3	3	0	0	3
6	22ME913	Robotic Simulation for Manufacturing	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – III (SEMESTER V)								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22ME914	Renewable Energy Sources	PEC	3	3	0	0	3
2	22ME915	Instrumentation for Thermal Systems	PEC	3	3	0	0	3
3	22ME916	Solar Energy Conversion System	PEC	3	3	0	0	3
4	22ME917	Battery Thermal Management Systems	PEC	3	3	0	0	3
5	22ME918	Gas Dynamics and Jet Propulsion System	PEC	3	3	0	0	3
6	22ME919	Computational Fluid Dynamics	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – IV (SEMESTER VI)								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22ME920	Electric and Hybrid Vehicles	PEC	3	3	0	0	3
2	22ME921	Future Mobility Systems	PEC	3	3	0	0	3
3	22ME922	Fuel Cell Technology	PEC	3	3	0	0	3
4	22ME923	Refrigeration and Air Conditioning	PEC	3	3	0	0	3
5	22ME924	Turbo Machines	PEC	3	3	0	0	3
6	22ME925	Power Plant Engineering	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – V (SEMESTER VI)								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22ME926	Process Planning and Cost Estimation	PEC	3	3	0	0	3
2	22ME927	Advanced Machining Processes	PEC	3	3	0	0	3
3	22ME928	Geometric Modeling and Tolerances	PEC	3	3	0	0	3
4	22ME929	Lean Manufacturing	PEC	3	3	0	0	3
5	22ME930	Smart Factory	PEC	3	3	0	0	3
6	22ME931	Design of Jigs and Fixtures	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – VI (SEMESTER VII)								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22ME932	Testing of Materials	PEC	3	3	0	0	3
2	22ME933	Non Destructive Testing and Evaluation	PEC	3	3	0	0	3
3	22ME934	Entrepreneurship Development	PEC	3	3	0	0	3
4	22ME935	Maintenance Engineering	PEC	3	3	0	0	3
5	22ME936	Industrial Safety Engineering	PEC	3	3	0	0	3
6	22ME937	Engineering Economics and Cost Analysis	PEC	3	3	0	0	3

MANAGEMENT ELECTIVE (SEMESTER VI)								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22ME938	Principles of Management	HSMC	3	3	0	0	3
2	22ME939	Total Quality Management	HSMC	3	3	0	0	3
3	22ME940	Material Management	HSMC	3	3	0	0	3
4	22ME941	Resource Management Techniques	HSMC	3	3	0	0	3
5	22ME942	Enterprise resource planning	HSMC	3	3	0	0	3
6	22ME943	Supply Chain Management	HSMC	3	3	0	0	3
7	22ME944	E - Commerce	HSMC	3	3	0	0	3

OPEN ELECTIVE									
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**	**Syllabus Approved in/Syllabus Incharge**
1		Green Building Design	OEC	3	3	0	0	3	CE
2		Cloud Computing	OEC	3	3	0	0	3	CSE
3		Artificial Intelligence and Expert System	OEC	3	3	0	0	3	CSE
4		Machine Learning	OEC	3	3	0	0	3	CSE
5		Database Management Systems	OEC	3	3	0	0	3	CSE
6		Sensors and Transducers	OEC	3	3	0	0	3	ECE
7		Industrial IoT Applications	OEC	3	3	0	0	3	ECE
8		MATLAB Programming	OEC	3	3	0	0	3	ECE
9		Introduction to Image Processing	OEC	3	3	0	0	3	ECE
10		Arduino for Engineers	OEC	3	3	0	0	3	ECE
11		Electronic Materials	OEC	3	3	0	0	3	ECE
12		Introduction to Embedded System	OEC	3	3	0	0	3	ECE
13		Web Design and Development	OEC	3	3	0	0	3	IT

SYLLABI: SEMESTER I AND II
SEMESTER – I

22MA101	MATRICES AND CALCULUS (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	5

(Common to all Branches except CSBS)

OBJECTIVES:

The Course will enable learners to:

- Explain the concepts of matrix algebra techniques needed for practical applications.
- Determine the curvature of the curves.
- Illustrate the simple applications of multivariable calculus and vector calculus.
- Elaborate the concept and application of multiple integrals.

UNIT I	MATRICES	15

Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

Experiments using SCILAB:

1. Introduction to SCILAB through matrices and general syntax.
2. Finding the Eigenvalues and Eigenvectors.
3. Plotting the graph of a quadratic form.

