



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



Approved by AICTE, Recognized by UGC & Affiliated to Anna University
Accredited by NBA-AICTE, NAAC-UGC with 'A++' Grade
Saravanampatti, Coimbatore – 641035.

**REGULATION 2023
CURRICULAM AND SYLLABI
CHOICE BASED CREDIT SYSTEM**

**DEPARTMENT OF MECHATRONICS
ENGINEERING**

B.E.–MECHATRONICS ENGINEERING



SNS COLLEGE OF TECHNOLOGY

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Coimbatore- 35

DEPARTMENT OF MECHATRONICS ENGINEERING



VISION

The Mechatronics Engineering Department aspires to impart knowledge, enhance creativity and confidence to make the graduates globally evolve as entrepreneurs, researchers, academicians and technocrats for the prosperity of the society.

MISSION

- To impart goal oriented, quality based and value added education in Mechatronics Engineering.
- To establish state-of-the-art laboratories to enhance practical knowledge in Mechatronics and Robotics to meet the needs of society and industry.
- To inculcate communication, leadership and entrepreneurship skills among the students for the sustained growth.
- To create centre of excellence in Mechatronics in rendering the support for technical needs.
- To imbibe social and ethical values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- PEO 1:** Graduates will possess requisite skill to solve the complex technical problems.
- PEO 2:** Graduates will have the capability to use modern engineering tools for product development and deployment.
- PEO 3:** Graduates will strive towards research and engage in lifelong learning for the career development leading to overall societal benefits.
- PEO 4:** Graduates will be able to lead a team with the qualities of professional, social and ethical responsibilities.

PROGRAMME OUTCOMES (PO)

At the end of the program, graduate will be able to:

PO-a	Engineering Knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO-b	Problem Analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO-c	Design/ Development of solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO-d	Conduct Investigations of complex problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO-e	Engineering Tool usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO-f	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO-g	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO-h	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO-i	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO-j	Project management and finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO-1	Life-long learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging and iii) critical thinking in the broadest context of technological change. (WK8) technologies

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the end of this program, graduate will be able to:

PSO 1: Recognize and apply the recent technological advancements for developing Mechatronics products to cater the global needs.

PSO 2: Automate and maintain the mechanical systems by using electrical and electronic devices as well as computational tools.



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 COIMBATORE-35
 DEPARTMENT OF MECHATRONICS ENGINEERING
R 2023 – SUGGESTED CURRICULUM
B.E – MECHATRONICS ENGINEERING



Description / Semester	AICTE	SNSCT – Suggested	Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8
Humanity, Social Science & Mandatory (HSMC)	12	11	3	4	2				2	
Basic Science (BSC)	25	29	8	11	5	5				
Engineering Sciences (ESC)	24	21.5	8	8	2	3.5				
Programme Core (PCC)	48	53.5			12	10.5	13	12	6	
Programme Elective (PEC)	18	15					3	3	3	6
Open Elective (OEC)	18	9					3	3	3	
Project/Seminar/Internship (EEC)	15	30	3	1	1	3	5	3	2	12
Mandatory Courses (MC)	(Non-Credit)									
TOTAL	160	169	22	24	22	22	24	21	16	18

SEMESTER I									
S.No.	CourseCode	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category
Theory Courses									
1.	23MAT101	Matrices and Calculus	3	1	0	4	4	40/60	BSC
2.	23PYT101	Engineering Physics	3	0	0	3	3	40/60	BSC
3.	23MET101	Engineering Mechanics	3	0	0	3	3	40/60	ESC
4.	23EET101	Basics Electrical and Electronics Engineering	3	0	0	3	3	40/60	ESC
5.	23GET103	Heritage of Tamils	1	0	0	1	1	40/60	HSMC
Theory Integrated Practical Courses									
6.	23GEB101	Design Thinking and Innovation	1	0	4	5	3	50/50	EEC
Practical Courses									
7.	23PYP101	Physics Laboratory	0	0	2	2	1	60/40	BSC
8.	23ENP101	Professional Communication	0	0	4	4	2	60/40	HSMC
9.	23GEP101	Workshop Practices	0	0	4	4	2	60/40	ESC
(Non Credit) -Mandatory Course									
10.	23CHT103	Environmental Science and Sustainability	2	0	0	2	0	100/0	MC
Total			16/1/14			31	22		

SEMESTER II									
SNo.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category
Theory Courses									
1.	23MAT102	Complex Analysis and Laplace Transforms	3	1	0	4	4	40/60	BSC
2.	23CHT102	Chemistry of Engineering Materials	3	0	0	3	3	40/60	BSC
3.	23ENT101	Communicative English	3	0	0	3	3	40/60	HSMC
4.	23ITT101	Programming In C And Data Structures	3	0	0	3	3	40/60	ESC
5.	23MET102	Engineering Drawing	1	0	4	5	3	40/60	ESC
6.	23MCT101	Engineering Materials	3	0	0	3	3	40/60	BSC
7.	23GET104	Tamils & Technology	1	0	0	1	1	40/60	HSMC
Practical courses									
8.	23CHP101	Chemistry Laboratory	0	0	2	2	1	60/40	BSC
9.	23ITP101	Programming In C And Data Structures Laboratory	0	0	4	4	2	60/40	ESC
10.	23MCP101	Internship-I	2 Weeks			-	1	100/0	EEC
(Non Credit)-Mandatory Course									
11.	23HST103	Indian Constitution	2	0	0	2	0	100/0	MC
Total			19/1/10			30	24		

SEMESTER III										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Pre-Requisites
Theory Courses										
1.	23MAT201	Partial Differential Equations and Transforms	3	0	0	3	3	40/60	BSC	23MAT101 23MAT102
2.	23MCT201	Solid Mechanics	3	0	0	3	3	40/60	PCC	
3.	23MCT202	Design of Digital Circuits	3	0	0	3	3	40/60	PCC	
4.	23MCT203	Production Technology	3	0	0	3	3	40/60	PCC	
5.	23MCT204	Theory of Control Engineering	3	0	0	3	3	40/60	PCC	
6.	23GET275	VQAR-I	2	0	0	2	2	40/60	BSC	
Theory Integrated Practical Courses										
7.		Language Elective	1	0	2	3	2	50/50	HSMC	
Practical Courses										
8.	23ITP204	Programming in Python	0	0	4	4	2	60/40	ESC	
9.	23MCP201	Mini Project - I	0	0	2	2	1	100/0	EEC	
		Total	18/0/8			26	22			

SEMESTER IV										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Pre-Requisites
Theory Courses										
1.	23MAT205	Probability, Statistics & Numerical Methods	3	0	0	3	3	40/60	BSC	23MAT201
2.	23MCT205	Mechanics of Machines	3	0	0	3	3	40/60	PCC	
3.	23MCT206	Electrical Drives and control	2	0	0	2	2	40/60	ESC	
4.	23CST205	Object Oriented Programming Using JAVA	3	0	0	3	3	40/60	PCC	
5.	23GET276	VQAR-II	2	0	0	2	2	40/60	BSC	23GET275
Theory Integrated Practical Courses										
6.	23MCB201	Fluid Mechanics and Thermal System	2	0	2	4	3	50/50	PCC	
Practical Courses										
7.	23MCP202	Electrical Machines and Drives Laboratory	0	0	3	3	1.5	60/40	ESC	
8.	23CSP205	Object Oriented Programming Using JAVA Laboratory	0	0	3	3	1.5	60/40	PCC	
9.	23GEP275	Personal Branding	0	0	4	4	2	60/40	EEC	
10.	23MCP203	Internship-II	2 Weeks				1	100/0	EEC	
		Total	15/0/12			27	22			

SEMESTER V										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Pre-Requisites
Theory Courses										
1.	23MCT301	Embedded Systems and Programming	2	0	0	2	2	40/60	PCC	23MCT201
2.	23MCT302	Machine Design	3	0	0	3	3	40/60	PCC	
3.	23MCT303	Industrial Electronics	3	0	0	3	3	40/60	PCC	23MCB201
4.		Professional Elective - I	3	0	0	3	3	40/60	PEC	
5.		Open Elective - I	3	0	0	3	3	40/60	OEC	
Theory Integrated Practical Courses										
6.	23MCB301	Integrated Automation	2	0	2	4	3	50/50	PCC	
7.		Career Course -I	2	0	4	6	4	50/50	EEC	
Practical Courses										
8.	23MCP301	Embedded Systems and Programming Laboratory	0	0	4	4	2	60/40	PCC	
9.	23MCP302	Mini Project – II	0	0	2	2	1	100/0	EEC	
		Total	18/0/1 2			30	24			

SEMESTER VI										
S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Pre-Requisites
Theory Courses										
1.	23MCT304	Sensors and Instrumentation	2	0	0	2	2	40/60	PCC	
2.	23MCT305	Data Analytics in Automation systems	3	0	0	3	3	40/60	PCC	
3.	23MCT306	Advanced manufacturing system	2	0	0	2	2	40/60	PCC	
4.		Professional Elective - II	3	0	0	3	3	40/60	PEC	
5.		Open Elective - II	3	0	0	3	3	40/60	OEC	
Theory Integrated Practical Courses										
6.	23MCB302	Fluid Power Systems and Industrial Automation	2	0	2	4	3	50/50	PCC	
7.		Career Course -II	1	0	2	3	2	50/50	EEC	
Practical Courses										
8.	23MCP304	Sensors and Instrumentation Laboratory	0	0	4	4	2	60/40	PCC	
9.	23MCP303	Internship-III	2 Weeks				1	100/0	EEC	
(Non Credit)-Mandatory Course										
10.	23HST105	Essence of Indian Traditional Knowledge	2	0	0	2	0	100/0	MC	
		Total	18/0/8			26	21			

SEMESTER VII

S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Pre-Requisites
Theory Courses										
1.	23MCT401	Applied Mechatronics Engineering	3	0	0	3	3	40/60	PCC	
2.	23GET401	Universal Human Values	2	0	0	2	2	40/60	HSMC	
3.		Professional Elective - III	3	0	0	3	3	40/60	PEC	
4.		Open Elective - III	3	0	0	3	3	40/60	OEC	
Theory Integrated Practical Courses										
5.	23MCB401	Robotics and Machine Vision System	2	0	2	4	3	50/50	PCC	
Practical courses										
6.	23MCP401	Project - I	0	0	4	4	2	60/40	EEC	
Total			13/0/6			19	16			

SEMESTER VIII

S No.	Course Code	Course	L	T	P	Contact hrs/week	Credit	Int/Ext	Category	Pre-Requisites
Theory Courses										
1.		Professional Elective - IV	3	0	0	3	3	40/60	PEC	
2.		Professional Elective - V	3	0	0	3	3	40/60	PEC	
Practical courses										
3.	23MCP402	Project - II	0	0	24	24	12	60/40	EEC	
Total			6/0/24			30	18			

OPEN ELECTIVES

S.No	Course Code	Courses offered	L	T	P	C
1.	23MCO301	Introduction of Robotics	3	0	0	3
2.	23MCO302	Introduction to PLC Programming	3	0	0	3
3.	23MCO303	Industrial Automation Systems	3	0	0	3
4.	23MCO304	Introduction to Mechatronics Engineering	3	0	0	3
5.	23MCO305	Mobile Robotics	3	0	0	3

LANGUAGE ELECTIVES

S.No	Course Code	Courses Offered	L	T	P	C
1	23GEB202	HINDI	1	0	2	2
2	23GEB203	JAPANESE	1	0	2	2
3	23GEB204	GERMAN	1	0	2	2
4	23GEB205	FRENCH	1	0	2	2

PROFESSIONAL ELECTIVES

S. No	Course Code	Courses Offered	L	T	P	C
Professional Elective - I						
1.	23MEE305	Principles of Management	3	0	0	3
2.	23MCE301	Micro-robotics	3	0	0	3
3.	23MCE302	Applied Signal Processing	3	0	0	3
4.	23MCE303	Drone Technologies	3	0	0	3
5.	23MCE304	Humanoid Robotics	3	0	0	3
6.	23MCE305	Micro Electro Mechanical Systems	3	0	0	3
Professional Elective – II						
1.		Total Quality Management	3	0	0	3
2.	23MCE306	Computer Integrated Manufacturing	3	0	0	3
3.	23MCE307	Robot and Machine Elements Design	3	0	0	3
4.	23MCE308	Electronics Manufacturing Technology	3	0	0	3
5.	23MCE309	Computer Aided Inspection and Testing	3	0	0	3
6.	23MCE310	CNC Machine Tools and Programming	3	0	0	3
Professional Elective – III						
1.	23MCE401	Electric and Hybrid Vehicles	3	0	0	3
2.	23MCE402	Automotive Mechatronics	3	0	0	3
3.	23MCE403	Biology for Mechatronics Engineering	3	0	0	3
4.	23MCE404	Aircraft Mechatronics	3	0	0	3
5.	23MCE405	Smart mobility and Intelligent Vehicles	3	0	0	3
6.	23MCE406	Advanced Driver Assistance Systems	3	0	0	3
Professional Elective – IV						
1.	23MCE407	Reliability and Maintenance Engineering	3	0	0	3
2.	23MCE408	Machine Learning for Intelligent Systems	3	0	0	3
3.	23MCE409	Condition Monitoring and Fault Diagnostics	3	0	0	3

4.	23MCE410	Immersive Technologies and Haptics	3	0	0	3
5.	23MCE411	Industrial Safety	3	0	0	3
6.	23MCE412	Systems Modelling and Simulation Methods	3	0	0	3
Professional Elective – V						
1.		Engineering Economics and Cost Analysis	3	0	0	3
2.	23MCE413	Computer Architecture and Organisation	3	0	0	3
3.	23MCE414	Virtual Instrumentation	3	0	0	3
4.	23MCE415	Industrial Network Protocols	3	0	0	3
5.	23MCE416	Motion Control System	3	0	0	3
6.	23MCE417	Digital Twin and Industry 5.0	3	0	0	3

CAREER COURSES (UG)

S.No	Course Code	Courses Offered	Sem	L	T	P	C
Track 1 Job (6 Credits)	23GEB375	Personnel Psychology & Technical Interviewing	V Semester	2	0	4	4
	23GEB379	Employable Skill Development	VI Semester	1	0	2	2
Track 2 Entrepreneurship (6 Credits)	23GEB376	Entrepreneurship & Business Canvas Model	V Semester	2	0	4	4
	23GEB382	Economics, Finance & Accounting and Intellectual Property Rights	VI Semester	1	0	2	2
Track 3 Higher Education (6 Credits)	23GEB377	Advanced Verbal Quantitative Aptitude & Reasoning and Networking	V Semester	2	0	4	4
	23GEB380	Higher Studies in Abroad & India	VI Semester	1	0	2	2
Track 4 Govt. /RRB/ Bank (6 credits)	23GEB378	Foundation Course on Competitive Exams	V Semester	2	0	4	4
	23GEB381	Personnel Psychology for Govt. Jobs	VI Semester	1	0	2	2

Mandatory Courses (UG)

Course Code	Course Title	L	T	P	C
23CHT103	Environmental Sciences and sustainability	2	0	0	0
23HST103	Indian Constitution	2	0	0	0
23HST105	Essence of Indian Traditional Knowledge	2	0	0	0

Other Special Courses (UG)

Course Code	Course Title	L	T	P	C
23GEB101	Design Thinking and Innovation	1	0	4	3
23GET275	VQAR – I	2	0	0	2
23GEP275	Personal Branding	0	0	4	2
23GET276	VQAR - II	2	0	0	2
23GET401	Universal Human Values	2	0	0	2

SEMESTER I

23MAT101	MATRICES AND CALCULUS	L	T	P	C
[Common to all B.E. / B. Tech. Courses]		3	1	0	4
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To develop the use of matrix algebra techniques that is needed by engineers for practical applications • To acquaint the student with mathematical tools needed in evaluating differential calculus, multiple integrals and their applications 					
UNIT I	MATRIX EIGENVALUE PROBLEM	12			
Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley Hamilton Theorem (statement only) and it's applications – Eigenvalue problems arising from population models (Leslie model)					
UNIT II	ORTHOGONAL TRANSFORMATION OF A REAL SYMMETRIC MATRIX	12			
Diagonalization of a real symmetric matrix – Quadratic form – Canonical form – Nature of the quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation – Applications: Stretching of an elastic membrane					
UNIT III	DIFFERENTIAL CALCULUS	12			
Curvature – Radius of Curvature in Cartesian co-ordinates – Centre of curvature and circle of curvature in Cartesian Co-ordinates – Evolutes – Envelopes					
UNIT IV	FUNCTIONS OF SEVERAL VARIABLES	12			
Partial derivatives – Homogeneous functions and Euler's theorem – Jacobians – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers					
UNIT V	MULTIPLE INTEGRALS	12			
Double integrals (Cartesian co-ordinates) – Change of order of integration – Applications of double integrals (Area) – Triple integrals (Cartesian co-ordinates) – Applications: Volume of solids					
		L:45	T:15	P: 0	Total: 60 Periods
TEXT BOOKS					
T1	Kreyszig.E, Advanced Engineering Mathematics, John Wiley and Sons, 10 th Edition, New Delhi 2016				
T2	James Stewart, Calculus, Cengage Learning, 8 th Edition, New Delhi 2015				
REFERENCES					
R1	Grewal.B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44 th Edition, 2018				
R2	Bali. N.P, Goyal. M. and Watkins. C., Advanced Engineering Mathematics, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7 th Edition, 2009				
R3	Jain. R.K. and Iyengar. S.R.K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 5 th Edition, 2016				
R4	Ramana. B.V., Higher Engineering Mathematics, McGraw Hill Education Pvt. Ltd, New Delhi, 2016				
R5	Thomas. G. B., Hass. J, and Weir. M.D, Thomas Calculus, 14 th Edition, Pearson India, 2018				

COURSE OUTCOMES	
At the end of the course students should be able to	
C01	Discuss about Eigen values and Eigen vectors and its role in the system of equations
C02	Compute the real symmetric matrix from quadratic form to canonical form by means of orthogonal transformation
C03	Demonstrate the radius, centre and circle of curvature of any curve
C04	Use differential calculus ideas on several variable functions
C05	Apply multiple integral ideas in solving areas, volumes and other practical problems

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	<small>(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)</small>													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3		2	2			2	2		2			
C02	3	3		2	2			2	2		2			
C03	3	3		1	2			2	2		2			
C04	3	3		1	2			2	2		2			
C05	3	3		1	2			2	2		2			

