You Choose, We Do It
St. JOSEPH'S COLLEGE OF ENGINEERING
(An Autonomous Institution)
St. Joseph's Group of Institutions
OMR, Chennai - 119

FACULTY OF MECHANICAL ENGINEERING

B.E. MECHATRONICS ENGINEERING

(Choice Based Credit System–CBCS)

REGULATIONS – 2021

CURRICULUM FOR I TO VIII SEMESTERS

SYLLABUS FOR I - IV SEM

B. E. MECHATRONICS ENGINEERING
REGULATIONS 2021
CURRICULUM FOR I TO VIII SEMESTERS

SEMESTER I

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS 1101	Communicative English	HSMC	3	0	0	3	3
2	MA 1102	Engineering Mathematics – I	BSC	4	0	0	4	4
3	PH 1103	Engineering Physics	BSC	3	0	0	3	3
4	CY 1104	Engineering Chemistry	BSC	3	0	0	3	3
5	GE 1106	Engineering Graphics	ESC	2	0	4	6	4
6	GE1109	Problem Solving and Programming in C	ESC	3	0	0	3	3
7	GE1209	தமிழர் மரபு/ Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICAL								
8	GE1110	Programming in C Laboratory	ESC	0	0	4	4	2
9	BS 1108	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
TOTAL				**19**	**0**	**12**	**31**	**25**

SEMESTER II

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS 1201	Professional English	HSMC	3	0	0	3	3
2	MA 1202	Engineering Mathematics – II	BSC	4	0	0	4	4
3	PH1256	Applied Materials science	BSC	3	0	0	3	3
4	BE 1252	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5	GE 1206	Engineering Mechanics	ESC	3	1	0	4	4
6	GE1214	Environmental science and Sustainability	BSC	2	0	0	2	2
7	GE 1210	தமிழரும் தததொழில்நுட்பமும்/ Tamils and Technology	HSMC	1	0	0	1	1
PRACTICAL								
8	GE 1207	Engineering Practices Laboratory	ESC	0	0	4	4	2

9	BE 1258	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
TOTAL				**19**	**1**	**8**	**28**	**24**

SEMESTER III

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1301	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2	MT1301	Digital Electronics and Microprocessor	PCC	3	0	0	3	3
3	MT1302	Fluid Mechanics and Thermal systems	ESC	3	0	0	3	3
4	MT1303	Manufacturing Technology	PCC	3	0	0	3	3
5	CS1302	Data Structures	ESC	3	0	0	3	3
6	EE1352	Electrical Drives and Controls	PCC	3	0	0	3	3
PRACTICAL								
7	MT1307	Manufacturing Technology Laboratory	PCC	0	0	4	4	2
8	EE1358	Electrical Engineering Laboratory	PCC	0	0	4	4	2
9	HS1310	Professional Skills Laboratory	HSMC	0	0	2	2	1
TOTAL				**18**	**1**	**10**	**29**	**24**

SEMESTER IV

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1401	Statistics and Numerical Methods	BSC	3	1	0	4	4
2	MT1401	Kinematics and Dynamics of Machinery	PCC	3	0	0	3	3
3	MT1402	Hydraulics and Pneumatics	PCC	3	0	0	3	3
4	MT1403	Sensors and Instrumentation (Lab Integrated)	PCC	3	0	2	4	4
5	MT1404	Embedded systems and IoT	PCC	3	0	0	3	3
6		OE I	OEC	3	0	0	3	3
PRACTICAL								
7	MT1407	Embedded systems and IoT Laboratory	PCC	0	0	4	4	2
8	MT1408	Hydraulics and Pneumatics Laboratory	PCC	0	0	4	4	2
9	MT1409	Design Studio	EEC	0	0	2	2	1
TOTAL				**19**	**0**	**12**	**30**	**25**