UNIT II	SINGLE VARIABLE CALCULUS	15

Curvature in Cartesian and Polar Co-ordinates – Centre and radius of curvature – Circle of curvature–Evolutes.

Experiments using SCILAB:

1. Evaluating the radius of curvature.
2. Finding the coordinates of the center of curvature.
3. Tracing of Curves.

UNIT III	MULTI VARIABLE CALCULUS	15

Partial derivatives (excluding Euler's theorem) – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables.

Experiments using SCILAB:

1. Evaluating the maxima of functions of several variables.
2. Evaluating the minima of functions of several variables.
3. Evaluation of Jacobians

UNIT IV	MULTIPLE INTEGRALS	15

Double integrals – Change of order of integration – Area enclosed by plane curves – Triple integrals – Volume of solids.

Experiments using SCILAB:

1. Evaluating area under a curve.
2. Evaluating area using double integral.
3. Evaluation of volume by integrals.

UNIT V	VECTOR CALCULUS	15

Gradient, divergence and curl (excluding vector identities) – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane and Gauss divergence theorem (Statement only) – Simple applications involving cubes and rectangular parallelopipeds.

Experiments using SCILAB:

1. Evaluating gradient.
2. Evaluating directional derivative.
3. Evaluating divergent and curl.

TOTAL: 75 PERIODS

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, 10th Edition, New Delhi, 2016.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:

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

LIST OF EQUIPMENTS:

1. SCILAB : Open Source.

22PH103	PHYSICS FOR MECHANICAL ENGINEERING (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The course will introduce the learners to:

Learn the basic concepts in laser, properties of matter, sensors and transducers, quantum physics and novel materials those are applicable to the students of mechanical engineering.

UNIT I	LASER AND ENGINEERING APPLICATIONS	15

Characteristics of laser - Population of energy levels - Einstein's A and B coefficients derivation - resonant cavity, optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction - Engineering applications – Qualitative industrial applications of lasers: Material processing–laser welding, drilling, cutting and heat treatment.

List of Exercise/Experiments

1.Determination of wavelength of laser source using grating
2.Determination of divergence of laser beam

UNIT II	PROPERTIES OF MATTER	15

Elasticity- Hooke's law -Relationship between three modulii of elasticity (qualitative) - Factors affecting elasticity, Torsional pendulum: theory and experiment - Bending moment - Depression of a cantilever - theory and experiment, Young's modulus by uniform bending - theory and experiment- I-shaped girders.

List of Exercise/Experiments

1.Determination of rigidity modulus of wire and moment of inertia of the disc by torsional pendulum.
2.Determination of Young's modulus of a beam by uniform bending method.

UNIT III	SENSORS AND TRANSDUCERS	15

Introduction – Sensor, Transducer and Actuators - Basic requirements of sensor/transducer - Classification of sensors/transducers – Mechanical sensor – Optical sensor - Thermal sensor – Biosensor.

List of Exercise/Experiments

1.Determination of wavelength of an ultrasonic wave in a liquid using ultrasonic transducer
2.Determination of strains using strain gauge.

UNIT IV	QUANTUM PHYSICS	15

Quantum theory of black body radiation – Planck's theory – Heisenberg's uncertainty principle - significance of wave function - Schrödinger's wave equation – time independent and time dependent wave equations – Application to particle in a one-dimensional box – Particle in an infinite potential well – Normalization - Quantum tunneling.

List of Exercise/Experiments

1. Determination of Planck's constant
2. Determination of Stefan's constant

UNIT V	NANO AND NOVEL ENGINEERING MATERIALS	15

Nanomaterials - properties and applications – Shape memory alloys: phases, shape memory effect, pseudo elastic effect, properties and applications - Metallic glasses: types, preparation - melt spinning process, properties and applications - Ceramics: types and applications - Composites: classification, role of matrix and reinforcement, processing of fibre reinforced plastics.

List of Exercise/Experiments

1.Synthesis of nanoparticles by sol-gel method
2.Determination of particle size using laser diffraction

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 to material processing

CO2: Comprehend the mechanical properties of matter and its measurement techniques

CO3: Describe the principles of working of various sensors and transducers

CO4: Explain the fundamentals of quantum mechanics and applications of Schrodinger's equations.

CO5: Understand the basic properties of various materials and apply those knowledge on various applications thereby help in finding the solution for specific needs by design.