23PYT101	ENGINEERING PHYSICS			L	T	P	C
[Common to AEROSPACE, AGRI, AUTO, CIVIL, FT, MECH & MCT]				3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To Comprehend and classify different crystal structures and develop the basic knowledge about elastic properties To realize the concepts of quantum theory and impart knowledge about conductors, superconductors, nano materials and Non-Destructive testing 							
UNIT I	CRYSTAL STRUCTURE						9
Single crystalline, poly crystalline and amorphous materials –single crystals: unit cell, crystal systems, Bravais lattices, Miller indices, directions and planes in a crystal – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP structures; Crystal imperfections – point, line, surface and volume imperfections							
UNIT II	ELASTICITY						9
Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment- bending of beams-bending moment–cantilever: theory and experiment– uniform and non-uniform bending: theory and experiment- I-shaped girders							
UNIT III	QUANTUM PHYSICS						9
Black body radiation – Planck’s theory (derivation) – Deduction of Wien’s displacement law and Rayleigh – Jean’s Law from Planck’s theory – Properties of Matter waves Physical significance of wave function-Schrödinger’s wave equations: Time independent and time dependent equations–Particle in a one dimensional box–Electron microscope-Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM)							
UNIT IV	PHYSICS OF ADVANCED MATERIALS						9
Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity. Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory. Nanomaterials: introduction and properties – synthesis – top-down process: Ball milling method - bottom-up approach: Physical Vapour deposition – applications							
UNIT V	NON-DESTRUCTIVE TESTING						9
Introduction- Types of defects-Methods of NDT-Visual inspection- Liquid/Dye penetrant testing- Magnetic particle testing-Eddy current testing-Ultrasonic inspection method- Advantages-X-Ray radiography-X-ray fluoroscopy-Comparison of conventional and real time radiography							
				L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS							
T1	M N Avadhanulu, P G Kshirsagar & TVS Arun Murthy, “A Textbook of Engineering Physics”, 11 th edition, 2020 ,S Chand Publishing						
T2	Hitendra K.Malik, A.K.Singh, “Engineering Physics”, 2 nd Edition, 2017, McGraw Hill Education						
REFERENCES							
R1	B.K.Pandey and S.Chaturvedi, “EngineeringPhysics”, 2 nd Edition, 2021, Cengage Learning India Pvt. Ltd						
R2	A.S.Vasudeva, “Modern Engineering Physics”, Revised Edition, 2013, S Chand Publishing						

COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Analyze crystal structures and the influence of imperfections on their properties
CO 2	Create the knowledge to demonstrate the elastic properties of materials
CO 3	Outline the concepts of quantum mechanics and its importance in modern tools
CO 4	Utilize the knowledge to identify and develop the materials for specific applications
CO 5	Apply the knowledge of non-destructive testing to examine the materials

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	<i>(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)</i>													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	2									2			
C02	3	2									2			
C03	3	2		1							2			
C04	3	2		1							2			
C05	3	2			1						2			

23MET101	ENGINEERING MECHANICS			L	T	P	C
[Common to All Non-Circuit Branches]				3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> • To introduce the techniques for analyzing the forces in the bodies. • To understand the basic principles involved in the dynamics of particle and rigid body. 							
UNIT I	BASICS & STATICS OF PARTICLES						9
Introduction - Units and Dimensions - Vectorial representation of forces and moments – Coplanar Forces –Laws of Mechanics -Lame’s theorem, Resolution and Composition of forces -Equilibrium of a particle - Principle of transmissibility –Free body diagram.							
UNIT II	EQUILIBRIUM OF RIGID BODIES						9
Types of supports and their reactions -requirements of stable equilibrium -Moments and Couples- Vectorial representation of moments and couples -Varignon’s theorem and applications-Forces in space-Equilibrium of a particle in space- Equilibrium of Rigid bodies in three dimensions.							
UNIT III	PROPERTIES OF SURFACES AND SOLIDS						9
Determination of centroid of areas, volumes and mass–moment of inertia of plane- Parallel axis theorem and perpendicular axis theorem-product of inertia-mass moment of inertia.							
UNIT IV	DYNAMICS OF PARTICLES						9
Displacements, Velocity and acceleration, their relationship-Relative motion–Curvilinear motion-Newton’s law-Work Energy Equation of particles.							
UNIT V	FRICITION AND RIGID BODY DYNAMICS						9
Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction-wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies –Velocity and acceleration.							
				L:45	T: 0	P: 0	Total: 45 Periods
TEXT BOOKS							
T1	Beer,F.Pand Johnston Jr.E.R.“Vector Mechanics for Engineers”, McGraw-Hill Education 11 th Edition (India) Pvt Ltd. 2016.						
T2	J.L.Meriam &L.G.Kraige, “Engineering Mechanics: Dynamics, 8 th edition, Wiley Student edition, 2016.						
REFERENCES							
R1	VelaMurali,“Engineering Mechanics”,Oxford University Press (2010).						
R2	D.P.Sharma “Engineering Mechanics”, Dorling Kindersley (India) Pvt. Ltd, New Delhi, 2010.						
R3	Dr.I.SGujral“Engineering Mechanics” 2 nd Edition, 2011,Lakshmi Publication (P).Ltd.						
R4	Arthur P. Boresi and Richard J.Schmidt, “Engineering Mechanics: Statics and Dynamics”, Thomson Asia Private Limited, Singapore, 2010.						
R5	Hibbeller,R.C, “Engineering Mechanics”, 14 th edition, Prentice Hall (McGraw-Hill)(2016).						

COURSE OUTCOMES**At the end of the course students should be able to**

CO 1	Recognize the basics of equilibrium of particles in 2D and 3D.
CO 2	Review the requirements of equilibrium of rigid bodies in 2D and 3D.
CO 3	Compute the center of mass and moment of inertia of surfaces and solids.
CO 4	Predict displacement, velocity and acceleration of dynamic particles.
CO 5	Solve for friction force and rigid body dynamics.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	3									3	2	
C02	2	3		2								3		
C03	2	2	2									3	2	
C04	3	2	2	2	2						2	3		
C05	3	3	3	2							2	3	2	

23EET101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING				L	T	P	C	
(Non circuit branches)				3	0	0	3		
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> To familiarize the elementary concepts of electric circuits, construction and operation of electrical machines and electrical wiring To acquire knowledge on the operation of analog and digital electronic devices and its applications 									
UNIT I	ELECTRICAL CIRCUITS							9	
DC Circuits: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws – Simple problems: Nodal analysis, Mesh analysis with Independent sources only (Steady state) AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor (Simple problems only)									
UNIT II	ELECTRICAL MACHINES							9	
Construction, Principle of operation, Basic equations and applications of DC Generator, DC Motor- Elementary treatment of Single phase Transformer, Single and three phase Induction Motors, Synchronous Generator									
UNIT III	WIRING, GROUNDING AND SAFETY							9	
Wiring: General Rules, materials and accessories, Types of wiring - Conduit wiring – Wiring layout of Residential building, Grounding: Importance of grounding, Types of grounding - Safety: Causes of accidents, Accident prevention									
UNIT IV	ANALOG ELECTRONICS							9	
Construction, working principle and VI characteristics of Diode, Zener diode, BJT, MOSFET, Applications: Bridge Rectifier, Voltage regulators, UPS, SMPS									
UNIT V	DIGITAL ELECTRONICS AND MEASURING INSTRUMENTS							9	
Boolean Algebra-Logic Gates - Half Adder and Full Adders - A/D and D/A Conversion (Any one concept) Functional elements of an instrument, Construction and Operating Principle: Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Data acquisition									
				L:45	T:0	P: 0	Total: 45 Periods		
TEXT BOOKS									
T1	Muthusubramanian R, Salivahanan S, “Basic Electrical and Electronics Engineering”, TataMcGrawHillPublishers,2010								
T2	Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020								
REFERENCES									
R1	V.Mittle, “Basic Electrical Engineering”,Tata McGraw Hill Publishers,2017								
R2	Mehta VK, Mehta Rohit,“Principles of Electrical Engineering and Electronics”,S.Chand&CompanyLtd,2010								
R3	Black & Decker , “The complete guide to Electrical Wiring”, S.Chand& Company Ltd,2012								
R4	Nagrath. I.J, “Electronics: Analog and Digital”, Prentice Hall India Pvt. Ltd., 2013								
R5	Mehta V K, Mehta Rohit, “Principles of Electronics”, S.Chand& Company Ltd, 2005								
COURSE OUTCOMES									
At the end of the course students should be able to									
CO 1	Familiarize the elementary concept of electric circuits								
CO 2	Understand the construction, operation and applications of electrical machines								
CO 3	Apply the concept of wiring and acquire the importance of grounding and safety								
CO 4	Gain knowledge on electronic devices and its applications								
CO 5	Acquire knowledge on basics of digital electronics and measurements								

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	3			1							3	
C02	3	2	3			1					3		3	
C03	3	2	3			1					3	1	3	
C04	3	2	3			1						1	3	
C05	3	2	3			1					3	1	3	

23GET103	HERITAGE OF TAMILS				L	T	P	C
	(Common to all B.E. / B. Tech. Courses)				1	0	0	1
UNIT I	LANGUAGE AND LITERATURE						3	
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.								
UNIT II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE						3	
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yash and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils								
UNIT III	FOLK AND MARTIAL ARTS						3	
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils								
UNIT IV	THINAI CONCEPT OF TAMILS						3	
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas								
UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE						3	
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books								
					L : 15	T:0	P: 0	Total: 15 PERIODS
TEXT BOOKS & REFERENCES								
<ol style="list-style-type: none"> 1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL 2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies) 3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies) 4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies) 5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ 6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) 7. Porunai Civilization Journey of Civilization Indus to Vaigai (R.Balakrishnan) 								

23GEB101	DESIGN THINKING AND INNOVATION				L	T	P	C	
	(Common to All B.E. / B. Tech. Courses)				1	0	4	3	
UNIT I	INTRODUCTION TO DESIGN THINKING						3+12		
A brief insight to Design Thinking and Innovation- People Centered Design & Evoking the 'right problem'- Purpose of Design Thinking- Design Thinking Framework									
UNIT II	PROCESS IN DESIGN THINKING (EMPATHY, DEFINE)						3+12		
Design Thinking Process – Empathy – Uncovering and Investigating Community Concerns - Define: Examine and Reflect on the problem									
UNIT III	CONCEPTING AND BUILDING (IDEA, CREATE)						3+12		
Generating Ideas-Identifying top three ideas-Bundling the Ideas and create concepts-Rapid Prototyping									
UNIT IV	TESTING, REFINING AND PITCHING THE IDEAS						3+12		
Importance & Testing the Design with People-Retest and Redefine Results-Creating a Pitch for the design									
UNIT V	VALUE PROPOSITION DESIGN						3+12		
Business Vs Startup-Briefing the Problem-Problem Validation and User Discovery- Challenge Brief									
					L :15	T: 0	P: 0	J: 60	T:75 PERIODS
TEXT BOOKS									
T1	Robert A Curedale0, Design Thinking Process & Methods 4th Edition, December 2017, Design Community College Inc								
T2	Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, First Edition, Nov 2018, Routledge								
REFERENCES									
R1	Idris Mootee, Design Thinking for Strategic Innovation - What They Can't Teach You at Business or Design School, First Edition, 2017, Wiley								
R2	Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadacos Alex Osterwalder, Value Proposition Design: How to Create Products and Services Customers Want, 2015, Wiley								
R3	Brown, Tim, and Barry Katz. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, 2009, Harper Business								
COURSE OUTCOMES :									
At the end of the course students should be able to									
CO1	Learn new approach-design thinking—that enhances innovation activities in terms of market impact, value creation, and speed								
CO2	Feel the Empathy and can define their problems based on the Community Concerns								
CO3	Strengthen their individual and collaborative capabilities to identify customer needs, create sound concept hypotheses, collect appropriate data, and develop a prototype that allows for meaningful feedback in a real-world environment								
CO4	Translate broadly defined opportunities into actionable innovation possibilities and recommendations for client organization								
CO5	Become an Entrepreneurs								

23PYP101	PHYSICS LABORATORY			L	T	P	C
[Common to All Branches]				0	0	2	1
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> • To develop the knowledge with an experimental understanding the properties of matter, semiconductors, viscosity and optics • To build knowledge on the practical oriented skills 							
BASIC MEASURING INSTRUMENT							
<ol style="list-style-type: none"> 1. Screw Gauge 2. Vernier Caliper 3. Travelling Microscope 4. Spectrometer 							
LIST OF EXPERIMENTS							
<ol style="list-style-type: none"> 1. Determination of wavelength of mercury spectrum – Spectrometer grating 2. Determination of Young’s modulus of the material – uniform bending 3. Determination of viscosity of liquid – Poiseuille’s method 4. (a) Determination of the Wavelength of a Laser (b) Particle size determination using Diode Laser 5. Determination of the Numerical Aperture and the acceptance angle of an optical fiber 6. Determination of thickness of a thin wire – Air wedge method 7. Determination of dispersive power of a prism using spectrometer 8. Determination of Young’s modulus of the material – non uniform bending 9. Torsional Pendulum - Determination of rigidity modulus of wire and moment of Inertia of disc 10. Determination of Band gap of semiconductor material 							
				L:0	T:0	P: 30	Total: 30 Periods
Experiment Beyond Syllabus : Demonstration of Deflection Magnetometer							
TEXT BOOKS							
T1	Physics Laboratory Manual, Department of Physics, 2019, SNSCT						
REFERENCES							
R1	R.Jayaraman, V.Umadevi, S.Maruthamuthu, B.Saravanakumar, “Engineering Physics Laboratory Manual”, 2013 Pearson Education India						
COURSE OUTCOMES							
At the end of the course students should be able to							
CO 1	Evaluate the young’s modulus and Rigidity Modulus of the given material						
CO 2	Apply the concept of diffraction, Interference and dispersive power to determine wavelength of the given light sources						
CO 3	Utilize the knowledge on principles of laser, fiber optics to find out the numerical aperture and particle size of a given materials						
CO 4	Use the concept of viscosity to determine the viscosity of a given liquids						
CO 5	Compute the band gap of a given semiconductor						

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2						2			2			
C02	3	2						2			2			
C03	3	2						2			2			
C04	3	2						2			2			
C05	3	2						2			2			

23ENP101	PROFESSIONAL COMMUNICATION	L	T	P	C	
[Common to All Branches]		0	0	4	2	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To develop students' verbal communication skills, enabling them to engage in clear, confident, and coherent discussions with one or multiple listeners, using effective communicative strategies To equip students with a thorough understanding of communication principles, enabling them to apply these effectively in a professional workplace environment 						
UNIT I	LISTENING SKILLS					10
The process of Listening & Barriers of listening, Listening to TED Talks and note taking, – Listening to conversations for specific information, Listening to classroom lectures/ talks/ Documentaries						
UNIT II	READING					10
Cloze exercises, Picture perception, Reading and paraphrasing, Reading and interpreting						
UNIT III	PROFESSIONAL WRITING					10
Cover letter & Resume preparation, Email writing – formal & Informal, Content writing- planning- writing- editing and proofreading, Report writing- types of report, report format - Fire Accident & Road Accident						
UNIT IV	COMMUNICATION & SOFT SKILLS					15
Communication & Barriers of Communication- Verbal & Nonverbal Communication, Time Management, Stress Management, Inter & Intra personal skills, Professional ethics, Basic Etiquettes- Social Etiquette- Telephone Etiquettes- Corporate Etiquette						
UNIT V	SPEAKING					15
Introduction of self and others, Extempore Speech, Public Speaking, Art of Storytelling- Describing and Narrating, Presentation Skills- preparing PPT and Oral presentation, – Group Discussion – Team building- Mock GD, Interview skills- resume based questions- Competency based question- Mock Interview						
		L: 0	T: 0	P: 4	Total: 60 Periods	
TEXT BOOKS						
T1	Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011					
T2	Rizvi, Ashraf. M. Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005					
REFERENCES						
R1	Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011					
R2	Mitra K. Barun, –Effective Technical Communication – A Guide for Scientists and Engineers , Oxford University Press, New Delhi, 2006					
R3	Leo Jones, Richard Alexander, New International Business English, updated Edition, Cambridge University Press, NY, USA					
R4	Smith—Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA					
R5	Sharon J. Gerson, Steven M. Gerson, –Technical Writing – Process & Product 3rd Edition, Pearson Education (Singapore) (P) Ltd., New Delhi					

COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Select appropriate listening techniques for both formal and informal contexts
CO 2	Use reading skills to comprehend ambiguity and complexity, and can articulate their own Interpretations.
CO 3	Demonstrate their writing skills for effective communication in both formal and informal situations
CO 4	Discuss clearly, confidently, comprehensively and communicate with one or many listeners using appropriate communicative strategies
CO 5	Apply the various principles of communication in the workplace environment

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01							1	3	2					
C02							1	3	2					
C03							1	3	3					
C04							3	3	3					
C05							3	3	3					

23GEP101	WORKSHOP PRACTICES LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To use hand tools and machinery in Carpentry, Welding, Fitting shop and Sheet Metal work To Employ knowledge on House wiring and Electronics components 					
LIST OF EXPERIMENTS					
GROUP A (CIVIL & MECHANICAL)					30
CIVIL ENGINEERING					12
<ul style="list-style-type: none"> Study of plumbing tools and Components Preparation of threads in pipes Preparation of single and multi-tap connections for domestic Study of carpentry tools and its applications Preparation of Cross Lap and Dovetail Joints 					
MECHANICAL ENGINEERING					18
<ul style="list-style-type: none"> Study of different types of Welding and its applications Preparation of Butt, Lap and Tee joints Study of sheet metal and its applications Preparation of Rectangular, Square Trays and Funnel Demonstration of Lathe and Drilling Operations Demonstration of Smithy, Foundry tools and Power Tool Operations Plastic Moulding and Glass Cutting 					
GROUP B (ELECTRICAL AND ELECTRONICS)					30
ELECTRICAL ENGINEERING PRACTICE					18
<ul style="list-style-type: none"> Residential house wiring using switches, fuse, miniature circuit breaker, indicator, Lamp and energy meter Fluorescent lamp wiring Stair-case wiring Measurement of electrical quantities -voltage, current, power & power factor in RL Circuit Measurement of energy using single phase energy meter Measurement of insulation resistance to earth of electrical equipment Measurement of single and three phase voltages Study of Iron Box, Emergency Lamp and Fan 					
ELECTRONICS ENGINEERING PRACTICE					12
<ul style="list-style-type: none"> Study of Electronic components and equipments –Resistor, color coding Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO Verification of logic gates: AND, OR, Ex-OR and NOT Generation of Clock Signal Soldering practice – Components Devices and Circuits Using general purpose PCB Characteristics of a PN Junction diode 					
		L: 0	T: 0	P: 60	Total: 60 Periods

COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Demonstrate plumbing system and Carpentry for the required applications.
CO 2	Relate the basic machining operations with engineering problems.
CO 3	Apply different types of Welding processes and Sheet metal processes for the Industrial applications.
CO 4	Illustrate Residential House wiring and simple wiring circuits..
CO 5	Employ knowledge on measuring electrical quantities.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO1	PSO2	PSO3
C01	3	2	2	2	3	3			3	2	3	3	3	
C02	3	2	3	2	2	2			2		2	3		
C03	3	2	2	2	3	2			3	3	3	3	2	
C04	3	3										1		
C05	3				1								2	

23CHT103	ENVIRONMENTAL SCIENCE & SUSTAINABILITY	L	T	P	C
(Common to all B.E / B.Tech)		2	0	0	0
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the basic concepts of environment, ecosystem and biodiversity and to impart knowledge on environmental pollution, renewable and non-renewable resources and causes of degradation To inculcate and embrace sustainability practices and develop a broad understanding on green materials, concept of carbon credit and changes of environmental management 					
UNIT I	ENVIRONMENT AND BIODIVERSITY	6			
Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Introduction to biodiversity– Values of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex- situ conservation of biodiversity. Field visit on Biodiversity					
UNIT II	ENVIRONMENTAL POLLUTION	6			
Environmental Pollution -Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollution. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHSMS). Environmental protection, Environmental protection acts					
UNIT III	RENEWABLE SOURCES OF ENERGY-	6			
Energy management and conservation, New Energy Sources: Need of new sources. Solar energy, Wind energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Case study on Present Energy resources in India and its sustainability					
UNIT IV	SUSTAINABILITY PRACTICES	6			
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Energy Cycles carbon cycle, emission and Sequestration, Sustainable urbanization and technological change					
UNIT V	SUSTAINABILITY AND MANAGEMENT	6			
Development, GDP, Sustainability - concept, needs and challenges-economic and social aspects of sustainability - millennium development goals and protocols Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry- A case study					
		L:30	T:0	P: 0	Total: 30 Periods
TEXT BOOKS					
T1	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018				
T2	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2016				
REFERENCES					
R1	G.Tyler Miller, "Environmental Science" Cengage Learning India Pvt.Ltd.New Delhi.2011				
R2	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . Edition 2010				
R3	Gilbert M. Masters and Wendell. P.Ela, "Introduction to EnvironmentalEngineering and Science" PHI Learning Pvt. Ltd. New Delhi.2010				
R4	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015				
R5	Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013				

COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Understand the ecological balance and preservation of bio diversity
CO 2	Know the role of human in prevention of pollution and making a clean environment
CO 3	Explore the environmental impact of various energy resources and also get knowledge about conservation of non-conventional energy resources
CO 4	Recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development
CO 5	Demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2				2	1				2			
C02	3	3	1			3	1				2			
C03	3	3	1			2					2			
C04	3	3	1	1		2	2				2			
C05	3	3	1	1		2	2				2			

SEMESTER II

23MAT102	COMPLEX ANALYSIS AND LAPLACE TRANSFORMS	L	T	P	C
[Common to AEROSPACE,AGRI,AUTO,BME,CIVIL,ECE,EEE,FT,MECH,MCT]		3	1	0	4
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To develop the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current • To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated 					
UNIT I	VECTOR CALCULUS				12
Derivatives: Gradient and Directional derivatives – Divergence and Curl of a vector field – Solenoidal and Irrotational of a vector – Green’s, Gauss divergence and Stoke’s theorems (statements only) – Verification of theorems and application in evaluating line, surface and volume integrals					
UNIT II	ORDINARY DIFFERENTIAL EQUATIONS				12
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type – Solution of system of simultaneous linear first order differential equations with constant coefficients					
UNIT III	COMPLEX DIFFERENTIATION				12
Derivatives of $f(z)$ – Analytic function – Cauchy-Riemann Equations – Harmonic function – Harmonic conjugate – Construction of Analytic function – Conformal Mapping – Mapping by functions: $w = z + c$, cz , $1/z$ – Bilinear transformations – Application to flow problems					
UNIT IV	COMPLEX INTEGRATION				12
Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s series – Zeros of an analytic function – singularities – Laurent’s series – Residues – Cauchy Residue theorem					
UNIT V	LAPLACE TRANSFORMS				12
Definition, properties, existence conditions – Transforms of elementary functions – Shifting theorem – Transforms of derivatives and integrals – Periodic functions – Initial and final value theorem – Inverse transforms – Application to solution of linear second order ordinary differential equations with constant coefficients					
		L:45	T:15	P: 0	Total: 60 Periods
TEXT BOOKS					
T1	Kreyszig.E, Advanced Engineering Mathematics, John Wiley and Sons, 10 th Edition, New Delhi 2016				
T2	Grewal.B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44 th Edition, 2018				
REFERENCES					
R1	Bali. N.P, Goyal. M. and Watkins. C., Advanced Engineering Mathematics, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7 th Edition, 2009				
R2	G.B.Thomas, Calculus, 12 th Edition, Pearson Education India, 2015				
R3	Jain. R.K. and Iyengar. S.R.K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 5 th Edition, 2016				
R4	Peter V.O Neil, “Advanced Engineering Mathematics”, 7 th Edition, Cengage learning India Pvt Ltd, New Delhi, 2012				

R5	Srimanta Pal, Subodh C Bhunia, "Engineering Mathematics", Oxford University Press,2015
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Evaluate gradient, divergence and curl and solve engineering problems involving cubes, rectangular parallelepipeds by applying various integral theorems
CO 2	Compute the higher order linear differential equations with various methods and apply them in some physical situations
CO 3	Discuss the analyticity, construct the analytic function and transform complex functions from z-plane to w-plane graphically by using conformal mapping
CO 4	Identify real and complex integrals over suitable closed path using various integral theorems
CO 5	Apply the mathematical principles on Laplace transforms and would provide them the ability to formulate and solve some of the physical problems of engineering

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3						2			2			
C02	3	3						2			2			
C03	3	3						2			2			
C04	3	3						2			2			
C05	3	3						2			2			

23CHT102	CHEMISTRY OF ENGINEERING MATERIALS	L	T	P	C
(Common to MECH, MCT, AUTO, AERO, AGRI, CIVIL& FT)		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To understand and equip the students with comprehensive knowledge of corrosion mechanisms, types, and control methods, enabling them to develop effective strategies to prevent and mitigate corrosion in various industrial applications To explore the students with an in-depth understanding of nano materials, fuels, water treatment technologies, and engineering materials, fostering their ability to innovate and apply the concepts in real-world scenarios 					
UNIT I	CORROSION AND ITS CONTROL	9			
Corrosion - Chemical corrosion (Oxidation corrosion)-Electrochemical corrosion-Types of electrochemical Corrosion -Corrosion control-Corrosion inhibitors- Cathodic protection (Sacrificial anodic protection and Impressed current Cathodic protection) – Protective coating-Paints and its constituents -Fire Retardant paint - Electroplating (Au)					
UNIT II	NANOMATERIALS	9			
Nano materials and Bulk materials - Size dependent properties (Optical, Electrical and Mechanical) –Synthesis - Sol gel method - Chemical Vapour Deposition, Solvo thermal, laser ablation - Types of nanomaterials - Carbon nanotubes – Properties and uses - Application of Nanotechnology in Electronics Energy science and Medicine					
UNIT III	FUELS AND COMBUSTION	9			
Fuels- Solid Fuel-Coal-classification-manufacture of metallurgical coke by Otto-Hoffmann method-Liquid Fuel--Synthetic petrol-Fischer and Bergius method- - Gaseous fuels- CNG and LPG.- Bio fuels: Categories, Types –Biodiesel, Biogas.Combustion-Calorific value-Gross and Net calorific value -Definition -Flue gas analysis by Orsat Apparatus					
UNIT IV	WATER TECHNOLOGY	9			
Introduction-Hard water and Soft water-Hardness-Types-Boiler Troubles- Water Softening – External treatment-Demineralization-Internal Treatment- Water Quality parameters(pH,TDS,Chloride, Fluoride, Sulphate, Iron, BOD ,COD and Heavy metals)- Municipal water treatment - Desalination –Reverse osmosis					
UNIT V	ALLOYS AND ENGINEERING MATERIALS	9			
Alloys-classification -Ferrous alloys (Nichrome and stainless steel only)-Non-ferrous alloys (brass and bronze) Heat treatment of steel- Definition of light metals, Characteristics and applications of light metals-Super alloys - Lubricants –Solid lubricants (Graphite and Molybdenum disulphide)- Mechanism of Lubrications. Cement – Portland cement-Chemical composition of Portland cement. Functions and limitations of cement ingredients					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	P.C.Jain&Monicka Jain, “Engineering Chemistry”, Dhanapat Rai Publising Company Pvt.Ltd. 2017				
T2	Wiley, “Engineering Chemistry”, John Wiley &Sins.InC,USA [2014]				
REFERENCES					
R1	B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2009)				
R2	Shikha Agarwal, Engineering Chemistry-Fundamentals and Applications, Cambridge University Press,Delhi, Second Edition, 2019				
R3	Dr.Sivanesan and Nandagopal, “Engineering Chemistry-I” V.K.Pub.Pvt.Ltd. 2011				
R4	O.G.Palanna, “Engineering Chemistry”Tata McGraw-Hill Pub.Co.Ltd, New Delhi.2017				

R5	Dara, S.S.; A Text Book of Engineering Chemistry (Tenth edition); S. Chand, 2003
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Explain the chemical and electrochemical mechanisms of corrosion, identify different types of electrochemical corrosion and evaluate methods for controlling corrosion
CO 2	Compare the properties of nanomaterials with bulk materials, and demonstrate the synthesis of nanomaterials, while exploring their applications in electronics, energy, and medicine
CO 3	Classify and explain the different types of fuels, understand the processes involved in the production of synthetic fuels and analyze the combustion process
CO 4	Identify the causes of boiler troubles and evaluate various eco-friendly method for water purification
CO 5	Classify different types of alloys and understand their applications, comprehend the characteristics and usage of various engineering materials

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	2	1			1								
C02	3	2	1	1		1					1			
C03	3		1			1								
C04	3	2	2			1					1			
C05	3	1	1			1								

23ENT101	COMMUNICATIVE ENGLISH	L	T	P	C
[Common to All Branches]		4	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To enhance students in the art of error-free communication, emphasizing the correct use of grammar and punctuation in both professional and social contexts To develop students' proficiency in formal letter writing, ensuring they can convey messages clearly, concisely, and professionally in various formal scenarios 					
UNIT I					9
Grammar - Tenses - Verb forms, Spelling and Importance of Punctuation, Vocabulary - Word formation- Prefixes & Suffixes, One word Substitution, Reading -Reading and understanding the Context, Writing - Sentence completion- filling the gap, Instructions- Imperative Instructions					
UNIT II					9
Grammar - Uses of Preposition, Active & Passive Voice- impersonal passive, Vocabulary - Technical Vocabulary- Synonyms-Antonyms-Compound words, Reading -Transfer of information (chart, pictures), Writing - Recommendations- writing suggestions, Preparing Checklist					
UNIT III					9
Grammar -Concord (Subject & Verb agreement), Definite & Indefinite Article, Vocabulary - Uses of Connectives and Linking words, Reading - Summarizing the given passage - Précis writing, Writing - Paragraph writing – Process writing, Analytical, Argumentative Paragraphs					
UNIT IV					9
Grammar - Direct and Indirect speech, Cause and Effect Expression, Vocabulary - Logical Sequence of words, Reading -Note-making using Linear method, Writing - Formal Letter writing- Permission letter for Industrial Visit & In-plant training					
UNIT V					9
Grammar - Clauses -If Conditionals, Vocabulary - Words often confused - Verbal Analogy, Reading - Writing a Book Review Writing - Business Letters- Letter of Quotations, Clarification, Placing orders & Complaint letter					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011				
T2	Rizvi, Ashraf. M. Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005				
REFERENCES					
R1	Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011				
R2	Mitra K. Barun, —Effective Technical Communication – A Guide for Scientists and Engineers, Oxford University Press, New Delhi, 2006				
R3	Leo Jones, Richard Alexander, New International Business English, updated Edition, Cambridge University Press, NY, USA				
R4	Smith—Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA				

R5	Sharon J. Gerson, Steven M. Gerson, —Technical Writing – Process & Productl. 3rd Edition, Pearson Education (Singapore) (P) Ltd., New Delhi
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Use their active and passive vocabulary and construct basic sentence structures
CO 2	Assess the different interpretations of ambiguous passages by comparing and contrasting various analyses
CO 3	Select appropriate formatting styles for various documents to enhance readability and professionalism while adhering to grammatical norms
CO 4	Utilize their letter writing skills to build rapport and convey important messages clearly in formal settings
CO 5	Build their communication skills and enable them to articulate with confidence

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01		1		1		1	1	3	3	1	1			
C02		1		1		2	2	3	3	3	3			
C03		1		1		2	3	3	3	3	3			
C04		1		1		2	2	3	3	3	3			
C05		1		1		2	2	3	3	3	3			

23ITT101	PROGRAMMING IN C AND DATA STRUCTURES	L	T	P	C	
[Common to Mech, MCT, and ECE]		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To make students to learn, design & develop their programming skills • To gain knowledge of data structures and their applications 						
UNIT I	INTRODUCTION TO C					8
Basic blocks of computers – Algorithm, Pseudo code, Flowchart - Structure of C program- Data types - Variables - Constants, Operators - Input and Output Statements						
UNIT II	DECISIONS STATEMENTS AND FUNCTIONS					11
Decision making and Branching statements - Looping statements, Functions, Call by value, Call by reference						
UNIT III	ARRAYS AND INTRODUCTION TO DATA STRUCTURES					10
Arrays - One dimensional arrays - Two dimensional Arrays - Structures – Pointers Introduction to Data structures - Types of Data structures - ADT						
UNIT IV	STACK AND QUEUE					9
Stack ADT - Queue ADT - Array implementation of Queue and Stack ADT - Infix to Postfix conversion - Postfix expression evaluation						
UNIT V	TREES					7
Trees - Binary Tree - Binary Search Tree - Insertion and Deletion Operation - Tree Traversal						
		L:45	T:0	P: 0	Total: 45 Periods	
TEXT BOOKS						
T1	Kamthane Ashok, “Programming in C, Pearson Education India 3/e, 3rd Edition, 2015					
T2	Aaron M. Tenenbaum, Yedidyah Langsam, Moshe Augenstein, “Data Structures using C”, Prentice-Hall of India, 2003					
REFERENCES						
R1	A. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2nd Edition, 2007					
R2	E.Balagurusamy “Data Structures Using C ”, McGraw-Hill Education (India) , 2013					
COURSE OUTCOMES						
At the end of the course students should be able to						
CO 1	Develop algorithms and design flowcharts to solve real-world problems effectively					
CO 2	Understand and apply decision-making constructs, branching, and looping statements in program development					
CO 3	Implement functions and arrays, and utilize basic data structures such as stacks and queues					
CO 4	Gain in-depth knowledge of stack and queue data structures, and their applications in various computational problems					
CO 5	Understand tree data structures and perform operations on trees, equipping them with the necessary skills to manage and manipulate hierarchical data					

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3	2	2										
C02	3	3	2	1	1									
C03	3	3	2	1	1									
C04	3	3	2	2	1									
C05	3	3	2	2	1	1								

23MET102	ENGINEERING DRAWING			L	T	P	C
[Common to all Non Circuit Branches]				1	0	4	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> • To provide a common language for engineers and manufacturers to communicate design ideas, specifications, and requirements • To acquire skills in creating and interpreting 2D and 3D representations of components, assemblies and systems 							
UNIT I	PROJECTION OF POINTS, LINES AND PLANE SURFACES						3+12
Projection of points - Projection of straight lines located in the first quadrant -Determination of true Lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to both reference planes							
UNIT II	PROJECTION OF SOLIDS						3+12
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method							
UNIT III	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES						3+12
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other -Obtaining true shape of section. Development of lateral surfaces of Simple and truncated solids -Prisms, pyramids, cylinders and cones							
UNIT IV	PICTORIAL PROJECTIONS AND FREE HAND SKETCHING						3+12
Principles of isometric projection -isometric scale -isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones Free hand sketching: Representation of Three Dimensional objects -Need for importance of multiple views and their placement -First angle projection -layout views -Developing visualization skills through free hand sketching of multiple views from pictorial drawing. Perspective projection of prisms, pyramids and cylinders by visual ray method (Not for Examination)							
UNIT V	BUILDING DRAWING						3+12
Drawing of a plan, Elevation and sectioning of security room and residential building (Two bed rooms, kitchen, hall, etc.) Practicing design in the CAD Software (Not for Examination)							
				L:15	T: 0	P: 60	Total: 75 Periods
TEXT BOOKS							
T1	N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2016						
T2	K. R. Gopalakrishnan, "Engineering Drawing" (Vol.I& II), Subhas Publications,2014						
REFERENCES							
R1	K.V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2015						
R2	K.Venugopal&V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2014						

COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Create the projections of a points, straight lines and plane surfaces
CO 2	Illustrate top view and front view of the solids
CO 3	Sketch sectioned views and develop area required
CO 4	Demonstrate about isometric, perspective and orthographic projections
CO 5	Design simple buildings with detailed plan and sectional elevation

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	<small>(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)</small>													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	3		2				2	1	3	2		
C02	3	2	2		2						3	1		
C03	3	2	3	2	3				3		3	1		
C04	3	3	3	2	3	1	2		2		3	3	3	
C05	3	3	3	3	3			2	2	1	3	3	3	