SEMESTER V

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MT1501	Robotics and Automation	PCC	3	0	0	3	3
2	MT1502	Real Time Operating System	PCC	3	0	0	3	3
3		PE I	PEC	3	0	0	3	3
4		PE II	PEC	3	0	0	3	3
5		OE II	OEC	3	0	0	3	3
PRACTICAL								
7	MT1506	Design and Modelling Laboratory	PCC	0	0	4	4	2
8	MT1507	Robotics and Process Automation laboratory	PCC	0	0	4	4	2
9	MT1508	Signals and Systems laboratory	PCC	0	0	4	4	2
10		Internship*	EEC	0	0	0	0	1
TOTAL				**15**	**0**	**12**	**27**	**22**

***Two weeks Summer Internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester.**

SEMESTER VI

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MT1601	Design of Mechatronics system	PCC	3	1	0	4	4
2	MT1602	Control Systems Engineering	PCC	3	0	0	3	3
3		PE III	PEC	3	0	0	3	3
4		PE IV	PEC	3	0	0	3	3
5		PE V	PEC	3	0	0	3	3
PRACTICAL								
7	MT1603	Mechatronics System Design Laboratory	PCC	0	0	4	2	2
8	MT1604	Proto Fabrication studio	EEC	0	0	4	2	2
9	MT1605	Control System Engineering Lab	PCC	0	0	4	2	2
10	MT1606	Technical Seminar	EEC	0	0	1	1	0
TOTAL				**15**	**1**	**13**	**23**	**22**

SEMESTER VII

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MT1701	Machine vision and Image processing	PCC	3	0	0	3	3
2	MT1702	Industrial Automation and IIOT	PCC	3	0	0	3	3
3	MT1703	Industrial Management	HSMC	3	0	0	3	3
4		PE VI	PEC	3	0	0	3	3
5		OE III	OEC	3	0	0	3	3
PRACTICAL								
7	MT1706	Machine vision and Image processing Lab	PCC	0	0	4	2	2
8	MT1707	IIOT LAB	PCC	0	0	4	2	2
9	MT1708	Project Work Phase -I	EEC	0	0	4	2	2
10		Internship#	EEC	0	0	0	0	1
TOTAL				**15**	**0**	**12**	**21**	**22**

#Two weeks Summer Internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester.

SEMESTER VIII

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MT1801	Project Work Phase-II	EEC	0	0	20	20	10
TOTAL				**0**	**0**	**20**	**20**	**10**

TOTAL CREDITS: 174

PROFESSIONAL ELECTIVE COURSES: VERTICALS

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
VERTICAL 1: AI AND APPLIED ROBOTICS (PE I)								
1	MT1511	IoT based Augmented Reality	PEC	3	0	0	3	3
2	MT1512	Introduction of Machine Learning	PEC	3	0	0	3	3
3	MT1513	Data Analytics for Robotics and Automation	PEC	3	0	0	3	3
4	MT1514	Micro robotics	PEC	3	0	0	3	3
5	MT1515	Collaborative Robotics	PEC	3	0	0	3	3
6	MT1516	Robot Operating Systems	PEC	3	0	0	3	3