TEXTBOOKS:

1. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, 2014.
2. V. Rajendran, Materials Science, Tata McGraw-Hill, 2011.
3. Sawney A K and PuneetSawney, A Course in Mechanical Measurements and Instrumentation and Control, Dhanpat Rai and Co, New Delhi, 12th edition, 2013.

REFERENCES:

1. Richard P. Feynman, The Feynman Lectures on Physics - Vol. I, II and III: The New Millennium Edition, 2012.
2. M.A. Wahab, Solid State Physics, Narosa Publishing House Pvt. Ltd., 3rd Edition, 2015
3. B.B. Laud, Lasers and Non Linear Optics, New Age International Publishers, 3rd Edition, 2011

LIST OF EQUIPMENTS:

1. Semiconductor laser
2. Torsional Pendulum apparatus
3. Young's modulus by Uniform bending apparatus
4. Ultrasonic interferometer set-up
5. Strain gauge set-up
6. Planck's constant set-up
7. Sol-gel synthesis

22CS101	PROBLEM SOLVING USING C++ (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

(Common to All Branches)

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
   b) 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++”, 5th Edition, Jones and Barklett 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

LIST OF EQUIPMENTS:

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

22CS102	SOFTWARE DEVELOPMENT PRACTICES (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

(Common to All Branches)

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.

UNIT II	HTML	15

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and datalist Elements – Page-Structure Elements.

List of Exercise/Experiments:

1. Create web pages using the following:
   - Tables and Lists
   - Image map
   - Forms and Form elements
   - Frames

UNIT III	CSS	15

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients – Multiple Background Images – Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module – Multicolumn Layout.

List of Exercise/Experiments:

1. Apply Cascading style sheets for the web pages created.

UNIT IV	JAVASCRIPT BASICS	15

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

List of Exercise/Experiments:

1. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.

UNIT V	JAVASCRIPT OBJECTS	15

Objects – Math, String, and Date, Boolean and Number, document Object – Using JSON to Represent objects – DOM: Objects and Collections – Event Handling.

List of Exercise/Experiments:

1. Implement Event Handling in the web pages.

Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.

a. Online assessment system
b. Ticket reservation system
c. Online shopping
d. Student management system
e. Student result management system
f. Library management
g. Hospital management
h. Attendance management system
i. Examination automation system
j. Web based chat application

TOTAL: 75 PERIODS

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, Nineth 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, 1 st 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
7. https://infyspringboard.onwingspan.com/web/en/app/ toc/lex_auth_013094421427470336209 9_shared/overview

LIST OF EQUIPMENTS:

Systems with either Netbeans or Eclipse
Java/JSP/ISP Webserver/Apache
Tomcat / MySQL / Dreamweaver or
Equivalent/ Eclipse, WAMP/XAMP

22EE101	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	L	T	P	C
		3	0	2	4

(Theory Course with Laboratory Component)

(Common to Civil Engineering and Mechanical Engineering)

OBJECTIVES:

The Course will enable learners to:

- To impart basics of DC and AC electrical circuits
- To understand principle of operation of electrical machines
- To comprehend operation of electron devices
- To understand design concepts of digital circuits
- To study working principle of measuring instruments and transducers

UNIT I	ELECTRIC CIRCUITS	15

Basics of electric circuits-nodal analysis, mesh analysis- introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits.

List of Experiments

1. Simulation of the given circuit and experimental validation of the same using mesh and nodal analysis
2. Simulation and experimental validation of power consumed by the given three phase balanced star and delta connected loads.

UNIT II	ELECTRICAL MACHINES	15

Principles of operation of: DC machines, transformers (single and three phase), synchronous machines, three phase and single-phase induction motors.

List of Experiments

1. Load test on DC Shunt, Series motor, Compound motor and Induction motor
2. Load test on Single Phase Transformer

UNIT III	ELECTRONIC DEVICES AND CIRCUITS	15

Diodes-half wave and full wave rectifiers-voltage regulation-bipolar junction transistor – characteristics – field effect transistors –introduction to operational amplifier –inverting amplifier –non inverting amplifier.

List of Experiments

1. Characteristics of a NPN Transistor under common emitter, common collector, and common base configurations
2. Characteristics of operational amplifier as inverting and non-inverting amplifier

UNIT IV	DIGITAL ELECTRONICS	15

Binary number system-Boolean algebra theorems- digital circuits-introduction to sequential circuits-flip flops- shift registers and counters- ADC-DAC.