23MCT101	ENGINEERING MATERIALS				L	T	P	C				
					3	0	0	3				
COURSE OBJECTIVES:												
<ul style="list-style-type: none"> To understand the phase diagrams those are important to design and control of heat treating process and to obtain desirable microstructures To enable students to understand the applications and selection of engineering materials based on the consideration of properties, cost, ease of manufacture, environmental issues and their in service performance To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic material 												
UNIT I	PHASE DIAGRAM							9				
Hume-Rothery theory - Phase rule, lever rule, Free energy of phase mixture Lecture, Unary systems, Effect of pressure on phase diagrams, Phase Diagrams of Binary, Eutectic, Eutectoid, peritectic, peritectoid systems, Iron carbon equilibrium diagram												
UNIT II	FERROUS AND NON-FERROUS MATERIALS							9				
Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel, Properties, Compositions and uses of Aluminium, Copper, Titanium, and Magnesium alloys. Properties of ceramic materials – Al ₂ O ₃ , SiC, Composite materials – Types, Manufacturing Properties and application												
UNIT III	PROPERTIES OF MATERIALS							9				
Mechanical Properties - Stress-strain diagrams of metallic, ceramic and polymeric materials, modulus of elasticity, yield strength, tensile strength, toughness, elongation, plastic deformation, viscoelasticity, hardness, impact strength, creep, fatigue, ductile and brittle fracture. Thermal Properties - Heat capacity, thermal conductivity, thermal expansion of materials. Environmental Degradation - Corrosion and oxidation of materials, prevention												
UNIT IV	TESTING OF MATERIALS							9				
Introduction; Indentation hardness testing: Brinell, Rockwell, Meyer, Vicker and Knoop hardness testing. Meyer's law. Micro- and nano-hardness testing. Impact testing with Charpy and Izod specimens. Drop weight testing. Fatigue and creep testing. NDE Methods – Visual, liquid penetrant testing, magnetic particle testing, ultrasonic testing, Eddy current testing												
UNIT V	ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS							9				
Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory : Tunneling – degenerate states – Fermi- Dirac Statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – paramagnetism in the conduction electrons in metals – exchange interaction and ferromagnetism – quantum interference devices – GMR devices												
L : 45					T : 0		P : 0		J : 0		Total: 45 PERIODS	
TEXT BOOKS												
T1	Callister, W.D., Materials Science & Engineering: An Introduction, Wiley & Sons (2001)											
T2	Smith, W., Principles of Materials Science and Engineering. McGraw Hill (1990)											
REFERENCES												
R1	Dieter George E. Mechanical Metallurgy, Mc-Graw-Hill Book Company (SI ed.) (1989)											
R2	Suryanarayana C. Experimental Techniques in Materials and Mechanics, CRC Press (1980)											
R3	Roesler J. H., Harders, and Baeker M., "Mechanical Behaviour of Engineering Materials: Metals, Ceramics, Polymers, and Composites", Springer-Verlag, (2007)											
R4	RK Rajput, "Engineering Materials", Chand Publishing, 2008											
R5	Michael F. Ashby and David R.H. Jones, "Engineering Materials 1: An Introduction to Properties and Applications", third edition, Elsevier Science, 2015											

COURSE OUTCOMES

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

CO1	Understand the various types of alloy structures using iron carbide equilibrium diagram and phase changes of various structures
CO2	Evaluate the effect of alloying elements, properties and application of ferrous and non-ferrous metals
CO3	Describe various methods for characterization material properties
CO4	Describe various methods of Testing of Materials
CO5	Identify Electrical and Magnetic properties of materials

COs	Mapping of Programme Outcomes / Programme Specific Outcomes (1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	3	3	2			3			2	2		
C02	3	2	2	3	2	2		3			2	2	2	
C03	3	2	2	3	2	2		3	2	1	2	1		
C04	3	2	3	3	2		2	3	2	1	2	2	3	
C05	3	3	2	3	2			3			2	2	3	

23GET104	TAMILS AND TECHNOLOGY (Common to all B.E. / B. Tech. Courses)				
	L	T	P	C	
UNIT I	WEAVING AND CERAMIC TECHNOLOGY			3	
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries					
UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY			3	
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period					
UNIT III	MANUFACTURING TECHNOLOGY			3	
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beads - Archeological evidences - Gem stone types described in Silappathikaram.					
UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY			3	
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society					
UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING			3	
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project					
		L : 15	T:0	P: 0	Total: 15 PERIODS
TEXT BOOKS & REFERENCES					
<ol style="list-style-type: none"> 1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) 2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies) 3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies) 4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies. 5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) 7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 8. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book 					

23CHP101	CHEMISTRY LABORATORY				L	T	P	C
[Common to All Branches]					0	0	2	1
COURSE OBJECTIVES:								
<ul style="list-style-type: none"> To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity, hardness, DO, chloride and copper To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions 								
LIST OF EXPERIMENTS								
<ol style="list-style-type: none"> Estimation of alkalinity of water sample by indicator method Determination of hardness of water sample by EDTA method Estimation of Dissolved oxygen in water sample by Winkler's method Estimation of Chloride in water sample by Argentometric method Estimation of copper in brass by EDTA method Determination of strength of HCl and CH₃COOH present in a mixture conductometrically Estimation of strength of iron by potentiometric titration Determination of molecular weight of given polymer by Ostwald's viscometer Determination of Strength of HCl by pH metry Determination of corrosion rate of mild steel by weight loss method <p>Demo Experiments</p> <ol style="list-style-type: none"> Synthesis of nanomaterials by chemical precipitation method Estimation of strength of iron by spectrophotometry 								
					L:0	T:0	P: 30	Total: 30 Periods
TEXT BOOKS								
T1	Department of Chemistry SNSCT "Chemistry Laboratory Manual", 2019.							
REFERENCES								
R1	J.Mendham, R.C.Denney, J.D.Bames, M.Thomas and B.Sivasankar, Vogel's "Text book of Quantitative chemical analysis", 6th edition, EBS, 2009.							
COURSE OUTCOMES								
At the end of the course students should be able to								
CO 1	Analyze the quality of water samples through basic techniques							
CO 2	Estimate the amount of metal ions in domestic and industry water							
CO 3	Determine the absolute viscosity and molecular weight of Organic solvents							
CO 4	Interpret the corrosion rate of metals							

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1		2					1			
CO2	3	3	1	1		1					1			
CO3	3	3	1	1		2					1			
CO4	3	3	1	1		2					1			

23ITP101	PROGRAMMING IN C AND DATA STRUCTURES LABORATORY	L	T	P	C
[Common to Mech, MCT, and ECE]		0	0	4	2
COURSE OBJECTIVES :					
<ul style="list-style-type: none"> • To train the student to the basic concepts of the C-programming language • To design and analyze simple linear and nonlinear data structures 					
List of Experiments					60
<ol style="list-style-type: none"> 1. Algorithms and Flow Chart <ol style="list-style-type: none"> a) Sequential b) Branching and Looping 2. Operators & Expressions <ol style="list-style-type: none"> a) Arithmetic b) Logical c) Relational 3. Condition Statements <ol style="list-style-type: none"> a) Nested if else b) Else-if Ladder 4. Looping <ol style="list-style-type: none"> a) For b) While c) Do-while 5. Functions <ol style="list-style-type: none"> a) With and without arguments b) With and without return type c) Call by value and Call by reference 6. Arrays <ol style="list-style-type: none"> a) Searching element in one dimensional array b) Matrix multiplication 7. Structures 8. Pointers 9. Implementation of Stack ADT 10. Implementation of Queue ADT 11. Implementation of Tree Traversal 12. Implementation of Binary Search Tree ADT 					
L:0		T:0	P: 60	Total: 60 Periods	
HARDWARE / SOFTWARE REQUIRED (For a Batch of 30 Students)					
Hardware					
<ul style="list-style-type: none"> • 30 PCs with Processor-2.0 GHz or Higher • RAM-1 GB or Higher • Hard disk-20 GB or Higher 					
Software					
<ul style="list-style-type: none"> • TURBO C version 3 (or) GCC version 3.3.4 • OS-Windows2000/Windows XP/NT 					
COURSE OUTCOMES					
At the end of the course students should be able to					
CO 1	Develop algorithm and draw flow chart to solve problem				
CO 2	write simple programs using basic concepts and control statements in C language.				
CO 3	write programs using arrays, structures and pointers.				
CO 4	Implement stack and queue data structure				
CO 5	Implement binary search tree ADT				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3	3	2										
C02	3	3	2	1										
C03	3	3	2	1										
C04	3	3	2	2		1								
C05	3	3	2	2		1								

23MCP101	INTERNSHIP - I	L	T	P	C
		-	-	-	1
<ol style="list-style-type: none"> 1. The Internship is provided for the students to update themselves with the recent Technologies and professional skills for better prospects in the future 2. Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by the concern and written consent of the student and parents 3. Student is supposed to produce joining letter and relieving letter once the internship is over in case of offline internship in any industry 4. Online internship in industry / other agencies 5. Seminar by student under mentorship of a faculty 6. A detailed report shall be submitted based on his Internship and shall be done by only one student 7. A Mini Project- on some suitable topic related to the branch of study. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc., depending on the branch of the student. Preferably a single student should do it <p>Student has to prepare detailed report and submit to his/her college</p> <ol style="list-style-type: none"> 8. A copy of report can be kept in the departments for record 9. Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor 10. The evaluation of the work done by students will be carried by the internal and external examiner 11. External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks 12. The presentation by student in the presence of all students is desirable 13. Student should produce successful completion certificate in case of offline / online internship in industry 					
					2 Weeks

23HST103	INDIAN CONSTITUTION (Common to All B.E. / B. Tech. Courses)			L	T	P	C
				2	0	0	0
UNIT I	INTRODUCTION					6	
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens							
UNIT II	STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT					6	
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review							
UNIT III	STRUCTURE AND FUNCTION OF STATE GOVERNMENT					6	
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts							
UNIT IV	CONSTITUTION FUNCTIONS					6	
Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India							
UNIT V	ELECTION COMMISSION					6	
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women							
				L :30	T: 0	P: 0	T:30 PERIODS
TEXT BOOKS							
T1	Durga Das Basu, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi						
T2	R.C.Agarwal, “Indian Political System”, S.Chand and Company, New Delhi. (1997)						
REFERENCES							
R1	Maciver and Page, “ Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi						
R2	K.L.Sharma, “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi. (1997)						
R3	Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, NewDelhi.						
R4	U.R.Gahai, “Indian Political System”, New Academic Publishing House, Jalaendhar						
R5	R.N. Sharma, “Indian Social Problems”, Media Promoters and Publishers Pvt. Ltd						
COURSE OUTCOMES :							
At the end of the course students should be able to							
CO1	Understand the functions of the Indian government						
CO2	Know the structure and functioning of central government						
CO3	Understand functioning of Indian constituent						
CO4	Analyze the functions of the Indian government						
CO5	Summarize the functioning of election commission						

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3		2								3		
C02					3					3			2	
C03	3		3		3						1	2		
C04			3				2					3		
C05	3	3		2								3	3	

SEMESTER III

23MAT201	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
[Common to AEROSPACE,AGRI,AUTO,BME,CIVIL,ECE,EEE,FT,MECH,MCT]		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To acquaint the students with Differential Equations which are significantly used in engineering problems To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems 					
UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	9			
Formation of partial differential equations – Solutions of standard types of first order partial differential equations – Lagrange’s linear equation – Linear partial differential equations of second order with constant coefficients of homogeneous types – Applications					
UNIT II	FOURIER SERIES	9			
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis					
UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9			
Classification of PDE – Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only)					
UNIT IV	FOURIER TRANSFORMS	9			
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity					
UNIT V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	9			
Z-transforms – Elementary properties – Initial and final value theorems – Inverse Z-transform using partial fraction and convolution theorem – Formation of difference equations – Solution of difference equations using Z - transforms					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	Kreyszig,E, Advanced Engineering Mathematics, John Wiley and Sons, 10 th Edition, New Delhi 2016				
T2	Grewal.B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44 th Edition, 2018				
REFERENCES					
R1	Bali. N.P, Goyal. M. and Watkins. C., Advanced Engineering Mathematics, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7 th Edition, 2009				
R2	James. G., "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, New Delhi, 2016				
R3	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018				
R4	Wylie. R.C. and Barrett . L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012				

R5	Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Discuss partial differential equations and solve certain types of partial differential equations
CO 2	Demonstrate differential equations using Fourier series analysis which plays a vital role in Engineering applications
CO 3	Utilize the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations
CO 4	Analyze the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some physical problems of engineering
CO 5	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3			2			2			2			
C02	3	3			2			2			2			
C03	3	3			2			2			2			
C04	3	3			2			2			2			
C05	3	3			2			2			2			

23MCT201		SOLID MECHANICS			
		L	T	P	C
		3	0	0	3
PRE-REQUISITES: Studying Mechanics of solids requires knowledge of Engineering Mechanics. One should have sufficient knowledge about Moments, Forces, System of forces, Centroids, Moment of Inertia, Stress and strain					
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To ensure that the structure or the member which is designed will not fail under applied loads To determine whether the properties of materials used is acceptable 					
UNIT I	SIMPLE STRESSES AND STRAINS				9
Elasticity and plasticity- Types of stresses and strains- Hookes's law- Stress-strain diagram for mild steel- Working stress- Factor of safety- Lateral strain, Poisson's ratio and volumetric strain, Elastic moduli and the relationship between them- Bars of varying section- Composite bars- Temperature stresses, Strain energy- Resilience, Gradual, sudden, impact and shock loadings					
UNIT II	SHEAR FORCE AND BENDING MOMENT				9
Types of beams- Concept of shear force and bending moment, S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads- Point of contra flexure- Relation between S.F, B.M and rate of loading at a section of a beam					
UNIT III	FLEXURAL AND SHEAR STRESSES				9
Theory of simple bending – Assumptions- Derivation of bending equation, Neutral axis- Determination bending stresses- section modulus of rectangular and circular sections (Solid and Hollow)- Design of simple beam sections - Shear stress distribution across various beams section like rectangular, circular, triangular sections					
UNIT IV	DEFLECTION OF BEAMS AND BUCKLING OF COLUMNS				9
Elastic curve of Neutral axis of the beam under normal loads - Evaluation of beam deflection and slope: Double integration method, Macaulay Method - Columns- End conditions - equivalent length of a column -Euler equation -Slenderness ratio -Rankine formula for columns					
UNIT V	TORSION & SPRINGS				9
Theory of pure torsion-Derivation of Torsion equations, Assumptions made in the theory of pure torsion- Torsional moment of resistance-Polar section modulus-Power transmitted by shafts-Combined bending and torsion and end thrust - Application to closely coiled helical springs - Maximum shear stress in spring section including Wahl Factor - Deflection of helical coil springs under axial & torsion loads					
		L : 45	T: 0	P: 0	Total: 45 PERIODS
TEXT BOOKS					
T1	R.K.Rajput, "Strength of Materials", S.Chand and Company Ltd., New Delhi 2021				
T2	R.S.Khurmi, "Strength of Materials", S.Chand and Company Ltd. New Delhi 2019				
REFERENCES					
R1	Popov E.P, "Engineering Mechanics of Solids", Prentice - Hall of India, New Delhi, 2019				
R2	Ryder G.H, "Strength of Materials, Macmillan India Ltd". Third Edition, 2020				
R3	Strength of materials by S.S.Rattan, Tata McGraw Hill Education Pvt..Ltd.				
R4	Singh D.K "Mechanics of Solids" Pearson Education				
R5	Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books				
COURSE OUTCOMES					
At the end of the course student should be able to:					
CO1	Describe the fundamentals about the simple stresses, strains, and deformation in components due to external loads				
CO2	Draw the shear force and bending moment diagrams for various beams				
CO3	Evaluate the shear stresses developed in beams of different cross sections				
CO4	Determine the sloped deflection of the beams and buckling of columns				
CO5	Explain the effect of torsion on shaft and helical springs				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	2											2	2	
C02			3	2								3	3	
C03				2							2	2	2	
C04			2	2								2	3	
C05	2		3	2								3	3	

23MCT202	DESIGN OF DIGITAL CIRCUITS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the Digital fundamentals, Boolean algebra and its applications in digital systems To familiarize with the design of various combinational and Sequential digital circuits using logic gates 					
UNIT I	MINIMIZATION TECHNIQUES AND LOGIC GATES	9			
Number System and Codes - Boolean Algebra and Theorems - Boolean expression and Minimization of Boolean expressions — Minterm and Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization and Don't care conditions – Quine McCluskey method of minimization – Logic gates and Implementations					
UNIT II	COMBINATIONAL CIRCUITS	9			
Design procedure – Half adder and Full Adder – Half subtractor and Full subtractor – Multiplexer and Demultiplexer – decoder and encoder – parity checker – parity generators – code converters - Magnitude Comparator					
UNIT III	SEQUENTIAL CIRCUITS	9			
Latches, Edge triggered Flip flops - SR, JK, T, D and Master slave – Characteristic table and equation, Application table – Synchronous counter - Asynchronous counters - Design of synchronous counters - up/down counter – Modulo n counter - Decade counters					
UNIT IV	DESIGN OF SEQUENTIAL CIRCUITS	9			
Register - shift registers - Universal shift register –Shift counters - Classification of sequential circuits: Moore and Mealy - Design of synchronous sequential circuits - state diagram, State table - State minimization, State assignment - Introduction to Hazards: Static, Dynamic					
UNIT V	MEMORY AND PLD	9			
Memories: ROM, PROM, EPROM, EEPROM - RAM, SRAM & DRAM - Programmable Logic Devices: Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Implementation of combinational logic using PROM - PLA – PAL - Digital logic families: TTL, ECL and CMOS - Introduction to Hardware Description Language (HDL)					
		L : 45	T: 0	P: 0	Total: 45 PERIODS
TEXT BOOKS					
T1	M. Morris Mano, “Digital Design”, 4th Edition, Prentice Hall of India Pvt. Ltd., 2017				
T2	S.Salivahanan and S.Arivazhagan, “Digital Circuits and Design” Third Edition, Oxford University Press, New Delhi, 2018.				
REFERENCES					
R1	Roger L. Tokheim, “Digital Electronics: Principles and Applications”, 9th Edition, McGraw-Hill Education, 2013				
R2	Charles H.Roth. “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013				
R3	Donald P.Leach and Albert Paul Malvino, “Digital Principles and Applications”, 8th Edition, Tata Mc-Graw Hill Publishing company limited, New Delhi, 2014				
R4	John F.Wakerly, “Digital Design”, Fifth Edition, Pearson/PHI, 2017				
R5	William Kleitz, "Digital Electronics: A Practical Approach with VHDL" 9th Edition, Pearson, 2020				
COURSE OUTCOMES					
At the end of the course student should be able to:					
CO1	Understand the different techniques used for simplification of Boolean expressions				
CO2	Illustrate the working mechanism and design guidelines of different combinational circuits				
CO3	Analyze the working mechanism and design guidelines of different sequential circuits				
CO4	Design a Sequential Logic Circuits using different Flipflop				
CO5	Classify the different memories and explain the basic concepts of Programmable logic devices				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO1	PSO2	PSO3
C01	3		2					1			2		2	
C02		3												
C03				2				2				2		
C04			3								3			
C05						2								