VERTICAL 2: DESIGN AND MANUFACTURING (PE II)								
1	MT1521	Robot and Machine Elements Design	PEC	3	0	0	3	3
2	MT1522	CNC Machine Tools and Programming	PEC	3	0	0	3	3
3	MT1523	Advanced Manufacturing Systems	PEC	3	0	0	3	3
4	MT1524	Mechatronic Systems in Additive Manufacturing	PEC	3	0	0	3	3
5	MT1525	Electronics Manufacturing Technology	PEC	3	0	0	3	3
6	MT1526	Computer Aided Inspection and Testing	PEC	3	0	0	3	3
VERTICAL 3: SMART MOBILITY SYSTEMS (PE III)								
1	MT1611	Automobile Engineering	PEC	3	0	0	3	3
2	MT1612	Electric and Hybrid Vehicles	PEC	3	0	0	3	3
3	MT1613	Automotive Mechatronics	PEC	3	0	0	3	3
4	MT1614	Automotive System Modelling and Simulation	PEC	3	0	0	3	3
5	MT1615	Smart mobility and Intelligent Vehicles	PEC	3	0	0	3	3
6	MT1616	Advanced Driver Assistance Systems	PEC	3	0	0	3	3
VERTICAL 4: INTELLIGENCE SYSTEMS AND NETWORKING (PE IV)								
1	MT1621	Applied Signal Processing	PEC	3	0	0	3	3
2	MT1622	Applied Image Processing	PEC	3	0	0	3	3
3	MT1623	Machine Learning for Intelligent Systems	PEC	3	0	0	3	3
4	MT1624	Condition Monitoring and Fault Diagnostics	PEC	3	0	0	3	3
5	MT1625	Industrial Networking	PEC	3	0	0	3	3
6	MT1626	Design Thinking and product development	PEC	3	0	0	3	3
VERTICAL 5: INDUSTRIAL AUTOMATION (PE V)								
1	MT1631	Factory Automation	PEC	3	0	0	3	3
2	MT1632	Process Control and Automation	PEC	3	0	0	3	3
3	MT1633	Virtual Instrumentation using LabVIEW	PEC	3	0	0	3	3
4	MT1634	Motion Control System	PEC	3	0	0	3	3
5	MT1635	Digital Twin and Industry 5.0	PEC	3	0	0	3	3
6	MT1636	Cyber Physical Systems	PEC	3	0	0	3	3
VERTICAL 6: DIVERSIFIED COURSES (PE VI)								
1.	MT1711	Linear Integrated Circuits	PEC	3	0	0	3	3
2.	MT1712	Single Board Computers	PEC	3	0	0	3	3
3.	MT1713	Reliability and Maintenance Engineering	PEC	3	0	0	3	3
4.	MT1714	Integrated Product Development	PEC	3	0	0	3	3
5.	MT1715	Medical Mechatronics	PEC	3	0	0	3	3
6.	MT1716	Micro Electro Mechanical Systems	PEC	3	0	0	3	3
7.	MT1717	Process Planning and Cost Estimation	PEC	3	0	0	3	3
8.	MT1718	VLSI and FPGA	PEC	3	0	0	3	3
9.	MT1719	Computer Vision and Deep Learning	PEC	3	0	0	3	3

OPEN ELECTIVES

SL.NO	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1	Basics of Arduino and Raspberry pi	OEC	3	0	0	3	3
2	Drone Technology	OEC	3	0	0	3	3
3	Quantum Computing in Robotics	OEC	3	0	0	3	3
4	Block chain Technology for Robotics Applications	OEC	3	0	0	3	3
5	Graphical Simulation Using LabVIEW	OEC	3	0	0	3	3
6	MEMS & NEMS	OEC	3	0	0	3	3
7	Product design and development	OEC	3	0	0	3	3
8	Cyber physical systems	OEC	3	0	0	3	3
9	Introduction to industry 4.0	OEC	3	0	0	3	3
10	Production and Operations Management for Entrepreneurs	OEC	3	0	0	3	3
11	Additive Manufacturing	OEC	3	0	0	3	3
12	Renewable Energy Technologies	OEC	3	0	0	3	3
13	Introduction to Python Programming	OEC	3	0	0	3	3

SUMMARY

B.E. Mechatronics Engineering										
S. No	**Subject Area**	**Credits per Semester**							**Total Credits**	**Subjects**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	
1	**HSMC**	**4**	**4**	**1**				**3**		**12**	**4**
2	**BSC**	**12**	**9**	**4**	**4**					**31**	**9**
3	**ESC**	**9**	**11**	**6**						**26**	**9**
4	**PCC**			**13**	**20**	**12**	**11**	**10**		**67**	**23**
5	**PEC**					**6**	**9**	**3**		**18**	**7**
6	**OEC**					**3**		**3**		**6**	**3**
7	**EEC**				**1**	**1**	**2**	**3**	**10**	**17**	**3**
8	**Non-Credit / (Mandatory)**	-	-	-	-	-	-	-	-	-	
Total		**25**	**24**	**25**	**25**	**22**	**22**	**22**	**10**	**174**	**58**