List of Experiments

1. Implementation of Boolean functions.
2. Implementation of adder and subtractor circuits.

UNIT V	MEASUREMENTS & INSTRUMENTATION	15

Introduction to transducers - classification of transducers: resistive, inductive, capacitive, thermoelectric, piezoelectric, photoelectric, Hall effect and mechanical-classification of instruments - types of indicating instruments – moving coil and moving iron –oscilloscopes.

List of Experiments

1. Study of dynamics of sensors/ transducers: (a) Temperature (b) Pressure (c) Displacement (d) Optical (e) Strain (f) Flow
2. Study of CRO and measurement of RMS voltage, frequency and power factor.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Understand concept of DC and AC electric circuits.
CO2: Identify appropriate machine for a given application.
CO3: Understand the working of electron devices.
CO4: Demonstrate the concept of digital logic circuits.
CO5: Choose appropriate transducers for specific application.
CO6: Choose appropriate instruments for given application.

TEXTBOOKS:

1. S.K. Bhattacharya, "Basic Electrical & Electronics Engineering", Pearson Education, second edition, 2019.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 5th Edition, 2017.
3. M. Morris Mano, Micheal D.Ciletti , ‘Digital Design :With an introduction to the Verilog HDL,VHDL and System Verilog’,6th Edition, Pearson Education,2018.
4. Robert Boylestad and Lowis Nashelsky, “Electronic Devices and Circuit Theory”, eleventh edition, Pearson Education, 2019.
5. J. B. Gupta, ‘A Course in Electronic and Electrical Measurements’, S. K. Kataria& Sons, Delhi, 2016.

REFERENCES:

1. Del Toro, Electrical Engineering Fundamentals, Pearson Education, New Delhi, second edition, 2014.
2. Floyd and Jain, Digital Fundamentals, 8th edition, Pearson Education, tenth edition, 2017.
3. Allan S Moris, Measurement and Instrumentation Principles, Elsevier, First Indian Edition, 2006
4. David A. Bell, Electronic Devices and Circuits, 5th Edition, Prentice Hall India, fifth edition, 2017.
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, Basic Electrical Engineering, McGraw Hill Education (India) Private Limited, 2009
6. N K De, Dipu Sarkar, Basic Electrical Engineering‖, Universities Press (India) Private Limited, 2016.
7. P. S. Bimbhra, Electric Machines, Khanna Publishers, 2nd Edition, 2017.

LIST OF EQUIPMENTS:			
S.No	**Name of the Equipment**	**Range**	**Quantity**
1	DC Shunt Motor with Loading Arrangement	5 H.P,220V	2
2	Single Phase Autotransformer	1 KVA, 0 to 270 V	3
3	Single Phase Transformer	1KVA, 230 / 115 V	3
4	Personal Computer with MATAB	-	5
5	Transistors, Logic Gates, Op-Amp		30
6	Dual Regulated Power Supply /Regulated Power Supply	0-30 V	5
7	Ammeter	0-10 A MI	4
		0-10 A MC	2
		0-2 A MC	2
		0-10 mA MC	10
		0-15 mA MC	10
		0-30 mA MC	10
8	Voltmeter	0-150/300 V MI	4
		0-300 V MC	2
		0-10 V MC	5
		0-300 V MI	5
		0-30 V MC	10
9	Wattmeter	300 V, 5/10 A, UPF	4
10	Resistive Load	-	2
11	Decade Resistance Box	-	2
12	Breadboard	-	10
13	Resistor of various ranges	-	Required No’s
14	Multimeter	-	5

22HS101	PROFESSIONAL COMMUNICATION (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

(Common to All Branches)

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. (Theory 6)

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. (Laboratory 6)

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. (Theory 6)

List of Exercise/Experiments

1. Communication Etiquettes.
2. Self -Introduction using SWOT Analysis. (Laboratory 6)

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. (Theory 6)

List of Exercise/Experiments

1. Mechanics of Reading Skills.
2. News Reading–Cloze Tests. (Laboratory 6)

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. (Theory 6)

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. (Laboratory 6)

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. (Theory 6)

List of Exercise/Experiments

1. Writing based on listening to academic lectures and discussions.
2. Leadership skills, Negotiation skills.
3. Mechanics of Report Writing. (Laboratory 6)

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.