23MCT203	PRODUCTION TECHNOLOGY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To understand the concept and basic mechanics of metal cutting, working of standard machine tools To understand the basic concepts of Traditional and non-traditional machining processes To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, forming and powder metallurgy and their relevance in current manufacturing industry 					
UNIT I	THEORY OF METAL CUTTING				9
Orthogonal and oblique cutting– Classification of cutting tools: Single, Multipoint – Tool signature for single point cutting tool – Mechanics of orthogonal cutting – Chip formation and Chip Breakers– Cutting tool materials– Tool wear and tool life – Machinability – Cutting Fluids					
UNIT II	MACHINING PROCESS				9
Conventional Machining Process - General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Milling, Drilling, Grinding NON- Conventional Machining Process EDM, ECM, AJM, USM, LBM process principle, and their applications (with schematic diagrams only)					
UNIT III	CASTING AND WELDING				9
Casting - Pattern and Core making – Moulding sand – Melting furnaces Cupola and Induction furnaces. Special casting processes – Shell, Investment, Die casting – Defects in casting Welding - Gas welding Types, Flame characteristics - Basic Arc Welding Processes, MIG & TIG, Thermit Welding - Electron Beam Welding - Friction Welding - Brazing and soldering – Defects in Welding					
UNIT IV	METAL FORMING AND POWDER METALLURGY				9
Principles and applications of the following processes: Extrusion, Forging, Rolling and Drawing. Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy – Simple Case Studies					
UNIT V	CNC MACHINING				9
Evolution of CNC Technology - CNC and DNC concept - CNC Machines Drives: Stepper Motor, Servo Motor - Economics and maintenance of CNC Machines - Factors influencing selection of CNC Machines - Preventive Maintenance - Diagnostic techniques. Basic CNC Programming using G Codes, M Codes for turning and facing operations					
		L : 45	T: 0	P: 0	Total: 45 PERIODS
TEXT BOOKS					
T1	Kalpakjian, S., “Manufacturing Engineering and Technology”, Pearson education India, 4th edition, 2001(ISBN 81 78081 571)				
T2	Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005				
REFERENCES					
R1	Sharma, P.C., “A textbook of Production Technology – Vol I and II“, S. Chand & Company Ltd., New Delhi, 1996				
R2	Gowri P. Hariharan, A.Suresh Babu, “Manufacturing Technology I”, Pearson Education, 2008				
R3	P.N.Rao, “Manufacturing Technology Vol I”, Tata-McGraw-Hill Publishing Ltd, 2010				
R4	Chua, C K., Leong, K F and Lim, C S., “Rapid Prototyping: Principles and Applications”, John Wiley, New York, 2003				
R5	YoreurKoren, “Computer Control of Manufacturing Systems”, Pitman, London, 1987				

COURSE OUTCOMES**At the end of the course student should be able to:**

CO1	To Understand the basics of cutting, cutting tools, and tool wear
CO2	To Gather knowledge about the conventional and unconventional machining processes
CO3	To meet knowledge about the basic casting and welding
CO4	To know the concepts of forming of materials
CO5	To have an basic exposure towards CNC machines

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3				2				1		3		
C02		3	3							3			3	
C03		2		3			2					2		
C04														
C05														

23MCT204	THEORY OF CONTROL ENGINEERING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To learn various methods for analyzing the time response, frequency response and stability of the systems To know about the state variable methods of control system analysis and stability analysis 					
UNIT I	INTRODUCTION				9
Basic elements in control systems - Open and closed loop systems - Transfer function - Mathematical modelling of: electrical systems, mechanical systems, electro-mechanical systems,-State-space modelling of dynamical systems					
UNIT II	CONTROL SYSTEM REPRESENTATION				9
Block diagrams reduction technique -Signal flow graph -Mason's gain formula -Linearity versus nonlinearity-time invariance versus time variance -Linearity time invariance versus nonlinearity time variance					
UNIT III	TIME RESPONSE OF DYNAMICAL SYSTEMS				9
Step response of standard first order and second order systems - time-domain specifications and their formulae -Definition of stability – Routh Hurwitz test -Basic idea of feedback control systems -Error analysis -P, PI, PD, PID controllers					
UNIT IV	FREQUENCY DOMAIN ANALYSIS				9
Bode plot -Nyquist plot and Nyquist stability criterion -Polar plot Gain and phase margins -robustness. Lead compensator -lag compensator – lead lag/lag lead compensators and their design					
UNIT V	INTRODUCTION TO SCILAB				9
Study of basic Commands in SCILAB -Program to implement Arithmetic Operations - Relational and Logical Operations - Control structures : if else, for and while and break and continue -Develop PID Controller - Simulation of Object Detection for Robot - basic Commands in MATLAB - Creating simple plots in MATLAB					
		L : 45	T: 0	P: 0	Total: 45 PERIODS
TEXT BOOKS					
T1	Franklin G.F., Powell J.D., Emami-Naeini A., Feedback Control of Dynamic Systems, Pearson, Upper Saddle River, New Jersey, 8th edition, 2020				
T2	Ogata K., Modern Control Engineering, Prentice-Hall of India Pvt Ltd., New Delhi, 5th edition, 2010				
REFERENCES					
R1	Dr Sandeep Nagar "Introduction to SCILAB: For Engineers and Scientists" APress, November 2017				
R2	S.K.Bhattacharya, "Control System Engineering", Pearson, 3 rd Edition, 2013				
R3	Benjamin C. Kuo and Farid Golnaraghi "Automatic Control Systems" 10th edition, 2017				
R4	I.J. Nagrath and M. Gopal "Control Systems: Engineering", 6th Edition, New Age International Publisher, 2017				
R5	A. Nagoor Kani "Control Systems Engineering" 5th edition, CBS Publishers & Distributors Pvt. Ltd., 2020				
COURSE OUTCOMES					
At the end of the course student should be able to:					
CO1	Compute the transfer function of different physical systems				
CO2	Illustrate reduction technique and representation of open loop and closed loop system				
CO3	Analyse the time domain specification and design the various controllers				
CO4	Analyze the frequency response characteristics and study of compensators				
CO5	Simulation and Implementation of various commands in SCILAB				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3		2								3		
C02					3					3			2	
C03	3		3		3						1	2		
C04			3				2					3		
C05	3	3		2								3	3	

23GET275	VQAR-I				L	T	P	C
[Common to All B.E. / B. Tech. Courses]					2	0	0	2
COURSE OBJECTIVES:								
<ul style="list-style-type: none"> To understand quantitative aptitude for financial applications & analytical and logical reasoning skills in verbal ability To grasp fundamental grammar and comprehension skills for effective communication 								
UNIT I	QUANTITATIVE ABILITY I							8
Number theory- Shortcuts, Divisibility rule- Unit place deduction-LCM &HCF, Square root and Cube Root, Decimal & Fraction Percentage, Profit, loss and discount, Simple and compound interest, Ratio & Proportions, Mixtures & Allegation, Partnership								
UNIT II	QUANTITATIVE ABILITY II							6
Problems on Ages, Average, Clocks, Calendar & Data Interpretation- Bar chart- Pie chart- Line chart- Tables chart								
UNIT III	VERBAL REASONING I							7
Analytical reasoning– Linear and circular arrangement, Blood relation, Direction Problems, Puzzles. Logical reasoning - Number and Alpha series, Odd man out, Element series and Logical series, Coding and decoding, Analogy, Classification, Logical sequence of words								
UNIT IV	LINGUISTICS SKILLS I							6
Parts of Speech- Noun, Verb, Participle, Articles, Pronoun, Preposition, Adverb, Conjunction. Logical Sequence of words, Tense & Voice, Comparison								
UNIT V	LINGUISTICS SKILLS II							3
Comprehension - Comprehend and understand a paragraph, Paragraph writing								
					L:30	T:0	P: 0	Total: 30 Periods
TEXT BOOKS								
T1	Rajesh Varma, “Fast Track Objective Arithmetic”, Arihant Publications							
T2	M. K. Panday, “Analytical Reasoning”, Magical Series							
REFERENCES								
R1	R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication							
R2	R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”,S.Chand & Company Pvt Limited							
R3	R.S.Agarwal, “A modern approach to Verbal & Non-verbal reasoning”, S.Chand & Company Pvt Limited							
R4	John Eastwood, “Oxford Practice Grammar”, Oxford							
COURSE OUTCOMES								
At the end of the course students should be able to								
CO 1	Apply the number system for solving application-orientated concepts in quantitative aptitude							
CO 2	Apply the financial ability for solving application-orientated concepts in quantitative aptitude and in the data interpretation techniques							
CO 3	Analyze the analytical reasoning and logical reasoning in verbal aptitude applications							
CO 4	Apply appropriate grammar in both speaking and writing							
CO 5	Analyze the given content and write a creative content							

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3			2									
C02	3			3						3				
C03		3	2						3					
C04							2	2	3					
C05			3						3		3			

23ITP204	PROGRAMMING IN PYTHON	L	T	P	C
[Common to All B.E/B.Tech Programme Except CSE, IT and AIML]		0	0	4	2
COURSE OBJECTIVES :					
<ul style="list-style-type: none"> To train the student to the basic concepts of python programming language To develop correct and efficient Python programs to solve problems spanning multiple disciplines 					
List of Experiments					60
<ol style="list-style-type: none"> 1. Program for various base conversion functions 2. Programs to demonstrate the usage of operators and conditional statements 3. Programs to demonstrate usage of control structures 4. Program using array operation 5. Programs to demonstrate the usage of String functions 6. Program using classes and functions 7. Program to implement recursive function 8. Program to implement lambda function 9. Program on file manipulation 10. Programs to demonstrate the usage of lists, sets, dictionaries and tuples 11. Program to implement function template 12. Program to implement class template 					
		L:0	T:0	P: 60	Total: 60 Periods
COURSE OUTCOMES					
At the end of the course students should be able to					
CO 1	Write simple programs using built-in data types of Python				
CO 2	Apply the conditional statements and loops for solving problems				
CO 3	Implement arrays, strings and functions in Python				
CO 4	Identify the commonly used operations involving lists, sets, dictionaries, tuples and file handling in real time applications				
CO 5	Implement exemplary applications related to templates for solving real time problems				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1									
CO2	3	3	2	1	1									
CO3	3	3	2	1	1						1			
CO4	3	3	2	2	1	1					1			
CO5	3	3	2	2	1	1					1			

23MCP201	MINI PROJECT - I	L	T	P	C
		0	0	2	1
Guidelines					
<ol style="list-style-type: none"> 1. The scope of the project work is to enable the students in convenient groups (not more than 4 members) involving theoretical and experimental studies through Design Thinking approach 2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem based on the courses such as Design of Digital Circuits , Production Technology, Theory of Control Engineering , Solid Mechanics, Python programming Essentials studied by the students in the current semester of study 3. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project 4. Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement the same. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for feature work 5. The continuous assessment shall be made according to the regulation which is tabulated below. 6. The progress of the project is evaluated based on a minimum of two reviews 7. The review committee may be constituted by the Head of the Department 8. Each student shall finally produce a comprehensive report covering background information, empathy, problem statement, project work details, result, conclusion and publications 9. This final report shall be typewritten form as specified in the guidelines 					
		L : 0	T: 0	P: 30	Total: 30 PERIODS

SEMESTER IV

23MAT205	PROBABILITY, STATISTICS AND NUMERICAL METHODS	L	T	P	C
[Common to CIVIL and MCT]		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To develop Probability techniques in manufacturing and quality evaluation process • To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines 					
UNIT I	PROBABILITY AND RANDOM VARIABLES	9			
Axioms of probability - Conditional probability - Total probability - Baye's theorem- Discrete and continuous random variables – Moments – Moment generating functions and their properties					
UNIT II	TESTING OF HYPOTHESIS	9			
Sampling distributions – Tests for single mean, proportion and difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes					
UNIT III	SOLUTIONS OF EQUATIONS	9			
Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Pivoting Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidal					
UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	9			
Lagrange's interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single integration using Trapezoidal and Simpson's 1/3 rules					
UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	9			
Single step methods: Taylor's series method – Euler's method – Modified Euler's Method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne's predictor-corrector methods for solving first order equations					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and statistics for Engineers", Pearson Education Asia, 9th Edition, 2018				
T2	Grewal, B.S and Grewal, J.S, "Numerical methods in Engineering and Science", 10 th Edition, Khanna Publishers, New Delhi, 2015				
REFERENCES					
R1	Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010				
R2	Burden, R.L and Faires, J.D, "Numerical Analysis", 9 th Edition, Cengage Learning, 2016.				
R3	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8 th Edition, 2014				
R4	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7 th Edition, 2007				

R5	Spiegel,M.R., Schiller, J. and Srinivasan,R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill edition, 4th Edition, 2012
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Revise fundamental knowledge of the concepts of probability distributions which can describe real life phenomenon
CO 2	Apply the statistical concepts and tools for engineering applications and to use different types of research methodology techniques for decision making under uncertainty
CO 3	Compute the algebraic equations representing steady state models formed in engineering problems
CO 4	Demonstrate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems
CO 5	Predict the system dynamic behaviour through solution of ODEs modelling the system

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3			2			2			2			
C02	3	3			2			2			2			
C03	3	3			2			2			2			
C04	3	3			2			2			2			
C05	3	3			2			2			2			

23MCT205	MECHANICS OF MACHINES			L	T	P	C
				3	0	0	3
Course Objective:							
1. To understand the basic components and layout of linkages in the assembly of a machine and mechanisms							
2. To understand the basic concepts of toothed gearing and kinematics of gear trains in machine components							
3. To understand the principles in force analysis and learn the basic concept of static and dynamic balancing and vibration							
UNIT I	KINEMATICS OF MECHANISMS						9
Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons (Velocity, Acceleration and Displacement diagram only graphical method)							
UNIT II	KINEMATICS OF CAMS						9
Types of cams and followers - Terminology and definitions – Displacement diagrams – SHM, uniform velocity, uniform acceleration and retardation. Graphical constructions of cam profiles – Disc cam with knife edge follower, roller follower and flat-faced follower							
UNIT III	GEARS AND GEAR TRAINS						9
Spur gear terminology – law of toothed gearing – Involute gearing – Path of contact, arc of contact and contact ratio. Interchangeable gears – Gear tooth action – interference and undercutting – Gear trains – Epicyclic gear train – tabular method of finding velocity ratio							
UNIT IV	FORCE ANALYSIS						9
Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis Inertia Forces and Inertia Torque – D’Alembert’s principle – superposition principle – dynamic Force Analysis in simple machine members							
UNIT V	BALANCING AND VIBRATION						9
Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft							
				L :45	T: 0	P: 0	Total: 45 PERIODS
TEXT BOOKS							
T1	Khurmi R.S& Gupta J.S, “Theory of Machines”, 14 th Edition, S.Chand & Company, 2020						
T2	Singh V.P, “Mechanical Vibrations”, 3rd Edition, Dhanpatrai & Co., 2016.						
REFERENCES							
R1	Rattan.S.S, “Theory of Machines”, Tata McGraw Hill Education Private Limited, 5 th Edition, 2019.						
R2	Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, East West Press, 3rd Edition, 2008.						
R3	Ashok G. Ambekar, “Mechanism and Machine Theory”, 1st Edition, PHI Learning Private limited, 2009.						
R4	Gordon R Pennock, Joseph E Shigley, “Theory of Machine and Mechanisms SI Edition, 4th Edition, Oxford University Press, 2014						
R5	Bansal R.K., “Theory of Machines”, Laxmi Publications Pvt Ltd., New Delhi, 20th edition 2009.						
COURSE OUTCOMES							
At the end of the course student should be able to:							
CO1	Understand the fundamentals of Mechanisms						
CO2	Interpret the various concepts of kinematics of Cams						
CO3	Analyze the working of gears and gear train						
CO4	Conceive the fundamentals of Force Analysis						
CO5	Calculate the balancing masses and their locations of reciprocating and rotating masses						

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3												2	
C02	3	3										2	2	
C03	3												2	
C04	3	2											2	
C05	3	2											2	

23MCT206	ELECTRICAL DRIVES AND CONTROL	L	T	P	C
		2	0	0	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To provide knowledge in fundamentals of Electric Machines performance and control drives 					
UNIT I	OVERVIEW OF ELECTRICAL DRIVE				6
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and load variation factors					
UNIT II	ELECTRICAL MOTORS				6
Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, universal motor, servo motor, stepper motor					
UNIT III	SPEED CONTROL AND STARTING				6
Speed control of D.C series and shunt motors- speed control of single and three phase induction motors –starting methods of D.C. motor and three phase induction motors					
UNIT IV	SOLID STATE SPEED CONTROL OF D.C DRIVES				6
Power electronic devices, Controlled rectifiers and choppers, Speed control of DC series and shunt motors using controlled rectifiers -Application of DC Servo drives in mechatronics					
UNIT V	SOLID STATE SPEED CONTROL OF A.C DRIVES				6
Inverters and voltage regulators, Speed control of three phase induction motor – Voltage control, voltage / frequency control and slip power recovery scheme using inverters and AC voltage regulators – applications, Speed control of AC Servo in Robotic Application					
		L :30	T: 0	P: 0	Total: 30 PERIODS
TEXT BOOKS					
T1	D.P.Kothari and I.J.Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill publishing company ltd, second edition, 2017 (Reprint)				
T2	S.K.Pillai, “ A First Course on Electrical Drives” New age publishing Ltd, 2019				
REFERENCES					
R1	Metha. V.K. & Rohit Metha, "Principle of Electrical Engineering", S.Chand & Co 2016				
R2	Vedam Subramaniam. "Electric Drives", Tata McGraw Hill , New Delhi ,2017				
R1	P.S Bimbhra, “Power Electronics”, Khanna Publishers, Pvt Ltd, 2014				
R2	Dubey.G.K. “Fundamental Electrical Drives” 2nd Edition, Narosa Publications, 2022				
R5	Bhattacharya S.K. & Brijinder Singh , "Control of Electrical Machines", New Age International Publishers, 2022				
COURSE OUTCOMES					
At the end of the course student should be able to:					
CO1	Apply the concept of selection of different electrical motors for drives				
CO2	Understand the principle of operation of AC and DC motors				
CO3	Recognize the conventional method of speed control for DC and AC motors				
CO4	Employ the implementation of solid state speed control for DC motors				
CO5	Employ the implementation of solid state speed control for AC motors				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01			3					3			3			
C02		2			3								3	
C03	3								2					
C04	3		1										2	3
C05		2					3					2		3