HS1101	COMMUNICATIVE ENGLISH	L	T	P	C
(Common for all Branches of B.E. / B. Tech Programmes)		3	0	0	3

OBJECTIVES

- To develop the basic reading and writing skills of first year engineering and technology students
- To help learners develop their listening skills, which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT - I	SHARING INFORMATION RELATED TO ONESELF/ FAMILY & FRIENDS	9
Reading– critical reading – finding key information in a given text – shifting facts from opinions - Writing - autobiographical writing - developing hints. Listening- short texts- short formal and informal conversations. Speaking- basics in speaking - introducing oneself - exchanging personal information- speaking on given topics & situations Language development – voices- Wh- Questions- asking and answering-yes or no questions – parts of speech. Vocabulary development-- prefixes- suffixes- articles - Polite Expressions.		CO1

UNIT - II	GENERAL READING AND FREE WRITING	9
Reading: Short narratives and descriptions from newspapers (including dialogues and conversations); Reading Comprehension Texts with varied question types - Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –. Listening - long texts - TED talks - extensive speech on current affairs and discussions Speaking – describing a simple process – asking and answering questions - Language development – prepositions, clauses. Vocabulary development- guessing meanings of words in context – use of sequence words.		CO2

UNIT - III	GRAMMAR AND LANGUAGE DEVELOPMENT	9
Reading- short texts and longer passages (close reading) & making a critical analysis of the given text Writing– types of paragraph and writing essays – rearrangement of jumbled sentences. Listening: Listening to ted talks and long speeches for comprehension. Speaking- role plays - asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- Direct vs. Indirect Questions. Vocabulary development – idioms and phrases- cause & effect expressions, adverbs.		CO3

UNIT - IV	READING AND LANGUAGE DEVELOPMENT	9
Reading- comprehension-reading longer texts- reading different types of texts- magazines. Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening: Listening comprehension (IELTS, TOEFL and others). Speaking -Speakingabout friends/places/hobbies - Language development- Tenses- simple present-simple past- present continuous and past continuous- conditionals –if, unless, in case, when and others Vocabulary development- synonyms-antonyms- Single word substitutes- Collocations.		CO4

UNIT - V	EXTENDED WRITING	9
Reading: Reading for comparisons and contrast and other deeper levels of meaning – Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing- Listening - popular speeches and presentations - Speaking - impromptu speeches & debates Language development-modal verbs- present/ past perfect		CO5

tense - Vocabulary development-Phrasal verbs- fixed and semi-fixed expressions	
Total Periods:	**45**

TEXT BOOKS:

1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2021.
2. Sanjay Kumar & Pushp Lata Communication Skills Second Edition, Oxford University Press: 2015.
3. Richards, C. Jack. Interchange Students" Book-2 New Delhi: CUP, 2015.

REFERENCE BOOKS:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means, L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning ,USA: 2007.
3. Redston, Chris & Gillies Cunningham Face 2 Face (Pre-intermediate Student,,s Book & Workbook) Cambridge University Press, New Delhi: 2005.
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
5. Dutt P. Kiranmai and Rajeevan Geeta Basic Communication Skills, Foundation Books: 2013.
6. John Eastwood et al : Be Grammar Ready: The Ultimate Guide to English Grammar, Oxford
7. University Press: 2020.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
CO3	Read different genres of texts adopting various reading strategies.
CO4	Listen/view and comprehend different spoken discourses/excerpts in different accents
CO5	Identify topics and formulate questions for productive inquiry

MA1102	**ENGINEERING MATHEMATICS –I**	**L**	**T**	**P**	**C**
(Common for all branches of B.E. / B. Tech Programmes)		4	0	0	4

OBJECTIVES

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus.
- The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- Matrix algebra is one of the powerful tools to handle practical problems arising in the field of engineering.
- This is a foundation course of single variable and multivariable calculus which plays an important role in the understanding of science, engineering, economics and computer science, among

other disciplines.