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

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

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

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 21st 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,2nd edition, 2021.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, 1st edition, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 3rd edition, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Universities Press(I) Pvt. Ltd., Hyderabad, 3rd Edition, 2021.

REFERENCES:

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

SEMESTER – II

22ME201	ENGINEERING MECHANICS (Common to B.E. – CE and ME)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.
- make the students understand the scalar representation of forces and moments and the static equilibrium of particles and rigid bodies.
- make the students understand the properties of surfaces and solids.
- develop capacity to predict the behaviour of particles under motion.
- understand the effect of friction on equilibrium, laws of motion and their interrelationship.

UNIT I	STATICS OF PARTICLES	9

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces - Coplanar Forces – rectangular components – Equilibrium of a particle – Equivalent systems of forces – Principle of transmissibility.

UNIT II	EQUILIBRIUM OF RIGID BODIES	9

Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions.

UNIT III	PROPERTIES OF SURFACES AND SOLIDS	9

Centroids and Centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section, Composite section by using standard formula -Parallel axis theorem and perpendicular axis theorem - moment of inertia of planes – Rectangular, circular, triangular areas, T section & I section by using standard formula – Product Moment of Inertia.

UNIT IV	DYNAMICS OF PARTICLES	9

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V	FRICTION	9

Friction: Types of friction, Limiting friction, Laws of friction – Static and Dynamic Friction; Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction – ladder friction – Belt friction – Rolling friction.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1: Illustrate the scalar representation of forces and moments

CO2: Analyze the rigid body in equilibrium

CO3: Evaluate the properties of surfaces and solids

CO4: Apply dynamic forces exerted in the bodies under motion

CO5: Solve the friction and the effects by the laws of friction

CO6: Apply the effort of forces and moments in the various design functions.

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 12th Edition, Tata McGraw-Hill Publishing company, New Delhi (2019).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2019)

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 2019.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 14th Edition, Pearson Education 2017.
3. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", 8th Edition, John Wiley & Sons,2018.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2017.

22MA201	TRANSFORMS AND NUMERICAL METHODS (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	5

(Common to All Branches except CSBS)

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, 7th Edition, 2009.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES:

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

LIST OF EQUIPMENTS:

1. **SCILAB : Open Source**

22CH103	CHEMISTRY FOR MECHANICAL ENGINEERING (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand the water quality criteria and water treatment methods.
- To gain insights on the basic concepts of electrochemistry and its applications.
- To gain knowledge on different types of fuels and combustion process.
- To comprehend the relevance of engineering materials and its applications.
- To understand concepts of phase rule, and its significance in alloys.

UNIT I	WATER TECHNOLOGY	15

Sources of water – Impurities - Drinking water quality parameters – Hardness and its types, problems - Boiler troubles - Scales and sludges, priming and foaming, boiler corrosion and caustic embrittlement, Boiler feed water: Requirements - Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning), 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.

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 – 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_2 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	FUELS AND COMBUSTION	15

Introduction - Classification of fuels - coal - analysis of coal (proximate and ultimate), carbonization, manufacture of metallurgical coke (Otto Hoffmann method) — petroleum - manufacture of synthetic petrol (fixed bed catalytic cracking, Bergius) - power alcohol —Biodiesel - knocking - octane number, cetane number - Gaseous fuels – natural gas, CNG, LPG.

Combustion - Calorific value - higher and lower calorific values (problems) - ignition temperature - spontaneous ignition temperature - explosive range - Flue gas analysis (ORSAT method).

List of Experiments

1. Preparation of bio diesel from used vegetable oil.
2. Theoretical air calculation for solid fuel (weight basis)
3. Theoretical air calculation for air fuel (volume basis)

UNIT IV	ENGINEERING MATERIALS	15

Lubricants - Characteristics of lubricants - viscosity, viscosity index, oiliness, flash point and fire point, cloud point and pour point - additives to lubricants- semi-solid (grease) - solid lubricant (graphite).

Refractories - Characteristics-classification- properties – Refractoriness, RUL, dimensional stability, thermal spalling, thermal expansion, porosity- manufacture of refractories (generalmethod).

Composites – Characteristics — Constituents of composites — types — polymer matrix composites (PMC), metal matrix composites (MMC), ceramic matrix composites (CMC) –FRP -properties and applications.