23CST205	Object Oriented Programming Using Java	L	T	P	C
[Common to ECE, EEE, BME]		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To understand the basic concepts and fundamentals of platform independent object-oriented language. Able to solve real world problems using OOP techniques 					
UNIT I	INTRODUCTION TO OOP	9			
Object Oriented Programming concepts–Objects–Classes–Inheritance– polymorphism – Abstraction– Encapsulation, Features of Java, Byte code and Java Virtual Machine, JDK					
UNIT II	INTRODUCTION TO JAVA	9			
Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java					
UNIT III	OBJECTS AND CLASS	9			
Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference					
UNIT IV	INHERITANCE AND POLYMORPHISM	9			
Inheritance- Super class - Sub class - protected members - constructors in sub class – Overriding – Abstract class-Final methods and classes, Interfaces, Packages					
UNIT V	MULTITHREADING IN JAVA	9			
Multithreading - Thread life cycle and methods, Thread Creation, Thread synchronization, Inter-thread communication, Exception handling with try-catch-finally					
		L:45	T:0	P: 0	Total: 45 Periods
TEXT BOOKS					
T1	Herbert Schildt, “Java: The Complete Reference”, 11 th Edition, McGraw Hill Education, New Delhi, 2019				
REFERENCES					
R1	Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11 th Edition, Prentice Hall, 2018				
COURSE OUTCOMES					
At the end of the course students should be able to					
CO 1	Understand the basic concepts of OOP				
CO 2	Adapt control structures and looping in solving problems				
CO 3	Apply the concepts of classes and objects in real time applications				
CO 4	Develop programs using inheritance, packages and interfaces				
CO 5	Make use of exception handling mechanisms and multithreaded model to solve real world problems				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	1	2		2								2	1	
C02	1	1		2	1							1	2	
C03	1	2		1		2						1	2	
C04	2		2				2			1		2		
C05			2	2		2				1				

23GET276	VQAR-II				L	T	P	C
[Common to All B.E. / B. Tech. Courses]					2	0	0	2
COURSE OBJECTIVES:								
<ul style="list-style-type: none"> To understand time, distance, and counting techniques like permutation and combination for quantitative applications To develop verbal and non-verbal reasoning skills along with linguistic abilities for effective communication 								
UNIT I	QUANTITATIVE ABILITY III							6
Time, speed & distance-Average speed- Relative speed- Train problems- Boats and streams- Races, Chain rule, Time and work -Pipes and cisterns								
UNIT II	QUANTITATIVE ABILITY IV							4
Permutation & Combination, Probability, Mensuration								
UNIT III	VERBAL REASONING II							7
Machine Input and Output, Coded Inequalities, syllogisms, Problems on Cubes, Data sufficiency. Critical Reasoning -Statement and Argument, Statement and Assumption, Statement and Conclusion, Cause and effect, Course of action								
UNIT IV	NON- VERBAL REASONING							5
Figure series, Odd man out, Mirror Image, Water image, Embedded Image, Cubes and Dices, Insert the Missing Characters, Analytical reasoning								
UNIT V	LINGUISTICS SKILLS III							8
Sentences - Simple, Compound, Complex & Mixed sentences, Sentence Rearrangement, Idioms & Phrases, Reading Comprehension at higher level, Word Substitution, Synonyms & Antonyms, Error Spotting								
					L:30	T:0	P: 0	Total: 30 Periods
TEXT BOOKS								
T1	Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications							
T2	M.K.Panday, "Analytical Reasoning", Magical Series							
REFERENCES								
R1	BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications							
R2	S.P.Bakshi, "Objective English" Arihant Publications							

R3	R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited
R4	R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand & Company Pvt Limited
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Apply the time and distance for solving application orientated concepts in quantitative aptitude
CO 2	Apply the financial ability for solving application orientated concepts in quantitative aptitude
CO 3	Analyze the verbal reasoning and the critical reasoning in quantitative aptitude
CO 4	Analyze the non-verbal reasoning in verbal aptitude applications
CO 5	Apply appropriate LSRW skills

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	3		3										
C02	3			2						3				
C03		2	2						2					
C04		3				2			3					
C05							3	2	3					

23MCB201	FLUID MECHANICS AND THERMAL SYSTEMS	L	T	P	C
		2	0	2	3
CAREER OBJECTIVES:					
<ul style="list-style-type: none"> To understanding basic laws, principles and phenomena in the fluid mechanics and the importance of various types of flow in pumps and turbines To apply the concepts and laws of thermodynamics for cycle analysis and performance of Internal Combustion engines and Air Compressor 					
UNIT I	FLUID CONCEPTS AND PROPERTIES	6 + 6			
Introduction to Fluid – Definition, real and ideal fluids - Units and dimensions - Properties of fluids - Density, Specific weight, Specific volume, Specific gravity, Viscosity, Capillary and Surface tension, Compressibility and Vapour pressure					
<i>Determination of the coefficient of discharge of given orifice meter Determination of the coefficient of discharge of given Venturimeter</i>					
UNIT II	FLUID KINEMATICS AND DYNAMICS	6 + 6			
Fluid Kinematics – Introduction and types of flow – continuity equation (one, two and three dimensional differential forms)					
Fluid dynamics – Euler’s equation of motion – Euler’s equation of motion along a streamline – Bernoulli equation and its application -Fluid flow - Flow through pipes - Darcy -Weisbach equation - Friction factor – Major and minor losses					
<i>Determination of major losses in pipes Determination of minor losses in pipes</i>					
UNIT III	HYDRAULIC TURBINES AND PUMPS	6 + 6			
Hydro turbines - Definition, types and classifications – Pelton and Francis turbines - Velocity triangles					
Pumps (Descriptive treatment only) - Definition and classifications – Positive Displacement -Dynamic Pumps- Classifications and working principle - Velocity triangles.					
<i>Performance studies on Centrifugal Pump Performance studies on Pelton wheel Turbine</i>					
UNIT IV	BASIC THERMODYNAMICS AND ENERGY	6 + 6			
Basic Thermodynamics – Introduction, Thermodynamic system properties . Thermodynamic state, thermodynamic process. Reversible, irreversible process, Quasi-static process. Thermodynamic equilibrium.					
Energy: classification, stored energy and energy in motion - Work and heat transfer , work done at the moving boundary - Comparison between work and heat - Temperature Scales - Zeroth and First Law of Thermodynamics.					
<i>Determination of Flash point and fire point Conduct a performance test on Air compressor</i>					
UNIT V	I.C. ENGINES & AIR COMPRESSORS	6 + 6			
I.C. Engines: Classifications - Four stroke SI & CI engines, Two stroke SI & CI engines, Power developed by engines-Comparison of two stroke & four stroke engines, SI and CI engines - Application of SI & CI engines					
AIR COMPRESSORS: Introduction – Types of Air Compressors – Single stage reciprocating air compressors and its advantages - Introduction to multistage compression and its advantages					
<i>Draw the valve timing and port timing of four stoke engine Conduct test Performance Test and Heat Balance Test on 4 - stroke Diesel Engine.</i>					
		L : 30	T: 0	P: 30	Total: 60 PERIODS

TEXT BOOKS	
T1	Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5th edition, Laxmi Publications (P) Ltd, New Delhi, 1995
T2	Nag.P.K., "Engineering Thermodynamics", 4thEdition, Tata McGraw-Hill, New Delhi, 2008
REFERENCES	
R1	Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995
R2	Kothandaraman. C.P., Domkundwar. S. & Domkundwar. A.V., "A course in Thermal Engineering" Dhanpatrai & Co (P) Ltd, Fifth edition, Reprint 2004
R3	Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2nd Edition, 2004
R4	Rajput R K, "Thermal Engineering", Lakshmi Publications 2010
R5	Pandya N. C & Shah C. S., "Elements of Heat Engines", CharoterPulishers, 2005
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Gather the basics of fluids and principles behind incompressible fluid
CO 2	Apply mathematical knowledge to predict the properties and characteristics of a fluid
CO 3	Analyze the performance of pumps and turbines
CO 4	Familiarize the students to understand the fundamentals of thermodynamics
CO 5	Understand the basics of engine performance and various efficiencies

Mapping of Programme Outcomes / Programme Specific Outcomes														
(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)														
COs	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3												1	
CO2	3	2						2	3					
CO3	3	2							3					
CO4	3									2		2		
CO5	1									2		2		

23MCP202	ELECTRICAL MACHINES AND DRIVES LABORATORY	L	T	P	C	
		0	0	3	1.5	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To provide knowledge in fundamentals of Electric Machines performance and control drives 						
LIST OF EXPERIMENTS						
Electrical Machines:						
<ul style="list-style-type: none"> Study of Basic Electric Components, Safety and Harness Load Test of DC Series Motor Load Test of DC Shunt Motor Speed control of DC Shunt Motor Load Test on Single phase Induction Motor Load Test on Three phase Induction Motor 						
Electrical Drives:						
<ul style="list-style-type: none"> Characteristics of Thyristers (SCR, TRIAC) Characteristics of Transistors (BJT, MOSFET, IGBT) SCR Based Voltage Regulator Solid state driver based Speed control of Single & Three Phase Induction Motor Solid state driver based Speed control of DC Motor & Induction Motor Solid state driver based Reluctance & BLDC Motor Control 						
		L :0	T: 0	P: 45	Total:45 PERIODS	
EQUIPMENTS						
Machines:	<ul style="list-style-type: none"> DC Series Motor- 1 No DC shunt Motor- 1 No Single phase Induction Motor- 1 No Three phase Induction Motor- 1 No 					
Drives:	<ul style="list-style-type: none"> SCR Trainer kit - 2 No TRIAC Trainer kit- 2 No IGBT Trainer kit- 2 No MOSFET Trainer kit- 2 No Single phase AC Voltage controller Trainer Kit- 1 No Rectifier based speed control of DC Drive- 1 No Speed control of AC Motors Trainer Kit – 1 No Speed control of Brushless DC motor Trainer – 1 No DSP based Speed control of SRM Motor Trainer – 1 No 					
COURSE OUTCOMES						
At the end of the course students should be able to						
CO1	Understand the load test of AC & DC Motors through experimentation					
CO2	Know the concept of conventional method of Speed control					
CO3	Differentiate the working of Solid state devices					
CO4	Understand the Solid state based AC & DC motor drive control					
CO5	Understand the Solid state based Special Machines drive control					

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01			3					3			3			
C02		2			3								3	
C03	3								2					
C04	3		1										2	
C05		2					3					2		

23CSP205	Object-Oriented Programming Using Java Laboratory	L	T	P	C
[Common to ECE, EEE, BME]		0	0	3	1.5
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java 					
LIST OF EXPERIMENTS					
<ol style="list-style-type: none"> Solving programs with I/O Statements Solving programs using Data types, variables, and Operators Solving problems using Control structures Solving problems using arrays Programs using classes, methods, and objects using overloading Programs using class and constructors Programs employing inheritance Programs employing Polymorphism Programs employing Abstract Class Solving problems using the concept of Exception Handling Solving problems using the concept of Multithreading 					
HARDWARE/SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS					
Hardware					
<ul style="list-style-type: none"> LAN System with 33 nodes (OR) Standalone PCs – 33 Nos. Printers – 3 Nos. 					
Software					
<ul style="list-style-type: none"> Java/J2SE Compiler, NetBeans 					
		L:0	T:0	P: 45	Total: 45 Periods
COURSE OUTCOMES					
At the end of the course students should be able to					
CO 1	Solves problems using datatypes, variables, and operators in Java				
CO 2	Discover the use of control structures and Looping using classes and methods				
CO 3	Infer the use of constructors in solving real-time applications				
CO 4	Apply the concepts of inheritance, polymorphism, and packages to solve real-world problems				
CO 5	Develop applications using the concept of threads and exceptions				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1		2		2								2	1	
CO2		1		2	1							2	2	
CO3	1	2		1		1						3	2	
CO4	2		2				1			1		2		
CO5				2		1				1				

23GEP275	PERSONAL BRANDING (PRACTICAL)			L	T	P	C
[Common to All B.E. / B. Tech. Courses]				0	0	4	2
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To understand personality self-development, body language, and social imaging qualities for professional grooming and effective interviews. To develop interview, leadership, and personal branding skills for self-assessment and career advancement 							
UNIT I	SELF-AWARENESS & PERSONAL DEVELOPMENT						
Self-Awareness: Key Areas -Personality, Values, Habits, Needs & Emotions, Impact of Self-Awareness on Personal Development Personality –Definition, Elements, Determinants, Needs and Benefits, Personality traits. Personality development skills, Positive traits for effective people, SWOT :Analyzing Strength and weakness (SWOT), Building Esteem & Self-Confidence, Working on attitudes (aggressive, assertive, submissive), Self-Motivation							
UNIT II	BODY LANGUAGE						
Body Language and Gestures, Personal Grooming, Personal Hygiene, Social Effectiveness, Business Etiquette							
UNIT III	INTERVIEW AND LEADERSHIP SKILLS						
Resume Building, Video Resume, Leadership Styles, Leadership Traits, Group Dynamics- Conflict management							
UNIT IV	SOCIAL IMAGE TRAITS						
Social etiquettes -Positive Social Image, Social Graces, Online Etiquettes, Dining Etiquettes, Voice Modulation, – Networking: Case Study and Company website references.							
UNIT V	PERSONALITY TEST						
Big Five Personality Test, Open DISC Assessment Test							
LIST OF EXERCISES							
<ol style="list-style-type: none"> SWOT Analysis Grooming, Dressing and Photo-shoot Body Language, Handshaking Art of Storytelling, Marketing & selling yourself Self-Discipline: Goal setting (Qualitative and Quantitative) Teamwork & Leadership Activity Dealing with Pressure, Failure & Decision Making Psychological/Personality test Video Resume Business Card creation Social Profiling in FB/Insta/Linked In/Personal Website Online Interview Speed Interview Networking Event-Online/Offline 							
				L:0	T:0	P: 60	Total: 60 Periods
TEXT BOOKS							
T1	Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill						
T2	Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition:Prentice Hall						

REFERENCES	
R1	Smith, B. Body Language. Delhi: Rohan Book Company. 2004
R2	Personality Development and Career management: By R.M.Onkar (S Chand Publications)
COURSE OUTCOMES	
At the end of the course students should be able to	
CO 1	Evaluate the quality of personality for self-development in a career perspective
CO 2	Apply the body language in his professional interview modes
CO 3	Apply the communication and leadership styles in public speaking
CO 4	Apply the social imaging qualities in their presentation skill
CO 5	Demonstrate personality skills in mock interviews

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01								3			3			
C02							3	3	3					
C03			2					3	3					
C04				2					3		2			
C05								3	3					

23MCP203	INTERNSHIP - II	L	T	P	C
		0	0	4	2
<ol style="list-style-type: none"> 1. The Internship is provided for the students to update themselves with the recent Technologies and professional skills for better prospects in the future 2. Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by the concern and written consent of the student and parents. 3. Student is supposed to produce joining letter and relieving letter once the internship is over in case of offline internship in any industry 4. Online internship in industry / other agencies 5. Seminar by student under mentorship of a faculty 6. A detailed report shall be submitted based on his Internship and shall be done by only one student 7. A Mini Project- on some suitable topic related to the branch of study. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc., depending on the branch of the student. Preferably a single student should do it <p>Student has to prepare detailed report and submit to his/her college.</p> <ol style="list-style-type: none"> 8. A copy of report can be kept in the departments for record 9. Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor 10. The evaluation of the work done by students will be carried by the internal and external examiner 11. External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks 12. The presentation by student in the presence of all students is desirable 13. Student should produce successful completion certificate in case of offline / online internship in industry 					
					2 Weeks

SEMESTER V

23MCT301	EMBEDDED SYSTEMS AND PROGRAMMING	L	T	P	C
		2	0	0	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To know the microcontroller programming methodology and to acquire the interfacing skills and data exchange methods using various communication protocols. To understand ARM processor architecture and its functions to meet out the computational and interface needs of growing mechatronic systems. 					
UNIT I	INTRODUCTION TO MICROCONTROLLER	6			
Fundamentals Functions of ALU - Microprocessor - Microcontrollers - Memory Organization - Instruction Sets – Addressing Modes.					
UNIT II	PROGRAMMING AND INTERFACING STANDARDS	6			
Fundamentals of Assembly Language Programming – Instruction to Assembler – Basic Arithmetic and Logical Programming - Interrupts – Interfacing and Programming of Serial Communication– Bluetooth and WI-FI interfacing of 8051 Microcontroller.					
UNIT III	CONTROLLERS AND PERIPHERAL INTERFACING	6			
I/O Programming – Interfacing of Memory, Key Board and Displays controllers–interfacing of ADC and DAC- Stepper Motors and DC Motors - Closed Loop Control Programming of Servomotor – Programming of Traffic Light					
UNIT IV	ARM PROCESSOR	6			
Introduction ARM 7 Processor – Modes of Operations –Instruction Sets –Thumb State Registers – Pipelining – basic programming of ARM 7 for Position Control with Feedback					
UNIT V	SINGLE BOARD COMPUTERS	6			
System on Chip - Broadcom BCM2711 SoC– Architecture of the MSP430 Processor -Real Time Embedded Operating Systems and programming Languages -- Python for navigation robots- Gesture recognition					
		L : 30	T:0	P: 0	Total: 30 PERIODS
TEXT BOOKS					
T1	Frank Vahid and Tony Givagis, “Embedded System Design”, 2011, Wiley.				
T2	Kenneth J. Aylala, “The 8051 Microcontroller, the Architecture and Programming Applications”, 2015.				
REFERENCES					
R1	Muhammad Ali Mazidi and Janice GillispicMazdi, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, 2018.				
R2	Simon Monk, Programming the Raspberry Pi, Second Edition: Getting Started with Python McGraw Hill TAB; 2nd edition,2020				
R3	James W. Stewart, “The 8051 Microcontroller Hardware, Software and Interfacing”, Regents Prentice Hall, 2013.				
R4	John B. Peatman, “Design with Microcontrollers”, McGraw Hill International, USA, 2018.				
R5	Embedded Microcomputer Systems – Real Time Interfacing – Jonathan W. Valvano; Cengage Learning; Third or later edition 2020.				
COURSE OUTCOMES					
At the end of the course students should be able to					
CO1	Identify the various functional units of microcontrollers, processors, and system-on-chip (SoC) based on their features and specifications				
CO2	Explain the role of different interfacing standards and demonstrate knowledge of programming for microcontrollers				
CO3	Interface sensors, actuators, and other I/O devices with microcontrollers, and understand the concept of controllers				
CO4	Perform basic programming with processors, demonstrating an understanding of their operations for various applications				
CO5	Develop real-time embedded applications using an embedded operating system				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	1	1	2	2						3	1	
C02	3	2	1	1	2	2						3	1	
C03	3	2	1	1	2	2						3	1	
C04	3	2	1	1	2	2						3	1	
C05	3	2	1	1	2	2						3	1	