UNIT - I	MATRICES	12
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms		CO1

UNIT - II	CALCULUS OF ONE VARIABLE	12
Limit of a function - Continuity - Derivatives - Differentiation rules – Interval of increasing and decreasing functions – Maxima and Minima - Intervals of concavity and convexity.		CO2

UNIT - III	CALCULUS OF SEVERAL VARIABLES	12
Partial differentiation – Homogeneous functions and Euler,,s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor,,s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange,,s method of undetermined multipliers.		CO3

UNIT - IV	INTEGRAL CALCULUS	12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.		CO4

UNIT - V	MULTIPLE INTEGRALS	12
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Change of variables from Cartesian to polar in double integrals- Triple integrals – Volume of solids.		CO5

Total Periods:	**60**

TEXT BOOKS:

1. Grewal B.S., Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units II & IV - Sections 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.2 - 7.4 and 7.8].

REFERENCE BOOKS:

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., ―Advanced Engineering Mathematics‖, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., ―Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. T. Veerarajan. Engineering Mathematics – I, McGraw Hill Education; First edition 2017.

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Have a clear idea of matrix algebra pertaining to Eigenvalues and Eigenvectors in addition to dealing with quadratic forms.
CO2	Understand the concept of limit of a function and apply the same to deal with continuity and

	derivative of a given function. Apply differentiation to solve maxima and minima problems, which are related to real world problems.
CO3	Have the idea of extension of a function of one variable to several variables. Multivariable functions of real variables are inevitable in engineering.
CO4	Understand the concept of integration through the fundamental theorem of calculus. Also acquire skills to evaluate the integrals using the techniques of substitution, partial fraction and integration by parts along with the knowledge of improper integrals.
CO5	Do double and triple integration so that they can handle integrals of higher order which are applied in the engineering field.

PH1103	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
(Common for all branches of B.E. / B. Tech Programmes)		3	0	0	3

OBJECTIVES

- To make the students conversant with
- Elastic properties of materials and various moduli of elasticity.
- Principles of laser and fiber optics and its various technological applications.
- Thermal conduction in solids, heat exchangers and its applications in various devices.
- Quantum concepts to explain black body radiation, Compton effect and matter waves.
- Various crystal structures, Miller indices and crystal growth techniques.

UNIT - I	**PROPERTIES OF MATTER**	**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 – Practical applications of modulus of elasticity- I shaped girders - stress due to bending in beams.		CO1

UNIT - II	**LASER AND FIBER OPTICS**	**9**
Lasers : population of energy levels, Einstein"s A and B coefficients derivation –resonant cavity, optical amplification (qualitative) – Nd-YAG Laser-Semiconductor lasers: homojunction and heterojunction –Industrial and medical applications of Laser– Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers– Fabrication of Optical fiber-Double crucible method-fibre optic sensors: pressure and displacement-Industrial and medical applications of optical fiber- Endoscopy-Fiber optic communication system.		CO2

UNIT - III	**THERMAL PHYSICS**	**9**
Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity –Rectilinear flow of heat- conduction through compound media (series and parallel)- Lee"s disc method: theory and experiment - Radial flow of heat – thermal insulation – applications: heat exchangers, refrigerators, oven, Induction furnace and solar water heaters.		CO3

UNIT - IV	**QUANTUM PHYSICS**	**9**

Black body radiation – Planck"s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger"s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – Electron microscope-tunnelling (qualitative) - scanning tunnelling microscope-Applications of electron microscopy.	CO4

UNIT - V	**CRYSTAL PHYSICS**	**9**
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures – Graphite structure-crystal imperfections: point defects, line defects – Burger vectors, stacking faults – growth of single crystals: solution and melt growth techniques-Epitaxial growth-Applications of Single crystal (Qualitative).		CO5
	Total Periods:	**45**

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2017.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2013

REFERENCE BOOKS:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2019.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H.Freeman, 2014.