List of Experiments

1. Determination of flash and fire point of a lubricating oil (Pensky Martens apparatus)
2. Determination of cloud and pour point of a lubricating oil.

UNIT V	PHASE RULE AND ALLOYS	15

Phase rule – terminology **–** phase, component, degree of freedom - One component system (water system) **—** Two component system - Reduced phase rule- Thermal analysis and cooling curves - Simple eutectic (lead-silver system).

Alloys: Properties of alloys- Significance of alloying- ferrous alloys (stainless steel and carbon steels) - non-ferrous alloys (brass and bronze) - Heat treatment of steel - Special alloys (smart alloys, shape memory alloys).

List of Experiments

1. Estimation of the amount of copper in brass by EDTA method.
2. Study of phase change (Virtual lab)

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Analyze water quality parameters and suggest appropriate water treatment methods.

CO2: Construct electrochemical cells and sensors.

CO3: Investigate the types of fuel and combustion process.

CO4: Evaluate the importance of engineering materials.

CO5: Assess phase equilibrium diagram and alloys.

TEXT BOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 17th Edition, 2022.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd reprint, 2012.

REFERENCES:

1. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry",S. Chand & Company, New Delhi, 12thEdition, 2013.
2. J. C. Kuriacose and J. Rajaram, "Chemistry in Engineering and Technology", Volume -1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.
3. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, "Vogel's Quantitative Chemical Analysis", Pearson Education Pvt. Ltd., 6th edition, 2019.

LIST OF EQUIPMENTS:

1. Conductivity meter
2. pH meter
3. Pensky Martens apparatus
4. Cloud and Pour point apparatus

22IT203	DATA STRUCTURES AND ALGORITHMS (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand the concepts of linear structures ADTs.
- To gain the knowledge of searching and sorting algorithms.
- To learn hashing algorithms and its applications.
- To understand the tree data structures.
- To understand graph structures.

UNIT I	LINEAR DATA STRUCTURES	9+6

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation - circular linked list implementation - Double linked list implementation - Applications of linked lists. Stack: Operations, array and linked representations of stacks, stack applications. Queues: Operations, array and linked representations of Queue, Queue applications.

List of Exercise/Experiments

1. Implementation of Singly, Doubly and Circular Linked List
2. Implementation of Stack using Arrays and Linked List
3. Implementation of Stack applications
4. Implementation of Queue using Arrays and Linked List
5. Implementation of Queue applications

UNIT II	SEARCHING AND SORTING ALGORITHMS	9+6

Searching: Linear and binary search, Sorting: Bubble sort, Insertion sort - Selection sort - Quick sort – Merge sort.

List of Exercise/Experiments

1. Implementation of sorting algorithms

UNIT III	TREES	9+6

Trees: Binary Tree - Terminology and Properties - Binary Search Tree - Insertion, Deletion, Traversal – In order, Preorder and Post order, Level order traversal, finding min and max, finding the kth minimum element in a BST

List of Exercise/Experiments

1. Implementation of Binary Search Tree

UNIT IV	GRAPHS	9+6

Graphs – Representation - Traversal - BFS and DFS,Graph Algorithms: Minimum spanning Tree-Prims and Kruskal's, Shortest path algorithm - Dijkstra, Floyd and Warshall – Backtracking

List of Exercise/Experiments

1. Implementation of Graph Traversal algorithms
2. Implementation of Minimum spanning tree algorithms

UNIT V	HEAPS AND HASHING	9+6

Heaps and Hashing - Implementation of Heaps, Binary Heap, Heap sort - Applications - Hash functions, open hashing-separate chaining, closed hashing - linear probing, quadratic probing, double hashing, random probing, rehashing

List of Exercise/Experiments

1. Implementation of Hashing techniques
2. Implementation of Heap

TOTAL:45+30=75 PERIODS

OUTCOMES:

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

CO1: Understand the concepts of basic data structures such as array and linked list.

CO2: Applying a suitable algorithm for searching and sorting.

CO3: Analyze the various tree algorithms for solving real time computing problems.

CO4: Understanding graph algorithms, operations, and applications

CO5: Understanding the importance of hashing

TEXTBOOKS:

1. Thomas H. Cormen, C.E. Leiserson, R L. Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.
2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd edition, Pearson Education, 2021

REFERENCES:

1. Kurt Mehlhorn, and Peter Sanders – Algorithms and Data Structures - The Basic Toolbox, Springer - Verlag Berlin Heidelberg, 2008.
2. Debasis Samanta, "Classic Data Structures", Prentice Hall of India, 2nd edition, 2014.