23MCT302	MACHINE DESIGN			L	T	P	C
	(Use of Approved Data Book is permitted)			3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To learn the various steps involved in the design process, including designing shafts and couplings for different applications, as well as the design of temporary and permanent joints. To learn the design of helical and leaf springs, flywheels, connecting rods, crankshafts, and the selection of sliding and rolling contact bearings, seals, and gaskets for various applications. 							
UNIT I	INTRODUCTION TO THE DESIGN PROCESS						9
Factor influencing machine design, selection of materials based on mechanical properties – Direct, bending and torsion stress equations – Impact and shock loading – Calculation of principle stresses for various load combinations, eccentric bending – Factor of safety – Theories of failure – Stress concentration – Fatigue strength and the S-N diagram – Soderberg, Goodman and Gerber relations.							
UNIT II	DESIGN OF SHAFTS AND COUPLINGS						9
Design of solid and hollow shafts based on strength and rigidity– Design of keys and key ways – Design of rigid and flexible couplings							
UNIT III	DESIGN OF TEMPORARY AND PERMANENT JOINTS						9
Threaded fasteners – Design of bolted joints including eccentric loading- Design of Welded joints for pressure vessels and structures -Knuckle joints- Cotter joints–theory of bonded joints.							
UNIT IV	DESIGN OF ENERGY STORING ELEMENTS						9
Types of springs- Design of helical and concentric springs–surge in springs, Design of laminated springs - rubber springs – Design of Flywheels involving stresses in rims and arms for engines and punching machines							
UNIT V	DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS						9
Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi & Boyd graphs - Selection of Rolling Contact bearings –Design of Seals and Gaskets.							
				L : 45	T:0	P: 0	Total: 45 PERIODS
TEXT BOOKS							
T1	Bhandari V, “Design of Machine Elements”, 4rd Edition, Tata McGraw-Hill Book Co, New Delhi, 2016						
T2	Joseph Shigley, Richard G. Budynas and J. Keith Nisbett “Mechanical Engineering Design”, 10th Edition, Tata McGraw-Hill , 2015.						
REFERENCES							
R1	Sundararamamoorthy T. V. Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2015						
R2	Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 7th Edition, Wiley, 2017						
R3	Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, 3rd Edition Tata McGraw-Hill BookCo.(Schaums Outline), New Delhi, 2020						
R4	Bernard Hamrock, Steven Schmid,Bo Jacobson, “Fundamentals of Machine Elements”,2nd Edition, Tata McGraw-Hill Book Co, New Delhi, 2016						
R5	M. F. Spotts, Terry E. Shoup, “Design of Machine Elements”, 8 th Edition Pearson Publishing, 2019						
COURSE OUTCOMES							
At the end of the course students should be able to							
CO1	Utilize engineering analysis principles for the accurate evaluation of mechanical system components						
CO2	Determine appropriate dimensions for shafts, keys, and couplings						
CO3	Implement design principles for bolted, knuckle, cotter and welded joint						
CO4	Design helical and leaf springs, as well as flywheels, based on engineering concepts						
CO5	Apply design and selection principles for sliding and rolling contact bearings, seals and gaskets						

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	1	1	2	2						3	1	
C02	3	2	1	1	2	2						3	1	
C03	3	2	1	1	2	2						3	1	
C04	3	2	1	1	2	2						3	1	
C05	3	2	1	1	2	2						3	1	

23MCT303	INDUSTRIAL ELECTRONICS			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To understand the basic concepts of power electronic converters To apply the concept of Rectifier, Inverter, Chopper and Cyclo-converter 							
UNIT I	POWER SEMICONDUCTOR DEVICES						9
Classification of Power Semiconductor devices, Construction and working principle of SCR, TRIAC, BJT, MOSFET, IGBT- Triggering and commutation circuit for SCR- MOSFET Driver and snubber circuits							
UNIT II	PHASE-CONTROLLED CONVERTERS						9
Single phase half & fully controlled converters, Three phase half & fully controlled converters, Inversion mode of converter -performance parameters-Effect of source inductance-Dual converters-Battery charging circuit							
UNIT III	DC TO DC CONVERTER						9
Classifications of DC to DC converters- step-down and step-up DC to DC Converter -control strategies-Switched mode regulators- Buck, boost, buck- boost converter, Introduction to SMPS							
UNIT IV	INVERTERS & AC TO AC CONVERTERS						9
Single phase and three phase voltage source inverters (both 120° mode and 180° mode) -Voltage control methods -PWM techniques-Current Source Inverter, - Single phase and three phase cycloconverters.							
UNIT V	INDUSTRIAL APPLICATION FOR MECHATRONICS						9
Introduction to UPS, Solid state Relays, Electronic Timer, Motor Drive Application: AC, DC Motor Control, Servo Motor Control, Stepper Motor Control; Induction heating							
				L : 45	T: 0	P:0	Total: 45 PERIODS
TEXT BOOKS							
T1	P.S.Bimbra “Power Electronics” Khanna Publishers, third Edition, 2023						
T2	M.H.Rashid, ‘Power Electronics: Circuits, Devices and Applications’, Pearson Education, PHI , Third Edition, New Delhi, 2022						
REFERENCES							
R1	M.D. Singh and K.B. Khanchandani, “Power Electronics,” McGraw Hill India, 2023.						
R2	Joseph Vithayathil, “ Power Electronics, Principles and Applications” McGraw Hill Series, 6th Reprint, 2019.						
R3	Ned Mohan, Undeland, Robbins, “Power Electronics: Converters, Design and Applications”, WILEY India Edition						
R4	Muhammad H. Rashid, Power Electronics - Circuits, Devices and Applications, Prentice Hall of India Learning. Ltd., New Delhi, 2019						
R5	M. D. Singh and K. B. Khanchandani, Power Electronics, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2018.						
COURSE OUTCOMES							
At the end of the course student should be able to:							
CO1	Understand the characteristics of power electronics devices.						
CO2	Know the concept of AC-DC conversion systems						
CO3	Design various DC-DC converters						
CO4	Understand the working of DC-AC converters & AC-AC converters						
CO5	Apply power electronics converters for Mechatronics Application						

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2		2		1						2		
C02	3		2											
C03	2		3						1			2	3	
C04	3										2		2	
C05	3						2					3		

23MCB302	INTEGRATED AUTOMATION	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To understand the basic concepts PLC and its communication protocols with industrial applications To apply the various Automation tools like SCADA and DCS system 					
UNIT I	INTRODUCTION TO PLC	6+6			
Introduction – Principles of operation – Parts of PLC & hardware components – I/O section – Discrete and Analog Module – CPU processor and memory module –PLC Programming devices and Languages – Function Block Diagram – Interlocking and latching concepts					
Study of Programmer Logic Controller					
Construction of Ladder programming for Boolean operations & Math operations using PLC					
UNIT II	PLC INSTRUCTIONS & I/O DEVICES	6+6			
Timers, Delay And Retentive Timers – Counters – Data Manipulating Program – Data Handling: Control and Math Instructions – Sequencer and Shift Register– Electromagnetic Control Relays and Motor Starters – Latching Relays – Manually Operated Switches and Proximity Switches – Analog I/O devices, PLC integrated with IOT					
Sequential operation of pneumatic cylinders using PLC					
Linear actuation with timer, counter and speed control using PLC					
UNIT III	NETWORKING AND APPLICATIONS OF PLC	6+6			
Network Topologies - Communication Modes HART Networks and OSI models - Fieldbus, Modbus, Profibus - Device net - System Operation and Troubleshooting, Applications of PLC - Automatic control of warehouse door – Conveyor belt motor control - Automatic car washing machine - Bottle filling systems, PLC in process control					
Traffic light controller using PLC					
Speed control of DC motor using PLC					
UNIT IV	SUPERVISORY CONTROL AND DATA ACQUISITION	6+6			
HMI and its functions, Elements and Architecture of SCADA - Hardware, Software: Development, Runtime mode functions - Tools: Tag database - Recipe database - Alarm Logging-Trends: Real Time, Historical Trends - Security and User Access Management-Management Information System - Report Function.					
Interfacing PLC real time tag with HMI and SCADA					
UNIT V	DISTRIBUTED CONTROL SYSTEM	6+6			
Evolution of DCS - Types of Architecture - Local Control Unit - Communication Facilities - Operator and Engineering Interfaces - Operator Displays - Process Interfacing issues – Real time applications.					
Study of DCS for thermal power plant					
		L : 30	T:0	P:30	Total: 60 PERIODS
TEXT BOOKS					
T1	F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2020				
T2	Stuart A Boyer, “SCADA supervisory control and data acquisition”				
REFERENCES					
R1	K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2021 Batten G. L., “Programmable Controllers”, McGraw Hill Inc., Second Edition				
R2	Pradeep Kumar &Srivashtava , Programmable Logic Controller- BPB Publications.				
R3	Hughes .T, “Programmable Logic Controllers”, ISA Press, 2018				
R4	Gordan Clark, Deem Reynders, “Practical Modem SCADA Protocols” 2017				
R5	Lucas M.P, Distributed control systems, Van Nostrand Reinhold Company, New york, 2018				

COURSE OUTCOMES	
At the end of the course students should be able to	
CO1	Acquire an adequate knowledge about various functions of PLC and its interfacing
CO2	Understanding the concepts of various instructions in PLC programming language
CO3	Understanding the concepts Communication protocols and PLC applications
CO4	Understand the basic of Supervisory Control and Data Acquisition (SCADA)
CO5	Obtain the knowledge on evolution and architecture of DCS

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2		1				2	1			3	1	
CO2	3	1				1	2			1	3	1	1	
CO3			2		3					2	1		2	
CO4	1		3		2	1	1		1	3		2	1	
CO5	2	1						3			1			

23MCP301	EMBEDDED SYSTEMS AND PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To design the interface circuit and programming of I/O devices, sensors and actuators. 					
EXPERIMENTS:					
<ol style="list-style-type: none"> Arithmetic operation a) Addition of 2 - 8 bit numbers b) Subtraction of 2 - 8 bit numbers c) Multiplication of 2 - 8 numbers d) Division of 2 - 8 bit numbers Finding maximum value in an array Sorting of data a) Ascending order b) Descending order Seven segment display Keypad Interrupt Interface 6*2 LCD interface. Traffic Light Signal Interface. ADC Interfacing and DAC Interfacing L298 Driver for DC Motor and Stepper motor interface. SPI and I2C interfacing Temperature Sensor Interface. Traffic light controller A Study of blinking LED, Enabling LED using Switches 					
HARDWARE/SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS					
Hardware					
<ul style="list-style-type: none"> ESP32 IoT Development Trainer Kit 8051 Development Trainer kit 					
Software					
<ul style="list-style-type: none"> Arduino IDE 					
		L : 0	T:0	P: 60	Total: 60 PERIODS
COURSE OUTCOMES					
At the end of the course students should be able to					
CO1	Learn the basic commands and programming in microcontroller.				
CO2	Develop programs for controllers interfacing with microcontroller.				
CO3	Interface I/O's, peripherals with microcontroller				
CO4	Programming in microcontroller, Processors by interfacing various sensors.				
CO5	Design the circuit and write the programming for microcontroller for applications.				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	2						3	1	
CO2	3	2	1	1	2	2						3	1	
CO3	3	2	1	1	2	2						3	1	
CO4	3	2	1	1	2	2						3	1	
CO5	3	2	1	1	2	2						3	1	

Professional Elective – I

23MCE301	MICRO-ROBOTICS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To Learn micro scale, technologies for fabricating small devices, bio- inspired design, and applications of the field. • To Understand to various Mathematical formalism for flexures, Electrostatic actuators, Piezo-electric actuators, Magneto-strictive actuator and other sensors. 					
UNIT I	INTRODUCTION TO MICROROBOTICS	9			
Introduction to Micro robotics -MST (Micro System Technology) - Micromachining - Working principles of Microsystems Applications of Microsystems - Micro-fabrication principles-Design selection criteria for micromachining - Packaging and Integration aspects - Micro-assembly platforms and manipulators.					
UNIT II	SCALING LAWS AND MATERIALS FOR MEMS	9			
Introduction - Scaling laws - Scaling effect on physical properties scaling effects on Electrical properties - scaling effect on physical forces - Physics of Adhesion - Silicon - compatible material system - Shape memory alloys - Material properties - Piezoresistivity, Piezoelectricity and Thermoelectricity.					
UNIT III	FLEXURES, ACTUATORS AND SENSORS	9			
Elemental flexures - Flexure systems - Mathematical formalism for flexures - Electrostatic actuators - Piezo-electric actuators - Magneto-strictive actuators - Electromagnetic sensors - Optical-based displacement sensors - Motion tracking with microscopes.					
UNIT IV	MICROROBOTICS	9			
Introduction - Task specific definition of micro-robots - Size and Fabrication Technology based definition of micro-robots - Mobility and Functional-based definition of micro-robots - Applications for MEMS based micro-robots.					
UNIT V	IMPLEMENTATION OF MICROROBOTS	9			
Arrayed actuator principles for micro-robotic applications - Micro-robotic actuators- Design of locomotive micro-robot devices based on arrayed actuators - Micro-robotics devices - Microgrippers and other micro-tools - Micro-conveyors - Walking MEMS Micro-robots - Multi-robot system: Micro-robot powering, Micro-robot communication.					
		L : 45	T:0	P: 0	Total: 45 PERIODS
TEXT BOOKS					
T1	Mohamed Gad-el-Hak , "The MEMS Handbook", 2nd Edition, CRC Press, New York, 2019.				
T2	Yves Bellouard, "Microrobotics Methods and Applications", CRC Press, Massachusetts, 2019.				
REFERENCES					
R1	NadimMaluf and KirtWilliams, "An Introduction to Microelectromechanical systems Engineering", 2nd edition, Artech House, 2014.				
R2	Julian W Gardner, "Microsensors: Principles and Applications", 2nd edition, Wiley, 2017				
R3	MetinSitti, "Mobile Microrobotics", MIT Press, 2017.				
R4	Nicolas Chaillet, Stephane Rangier,"Microrobotics for Micromanipulation", John Wiley & Sons, 2013.				
R5	Vikas Choudhry, Krzysztof, "MEMS: Fundamental Technology and Applications", CRC Press, 2013.				
COURSE OUTCOMES					
At the end of the course students should be able to					
CO1	Explain and apply the concepts of mass, energy, and momentum balance in microrobotics.				
CO2	Apply adapt, and synthesize learned engineering skills to create microrobot.				
CO3	Modelmicrorobots for different robotics applications				
CO4	Formulate the specifications and design of mechatronic systems.				
CO5	Program the Microrobot for different robotics applications				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	1	1	2							2	2	
C02	3	2	1	1	2							2	2	
C03	3	2	1	1	2							2	2	
C04	3	2	1	1	2							2	2	
C05	3	2	1	1	2							2	2	

23MCE302	APPLIED SIGNAL PROCESSING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To learn and analyze the continuous time and discrete time signals processing. To design digital filters for signal processing and to learn about various signal processors and its applications 					
UNIT I	INTRODUCTION TO SIGNALS AND SYSTEMS	9			
Elementary signals in continuous and discrete time - graphical and mathematical representation - Elementary operations and classification of continuous and discrete time signals – CT systems and DT systems - Properties of CT systems and DT systems Classification of systems					
UNIT II	ANALYSIS OF CONTINUOUS TIME SIGNALS AND SYSTEMS	9			
The continuous time Fourier series - Fourier Transform properties - Laplace transform and properties - Impulse response - convolution integrals - Fourier and Laplace transforms in Analysis of CT systems - Frequency response of systems characterized by differential Equations					
UNIT III	ANALYSIS OF DISCRETE TIME SIGNALS AND SYSTEMS	9			
Fourier Transform of discrete time signals (DTFT) Properties of DTFT - Discrete Fourier Transform - Fast Fourier Transform (FFT) - Z Transform and Properties – Impulse response - Convolution sum - System analysis from difference equation model - Stability of systems					
UNIT IV	DESIGN OF DIGITAL FILTERS	9			
Review of design techniques for analog low pass filters - Frequency transformation – IIR filters-Properties - Design of IIR digital filters using bilinear transformation - FIR filters - Characteristics of FIR filters with linear phase - Design of FIR filters using Window functions					
UNIT V	DIGITAL SIGNAL PROCESSORS AND APPLCATIONS	9			
Architecture of TMS320C54xx DSP - Addressing Modes - Instructions and Programming - Applications: Signal Compression - Sine wave generators - Noise generators – DTMF Tone Detection - Echo cancellation - Speech enhancement and recognition					
		L : 45	T:0	P: 0	Total: 45 PERIODS
TEXT BOOKS					
T1	Alan V Oppenheim, Alan S Willsky, Hamid Nawab S , "Signals and Systems", 2nd edition, Learning, New Delhi, 2015.				
T2	John G. Proakis, Dimitris K Manolakis , "Digital Signal Processing, 5th edition, Hoboken,NJ : Pearson Education, New Delhi, 2021				
REFERENCES					
R1	Lonnie C Ludeman, "Fundamentals of Digital Signal Processing", Wiley & Sons, New Delhi, 2014.				
R2	Emmanuel C Ifeachor, Barrie W Jervis, "DigitalSignal Processing"Pearson Education, New Delhi, 2013.				
R3	Haykin S, Barry Van Veen, "Signals and Systems", John Wiley and sons, New Delhi, 2016.				
R4	Vinay K Ingle, John G Proakis , "Digital Signal Processing using MATLAB", Cengage Learning, New Delhi, 2012.				
R5	Dimitris G. Manolakis, Vinay K. Ingle, and Stephen M. Kogon, “Applied Digital Signal Processing: Theory and Practice”,Cambridge University Press, 21 Nov 2011				
COURSE OUTCOMES					
At the end of the course students should be able to					
CO1	Understand the characteristics of various types of signals.				
CO2	Analyze continuous time signals and systems				
CO3	Understand DTFT, FFT and Z-Transform methods in signals processing.				
CO4	Design digital IIR, FIR filters for signal processing				
CO5	Analyze and Apply various signal processors and its applications of signals.				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	1	1								1	1	
C02	3	2	1	1								1	1	
C03	3	2	1	1								1	1	
C04	3	2	1	1								1	1	
C05	3	2	1	1								1	1	