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	The elastic property and stress strain diagram, determination of rigidity modulus by torsional pendulum and Young"s modulus by various methods.
CO2	Principle of laser, Einstein"s coefficients of laser action, semiconductor laser and its applications, optical fibers and their applications in sensors and communication system.
CO3	The heat transfer through solids and the determination of thermal conductivity in a bad conductor by Lee 's disc method and radial flow of heat.
CO4	The quantum concepts and its use to explain black body radiation, Compton effect and wave equation for matter waves, tunnelling electron microscopy and its applications.
CO5	The importance of various crystal structures, Miller indices and various growth techniques.

CY1104	ENGINEERING CHEMISTRY	L	T	P	C
(Common for all branches of B.E. / B. Tech Programmes)		3	0	0	3

OBJECTIVES

- To make the student conversant with the
- Principles of water characterization and treatment for industrial purposes.
- Principles and applications of surface chemistry and catalysis.
- Phase rule and various types of alloys
- Various types of fuels, applications and combustion
- Conventional and non–conventional energy sources and energy storage device

UNIT - I	WATER AND ITS TREATMENT	9

Hardness of water – Types – Expression of hardness – Units – Estimation of hardness by EDTA method – Numerical problems on EDTA method – Boiler troubles (scale and sludge, caustic embrittlement , boiler corrosion, priming and foaming) – Treatment of boiler feed water – Internal treatment (carbonate, phosphate, colloidal, sodium aluminate and calgon conditioning) – External treatment – Ion exchange process, Zeolite process – Desalination of brackish water by Reverse Osmosis. CO1

UNIT - II	SURFACE CHEMISTRYAND CATALYSIS	9

Surface chemistry : Types of adsorption – Adsorption of gases on solids – Adsorption of solute from solutions – Adsorption isotherms – Freundlich"s adsorption isotherm – Langmuir"sadsorption isotherm – Kinetics of uni-molecular surface reactions – Adsorption in chromatography – Applications of adsorption in pollution abatement using PAC.
Catalysis: Catalyst – Types of catalysis – Criteria – Contact theory – Catalytic poisoning and catalytic promoters – Industrial applications of catalysts – Catalytic convertor – Auto catalysis – Enzyme catalysis – Michaelis-Menten equation. CO2

UNIT - III	PHASE RULE AND ALLOYS	9

Phase rule: Introduction – Definition of terms with examples – One component system – Water system – Reduced phase rule – Thermal analysis and cooling curves – Two component systems – Lead-silver system – Pattinson process.
Alloys: Introduction – Definition – Properties of alloys – Significance of alloying – Functions and effect of alloying elements – Nichrome, Alnico, Stainless steel (18/8) – Heat treatment of steel – Non-ferrous alloys –Brass and bronze. CO3

UNIT - IV	FUELS AND COMBUSTION	9

Fuels: Introduction – classification of fuels – Comparison of solid, liquid, gaseous fuels –Coal – Analysis of coal (proximate and ultimate) – Carbonization – Manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – Cracking – Manufacture of synthetic petrol (Bergius process, Fischer Tropsch Process) – Knocking – Octane number – Diesel oil – Cetane number – Compressed natural gas (CNG) – Liquefied petroleum gases (LPG) – Power alcohol and biodiesel.
Combustion of fuels: Introduction – Calorific value – Higher and lower calorific values – Theoretical calculation of calorific value – Ignition temperature – Spontaneous ignition temperature – Explosive range – Flue gas analysis by Orsat Method. CO4