LIST OF EQUIPMENTS:

2. Systems with Linux Operating System and GNU Compiler

22CS202	JAVA PROGRAMMING (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

(Common to CSE, CSD, EEE, ECE, ME, IT, ADS and CSBS)

OBJECTIVES:

The Course will enable learners to:

- To explain object oriented programming concepts and fundamentals of Java
- To apply the principles of packages, interfaces and exceptions
- To develop a Java application with I/O streams, threads and generic programming
- To build applications using strings and collections.
- To apply the JDBC concepts

UNIT I	JAVA FUNDAMENTALS	15

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – this keyword - Overloading methods - Overloading constructors - Access Control – Static – Final.

List of Exercise/Experiments:

1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff

   If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   First 100 units - Rs. 1 per unit
   101-200 units - Rs. 2.50 per unit
   201 -500 units - Rs. 4 per unit
   > 501 units - Rs. 6 per unit
   If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   First 100 units - Rs. 2 per unit
   101-200 units - Rs. 4.50 per unit
   201 -500 units - Rs. 6 per unit
   > 501 units - Rs. 7 per unit

2. Arrays Manipulations: (Use Methods for implementing these in a Class)
   a. Find k^{th} smallest element in an unsorted array
   b. Find the sub array with given sum
   c. Matrix manipulations – Addition, Subtraction, Multiplication
   d. Remove duplicate elements in an Array
   e. Accept an integer value N and print the N^{th} digit in the integer sequence 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.

   Example: The 11th digit in the sequence 12345678910111213…. is 0.

UNIT II	INHERITANCE, INTERFACES AND EXCEPTION HANDLING	15

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

List of Exercise/Experiments:

1. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member 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 Numberofsides() 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 andgenerics programming.
CO4: Apply strings and collections in developing applications.
CO5: Implement the concepts of JDBC.

TEXT BOOK:

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

REFERENCES:

1. Cay S. Horstmann, Gary Cornell, “Core Java Volume – I Fundamentals”, 11th 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

LIST OF EQUIPMENTS:

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

22ME202	COMPUTER AIDED ENGINEERING GRAPHICS (Laboratory Course with Theory Component)	L	T	P	C
		1	0	2	2

(Common to CE, CSE, CSD, ECE, EEE, ME, IT and ADS)

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.
2. Drafting of Conic curves - Ellipse, Parabola and Hyperbola.

UNIT II	ORTHOGRAPHIC PROJECTION (3+6)

Visualization concepts and Orthographic Projection - Layout of views – Orthographic Projection- Conversion of pictorial diagram into orthographic views.

List of Exercise/Experiments

1. Drawing orthographic view of simple solids like Prism, Pyramids, Cylinder, Cone, etc, and dimensioning.
2. Drawing of orthographic views from the given pictorial diagram.

UNIT III	PROJECTION OF PLANES (3+6)

Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method.

List of Exercise/Experiments

1. Drawing of plane Surface inclined to HP.
2. Drawing of plane Surface inclined to VP.

UNIT IV	PROJECTION OF SOLIDS (3+6)

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis is inclined to HP by rotating object method.

List of Exercise/Experiments

1. Drawing of simple solids like prism and pyramids when the axis is inclined to HP.
2. Drawing of simple solids like cylinder and cone when the axis is inclined to HP.

UNIT V	ISOMETRIC DRAWING	(3+6)

Principles of isometric view – Isometric view of simple solids – Prism, Pyramid, Cylinder and Cone.

List of Exercise/Experiments

1. Drawing isometric projection of simple solids.
2. Modeling of 2D to 3D objects using drafting software.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1: Explain the various engineering standards required for drafting and explore knowledge in conic sections.
CO2: Draw the orthographic views of 3Dprimitive objects.
CO3: Describe the projection of plane surfaces by the rotating plane method.
CO4: Apply the projection concepts and drafting tools to draw projections of solids.
CO5: Sketch the pictorial views of the objects using CAD tools.

TEXT BOOKS:

1. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 33rd Edition, 2020.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 15th Edition, 2019.

REFERENCES:

1. Bhatt N.D. “Engineering Drawing”, Charotar Publishing House, 53rd edition , 2019.
2. BasantAgarwal 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

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

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.