23MCE303	DRONE TECHNOLOGY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To learn and understand the fundamentals of design, fabrication and programming of drone To impart the knowledge of an flying and operation of drone 					
UNIT I	INTRODUCTION TO DRONE TECHNOLOGY	9			
Concept of Drone - Terminologies - History of drones - Types of modern drones based on their method of propulsion - Impact on the businesses - Drone business through entrepreneurship - Applications - Opportunities for entrepreneurship and employability					
UNIT II	DRONE FLIGHT AND OPERATION	9			
Concept of drone operation - Flight modes - Operate a small drone in a controlled environment- Drone controls Flight operations – management tool – Sensors - Onboard storage capacity - Removable storage devices- Linked mobile devices.					
UNIT III	DRONE SAFETY AND ADVANCES	9			
The safety risks - Guidelines to fly safely - Specific aviation regulation and standardization- Drone license - Pilot License - Miniaturization of drones- Increasing autonomy of drones - The use of drones in swarms - Advances in drones					
UNIT IV	DRONE DESIGN, FABRICATION AND PROGRAMMING	9			
Classifications of the UAV -Overview of the main drone parts -Function of the component parts -Assembling a drone- The energy sources- Drones configurations -Multi rotor stabilization- Flight modes - The methods of programming drone- Download, Installation and Running programs on computer.					
UNIT V	DRONE COMMERCIAL APPLICATIONS	9			
Choosing a drone based on the application - Drones in the insurance sector - Drones in delivering mail, parcels and other cargo - Drones in agriculture - Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing - Drones in Mapping and Surveying - Drones in Defence - Drones in Search and Rescue					
		L : 45	T:0	P: 0	Total: 45 PERIODS
TEXT BOOKS					
T1	Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.				
T2	Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc, 2016				
REFERENCES					
R1	Mark LaFay, “Drones For Dummies”, John Wiley & Sons, 2016				
R2	John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016				
R3	David Daily, “The Drone Pilot's Manual: A Comprehensive Guide to Rules, Regulations, Safety, and Operations”, ASA Aviation Supplies & Academics, 2016.				
R4	Jeremy Moore, “Commercial Drone Piloting: The Comprehensive Guide to Starting a Business, Passing the FAA Part 107 Exam, and Operating Under the Rules”, Drone Launch Academy, 2017.				
R5	Alessandro Golkar and Reza Langari (Editors), “Drones and the Future of Aerial Operations”, Elsevier, 2019.				
COURSE OUTCOMES					
At the end of the course students should be able to					
CO1	Understand the basics of drone concepts				
CO2	Execute the suitable operating procedures for flying a drone				
CO3	Understand the basics of drone flight regulations				
CO4	Design, fabricate and program a drone				
CO5	Select drone and its components based on the applications				

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	1	1								1	1	
C02	3	2	1	1								1	1	
C03	3	2	1	1								1	1	
C04	3	2	1	1								1	1	
C05	3	2	1	1								1	1	

23MCE304	HUMANOID ROBOTICS			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
<ul style="list-style-type: none"> To learn about the dynamics and kinematics in humanoid robots. To understand the basic in biped walking and different walking patterns. 							
UNIT I	INTRODUCTION						9
Historical development of Humanoids, Human Likeness of a Humanoid Robot, Trade-Offs in Humanoid Robot Design, Human-Friendly Humanoid Robot Design, characteristics of humanoid robots.							
UNIT II	KINEMATICS						9
Kinematic structure, forward and inverse kinematic problems, differential kinematics, Twist, Spatial Velocity, and Spatial Transform, Inverse Differential Kinematic Relations. Differential kinematics at singular configurations- Gait Analysis							
UNIT III	ZMP AND DYNAMICS						9
ZMP Overview, 2D Analysis, 3D Analysis, Measurement of ZMP, General Discussion- ZMP of Each Foot, ZMP for Both Feet Contact, Dynamics of Humanoid Robots, Humanoid Robot Motion and Ground Reaction Force, Momentum, Angular Momentum, Angular Momentum and Inertia Tensor of Rigid Body, Calculation of Robot's Center of Mass, Link Speed and Angular Velocity, Calculation of Robot's Momentum and Angular Momentum							
UNIT IV	BIPED WALKING						9
Two Dimensional Walking Pattern Generation, Two Dimensional Inverted Pendulum, Behavior of Linear Inverted Pendulum, Orbital Energy, Support Leg Exchange, Planning a Simple Biped Gait, Extension to a Walk on Uneven Terrain.							
UNIT V	WALKING PATTERN GENERATION						9
ZMP Based Walking Pattern Generation, Cart-Table Model, Off-Line Walking Pattern Generation, Stabilizer, Principles of Stabilizing Control, Stabilizing Control of Honda Humanoid Robot, Advanced Stabilizers.							
				L : 45	T:0	P: 0	Total: 45 PERIODS
TEXT BOOKS							
T1	Dragomir N. Nenchev, Atsushi Konno, "Humanoid Robots Modeling and Control", Butterworth Heinemann, 2019						
T2	J. Craig, "Introduction to Robotics: Mechanics and Control", Fourth Edition, Pearson, 2022						
REFERENCES							
R1	Goswami Ambarish, Vadakkepat Prahlaad, "Humanoid Robotics: A Reference", Springer, 2019						
R2	A. Goswami, P. Vadakkepat (Eds.), "Humanoid Robotics: A Reference", Springer, Netherlands, Dordrecht, 2018						
R3	Shuuji K, Hirohisa H, Kensuke H, Kazuhito, Springer-Verlag GmbH "Introduction to Humanoid Robotics", Springer, London, 2014.						
R4	J K. Harada, E. Yoshida, K. Yokoi (Eds.), "Motion Planning for Humanoid Robots", Springer, London, 2020.						
R5	Jean-Claude Latombe, "Robot Motion Planning", Kluwer Academy Publishers, 2004. K. Harada, E. Yoshida, K. Yokoi (Eds.), "Motion Planning for Humanoid Robots", Springer, London, 2016.						
COURSE OUTCOMES							
At the end of the course students should be able to							
CO1	Describe about the evolution of Humanoid robots						
CO2	Expose the basic knowledge in kinematics of humanoids.						
CO3	Calculate the Humanoid Robot Motion and Ground Reaction Force.						
CO4	Identify Two-Dimensional Walking pattern on different terrain.						
CO5	Create the Walking Pattern models.						

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2	1	1								1	2	
C02	3	2	1	1								1		
C03	3	2	1	1								1	2	
C04	3	2	1	1								1	2	
C05	3	2	1	1								1	2	

23MCE305	MICRO ELECTRO MECHANICAL SYSTEMS			L	T	P	C	
				3	0	0	3	
COURSE OBJECTIVES:								
<ul style="list-style-type: none"> To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices. To introduce various sensors and actuators 								
UNIT I	INTRODUCTION						9	
Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices –Polymers in MEMS– Polyamide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon.								
UNIT II	SENSORS						9	
Characteristics of sensors - Electrostatic sensors – Parallel plate capacitors – Piezoresistive sensors – Piezoresistive sensor materials - Stress and strain analysis – Flexural beam bending - Torsional deflection– Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials								
UNIT III	ACTUATORS						9	
Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications –Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators -Actuation using Shape Memory Alloys								
UNIT IV	MICROMACHINING						9	
Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching– Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antirestriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process								
UNIT V	APPLICATIONS OF MEMS INERTIAL SENSORS						9	
Application to Acceleration, Inertia, Acoustic, Tactile, Pressure, Flow and Tactile sensors- Optical MEMS –Lenses and Mirrors -Actuators for Active Optical MEMS – RF MEMS and Microfluidics.								
L : 45				T: 0		P: 0		Total: 45 PERIODS
TEXT BOOKS								
T1	Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2014, 2 nd edition.							
T2	Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2008.							
REFERENCES								
R1	James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2020							
R2	Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son LTD,2012							
R3	Mohamed Gad-el-Hak, editor, “ The MEMS Handbook”, CRC press Baco Raton, 2020							
R4	Nadim Maluf,“ An Introduction to Micro Electro Mechanical System Design”, Artech House, 2020.							
R5	Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer 2018							

COURSE OUTCOMES

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

CO 1	Recognize MEMS Energy Domains and Transducers, Sensors and Actuators.
CO 2	Select the Various MEMS sensors and its Stress and strain
CO 3	Apply various MEMS actuators in Real time system.
CO 4	Demonstrate various micro machining processes, Structural and Sacrificial Materials
CO 5	Analyze the various MEMS inertial, tactile, pressure and flow sensors in real time system

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO1	PSO2	PSO3
C01	3	2	1	1								1	1	
C02	3	2	1	1								1	1	
C03	3	2	1	1								1	1	
C04	3	2	1	1								1	1	
C05	3	2	1	1								1	1	

OPEN ELECTIVES

23MCO301	INTRODUCTION TO ROBOTICS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To gain foundational knowledge of robotics systems and components To Learn and apply robotic systems in industrial and humanoid applications 					
UNIT I	ROBOTICS BASICS	9			
Robot - Basic concepts and Need of Robots - Law, History, Anatomy, specification of Robots - Robot configurations: Cartesian, cylinder, polar and articulate - Robot joints and links -Types - Motion interpolation Robot wrist mechanism - Precision and accuracy of robot					
UNIT II	SENSORS FOR ROBOTICS	9			
Basic Sensors in robot – Touch sensors - Tactile sensor – Proximity and range sensors – Robotic vision sensor- Force sensors -Light sensors - Pressure sensors					
UNIT III	ACTUATORS FOR ROBOTICS	9			
End effectors – Classification - Types of Mechanical actuation, Robot drive system - Types, Position and velocity feedback devices – Simple Case Studies					
UNIT IV	INDUSTRIAL ROBOTS AND APPLICATIONS	9			
Robot work cell design and control – Safety measures in Robot – Robot cell layouts – Multiple robots and machine interference – Robot cycle time analysis – Industrial applications of robots.					
UNIT V	HUMANOID ROBOTS	9			
Introduction– Need of Humanoid robots – Sensors: Proprioceptive sensors - Exteroceptive sensors – Actuators for Humanoid Robots - planning and control – DoF – ZMP – Applications – Basic concepts in V Rep programming					
L: 45 T: 0 P:0 TOTAL: 45 PERIODS					
TEXT BOOKS					
T1	Deb.S.R, "Robotics Technology and Flexible Automation", Tata McGraw – Hill Publishing Company Limited, 2010				
T2	Mikell. P. Groover, 'Industrial Robotics Technology', Programming and Applications, McGraw Hill Co, 2008				
REFERENCES					
R1	Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering : An Integrated Approach", Prentice Hall of India Pvt. Ltd.,1994				
R2	Fu.K.S, Gonzalez.R.C & Lee.C.S.G, "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 1987				
R3	Craig.J.J, "Introduction to Robotics mechanics and control", Addison- Wesley, 1999.				
R4	Ray Asfahl.C, "Robots and Manufacturing Automation", John Wiley & Sons Inc., 1985				
R5	Kozyrey, Yu. "Industrial Robotics", MIR Publishers Moscow, 1985				

COURSE OUTCOMES

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

CO1: understand the Robot fundamentals

CO2: Identify Robots various components parts and the robotic internal and external sensors

CO3: Know robot transformation system and its application to a robot's kinematic structure.

CO4: Understand the application of robot work cell

CO5: Apply the Robot programming and working of Humanoid robots.

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3										2			
C02		2	2									3		
C03			3	3										
C04	2									1			3	
C05	2	3	3										2	

23MCO302	INTRODUCTION TO PLC PROGRAMMING	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To familiarize different programming languages of PLC and develop PLC logic for simple applications. To Understand the hardware, software and communication architecture behind PLC and SCADA 						
UNIT I	INTRODUCTION					9
Introduction to PLC, Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP, PLC/DDC-PLC Memories, PLC I/O, , PLC Special I/O, PLC types.						
UNIT II	PLC INSTRUCTION					9
PLC Basic Instructions- PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays-Interlock examples- Timers, Counters.						
UNIT III	PLC PROGRAMMING					9
Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions.						
UNIT IV	PLC COMMUNICATION					9
Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures.						
UNIT V	PLC REAL TIME APPLICATIONS					9
Application of PLC Programs in Stepper Motor Control, Elevator Control, CNC Machine Control, conveyor control, Interlocking Problems.						
		L : 45	T: 0	P: 0	Total: 45 PERIODS	
TEXT BOOKS						
T1	Frank Petruzzola, Programmable Logic Controllers, Tata Mc-Graw Hill Edition.					
T2	John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication					
REFERENCES						
R1	Madhuchannda Mitra and Samerjit Sengupta, Programmable Logic Controllers Industrial Automation an Introduction, Penram International Publishing Pvt. Ltd.					
R2	J. R. Hackworth and F. D. Hackworth, Programmable Logic Controllers Principles and Applications, Pearson publication					
R3	Hughes .T, “Programmable Logic Controllers”, ISA Press, 2018					
R4	Gordan Clark, Deem Reynders, “Practical Modem SCADA Protocols” 2017					
R5	Industrial Automation Using PLC SCADA & DCS Publisher: Global Education Limited, R.G. Jamkar					
COURSE OUTCOMES						
At the end of the course student should be able to:						
CO 1	Know the basic requirements of a PLC input/output devices and architecture.					
CO 2	Apply Basics Instruction Sets used for ladder Logic and Function Block Programming.					
CO 3	Design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions					
CO 4	Develop a PLC logic for a specific application on real world problems.					
CO 5	Understand the Concepts of Communication used for PLC/SCADA.					

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2		1				2	1			3	1	
C02	3	1				1	2			1	3	1	1	
C03			2		3					2	1		2	
C04	1		3		2	1	1		1	3		2	1	
C05	2	1						3			1			

23MCO303	INDUSTRIAL AUTOMATION SYSTEMS			L	T	P	C		
				3	0	0	3		
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> To educate on PLC and supervisory control and data acquisition To Understand about communication protocols in automation 									
UNIT I	INTRODUCTION						9		
Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems : Modbus & Profibus.									
UNIT II	AUTOMATION COMPONENTS						9		
Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control									
UNIT III	COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS						9		
Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, Industrial communication systems, Data transfer techniques, Internet of things (IoT) for plant automation									
UNIT IV	PROGRAMMABLE LOGIC CONTROLLERS						9		
Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.									
UNIT V	DISTRIBUTED CONTROL SYSTEM						9		
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.									
L : 45				T: 0		P: 0		Total: 45 PERIODS	
TEXT BOOKS									
T1	"S.K.Singh, "Industrial Instrumentation", Tata Mcgraw Hill, 2nd edition companies,2020.								
T2	C D Johnson, "Process Control Instrumentation Technology", Prentice Hall India,8th Edition, 2018.								
REFERENCES									
R1	John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", 5th Edition, Prentice Hall Inc., New Jersey, 2015.								
R2	Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2016								
R3	Krishna Kant, "Computer - Based Industrial Control", 2nd Edition, Prentice Hall, New Delhi, 2017.								
R4	Frank Lamb, "Industrial Automation: Hands On" Illustrated Edition - 16 July 2013								
R5	Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing" 5th edition. Published by Pearson, 2021								
COURSE OUTCOMES									
At the end of the course student should be able to:									
CO 1	Design a signal conditioning circuits for various application.								
CO 2	Understand the basics and Importance of Automatiom components								
CO 3	Understand the basics and Importance of communication buses in applied automation Engineering.								
CO 4	Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.								
CO 5	Acquire a detail knowledge on data acquisition system interface and DCS system.								

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2		1				2	1			3	1	
C02	3	1				1	1			1	3	1	1	
C03	1	1	1		1					2	1		2	
C04	1	1	1		2	1	1			3		2	1	
C05	2	1						3			1			

23MCO304	INTRODUCTION TO MECHATRONICS ENGINEERING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To get acquainted with the sensors and the actuators, which are commonly used in mechatronics systems To inculcate skills in the design and development of mechatronics system for a various application 					
UNIT I	INTRODUCTION AND SENSORS				9
Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and Dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance Sensors – Temperature Sensors – Light Sensors.					
UNIT II	8085 MICROPROCESSOR				9
Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, Timing diagram of 8085.					
UNIT III	PROGRAMMABLE PERIPHERAL INTERFACE				9
Introduction – Architecture of 8255, Keyboard Interfacing, LED display – Interfacing, ADC and DAC Interface, Temperature Control – Stepper Motor Control – Traffic Control Interface					
UNIT IV	PROGRAMMABLE LOGIC CONTROLLER				9
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.					
UNIT V	ACTUATORS AND MECHATRONICS SYSTEM DESIGN				9
Types of Stepper and Servo motors – Construction – Working Principle – Characteristics, Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.					
L: 45 T: 0 P:0 TOTAL: 45 PERIODS					
TEXT BOOKS					
T1	Bolton W., “Mechatronics”, Pearson Education, 6th Edition, 2015				
T2	Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, Penram International Publishing Private Limited, 6th Edition, 2013.				
REFERENCES					
R1	Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applications”, McGraw Hill Education, 2015.				
R2	Davis G. Alciatore and Michael B. Histan, “Introduction to Mechatronics and Measurement systems”, McGraw Hill Education, 2011				
R3	Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, Cengage Learning, 2010				
R4	SBradley D.A., Burd N.C., Dawson D., Loader A.J., “Mechatronics: Electronics in Products and Processes”, Routledge, 2017.				
R5	David H., Gonzalo S., Patrick G., Rob B. and Jerome H., “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Pearson Education, 2018.				

COURSE OUTCOMES

At the end of the course students should be able to

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

CO1: Select sensors to develop mechatronics systems.

CO2: Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs

CO3: Design appropriate interfacing circuits to connect I/O devices with microprocessor

CO4: Apply PLC as a controller in mechatronics system

CO5: Design and develop the apt mechatronics system for an application

COs	Mapping of Programme Outcomes / Programme Specific Outcomes													
	(1/2/3 indicates Correlation Levels) 1- Slight(Low) 2- Moderate (Medium) 3-Substantial (High)													
	CO-PO Mapping											CO-PSO Mapping		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02	PS03
C01	3	2									2	3	2	
C02	3	2	1		2						2	1		
C03	2	3	1								2		2	
C04	3	2	2	2		1					2	2	2	
C05	3	2	2			1					3	2	2	