UNIT - V	NON–CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES	9

Nuclear energy – Fission and fusion reactions – Differences – Chain reactions – Nuclearreactors – Classification of reactors – Light water nuclear reactor for power generation – Breeder reactor – Solar energy conversion – Solar cells – Wind energy – Fuel cells – Hydrogen-oxygen fuel cell .Batteries – Types of batteries - Alkaline batteries – Lead-acid, Nickel-cadmium and Lithium batteries.	CO5
Total Periods:	**45**

TEXT BOOKS:

1. P.C.Jain, Monica Jain, "Engineering Chemistry" 17th Ed., Dhanpat Rai Pub. Co., New Delhi, (2015).
2. S.S. Dara, S.S. Umare, "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi(2020).
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India (P) Ltd. New Delhi, (2018).
4. P. Kannan, A. Ravikrishnan, "Engineering Chemistry", Sri Krishna Hi-tech PublishingCompany (P) Ltd., Chennai, (2009).

REFERENCE BOOKS:

1. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tata McGraw–Hill Pub.Co.Ltd, New Delhi (2008).
3. Prasanta Rath, "Engineering Chemistry", Cengage Learning India (P) Ltd., Delhi, (2015).
4. Shikha Agarwal, "Engineering Chemistry–Fundamentals and Applications", CambridgeUniversity Press, Delhi, (2015).
5. Pahari, B. Chauhan, "Engineering Chemistry", Firewall Media, New Delhi., (2010).
6. A. Sheik Mideen, Engineering Chemistry, Airwalk Publications, Chennai (2018)

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand impurities in industrial water, boiler troubles, internal and external treatmentmethods of purifying water.
CO2	Understand concepts of absorption, adsorption, adsorption isotherms, application of adsorptionfor pollution abatement, catalysis and enzyme kinetics.
CO3	Recognize significance of alloying, functions of alloying elements and types of alloys, uses ofalloys, phase rule, reduced phase and its applications in alloying.
CO4	Identify various types of fuels, properties, uses and analysis of fuels. They should be able tounderstand combustion of fuels, method of preparation of bio-diesel, synthetic petrol.
CO5	Understand conventional, non-conventional energy sources, nuclear fission and fusion, powergeneration by nuclear reactor, wind, solar energy and preparation, uses of various batteries.

GE1106	ENGINEERING GRAPHICS	L	T	P	C
(Common for all branches of B.E. / B. Tech Programmes)		2	0	4	4

OBJECTIVES

- To develop graphic skills for communication of concepts, ideas and design of engineering products.
- To inculcate drawing practice in standardized form whenever technical drawing is needed.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	1

UNIT - I	**PLANE CURVES AND FREEHAND SKETCHING**	**7+12**
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloidal curves – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles–Representation of Three-Dimensional objects –Layout of views- Freehand sketching of multiple views from pictorial views of objects (Draw without using drawing instruments)		CO1
UNIT - II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**6+12**
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		CO2
UNIT - III	**PROJECTION OF SOLIDS**	**5+12**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes when the solid is simply suspended by rotating object method.		CO3
UNIT - IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**5+12**
Sectioning of simple solids like prisms, pyramids, cylinder, and cone in a simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other –obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones - Graphically finding the shortest distance connecting two points.		CO4
UNIT - V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+12**
Principles of isometric projection – isometric scale –Isometric projections and isometric views of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.		CO5
	Total Periods:	**90**

TEXT BOOKS:

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, Twenty ninth edition 2017
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2011.
3. S. Ramachandran and K. Pandian, "Engineering Graphics" Airwalk Publications; 8th edition 2014

REFERENCE BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2018.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Understand the fundamentals and standards of Engineering graphics.
CO2	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
CO3	Understand the concept of orthographic projections of lines and plane surfaces.
CO4	Draw projections of the section of solids and development of surfaces.
CO5	Visualize and to project isometric and perspective sections of simple solids.

GE1109	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
(Common for all branches of B.E. / B. Tech Programme)		3	0	0	3

UNIT - I	PROBLEM SOLVING AND BASICS OF C PROGRAMMING	9
Introduction, Algorithms, building blocks of algorithms, Algorithmic problem-solving steps; Simple Strategies and notation for developing algorithms: Control flow, Flow charts, Pseudo codes, Programming languages; Introduction to C; Structure of a C Program; Compiling and Executing C Programmes, C Tokens and character set,Keywords, Identifiers, Basic Data types,Variables, Constants, Input/Output statements, Operators, Type conversion and Type Casting.		CO1
UNIT - II	**DECISION CONTROL, LOOPING STATEMENTS, FUNCTIONS, AND ARRAYS**	**9**
Conditional Branching statements, Iterative statements, Nested loops, The Break and continue statements, Goto statements; Introduction to Functions: Function declaration, Function definition, Function call, return statement, passing parameters to the function, Recursive Functions; Introduction to Arrays: Declaration, Accessing the Elements, storing values, operations on arrays, Passing Arrays to functions, two-dimensional array, Multidimensional arrays.		CO2
UNIT - III	**STRINGS AND POINTERS**	**9**
String: Introduction to String, Suppressing Input, String Taxonomy, String operation; Pointers: Introduction to Pointers, declaring pointers variables, Pointer expression and Pointer arithmetic, passing arguments to Function using Pointers, Pointers and Arrays, Array of pointers; Function Pointers, Pointers to Pointers, memory allocation in C Programs, Dynamic memory allocation; Drawbacks of pointers.		CO3
UNIT - IV	**STRUCTURES, UNIONSANDENUMERATED DATA TYPE**	**9**
Structure: declaration and initialization, accessing members of structure; Nested structures; Array of structures; Structures and functions; Self-referential structures; Union: declaration and initialization, Accessing members of Union; Array of Union variable; Unions inside Structures, Structures inside unions, Enumerated Data type.		CO4
UNIT - V	**FILE PROCESSING**	**9**
Introduction to files, using files in C, read data from files, Writing Data to files, Detecting the End of file, Error Handling duringfile operations; Accepting Command line arguments, Function for selecting a record randomly, Remove and renaming the File, Creating temporary file, Pre-processor directives.		CO5
	Total Periods:	**45**

TEXT BOOKS:

1. Reema Thareja, Programming in C, Oxford University Press, Third Edition, 2023.
2. Herbert Schildt, C The Complete Reference, Fourth Edition, McGraw-Hill, 2017.
3. Kernighan, B.W and Ritchie,D.M, The C Programming language, Second Edition, Pearson Education, 2015.

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, How to Program, Ninth edition, Pearson Publication 2022.
2. Dhabal Prasad Sethi and Manoranjan, Concepts and Techniques of Programming In C, Wiley India,2020.
3. Mamta Bhusry, C Concepts & Programming, Wiley India, 2019
4. Dr. Rupinder Singh, Inderpreet Kaur, and Davinder Kaur, C programming Beginner's guide, Notion Press, 2020.
5. M.T. Somashekara, D. S. Guru and K. S. Manjunatha, Problem Solving with C, PHI Learning,2018

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Develop simple applications in C using basic constructs.
CO2	Design and implement applications using arrays, strings, and functions.
CO3	Develop and implement applications in C using pointers.
CO4	Develop applications in C using structures and union.
CO5	Design applications using sequential and random-access file processing.

GE1209	தமிழர் மரபு	L	T	P	C
	(Common for all Branches of B.E. / B. Tech Programmes)	1	0	0	1

அலகு - I	மொழி மற்றும் இலக்கியம்	3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி- தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் திருக்குறளில் மேலாண்மைக் கருத்துக்கள் தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி -தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - II	மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை	3

நடுகல் முதல் நவீன சிற்பங்கள் வரை- ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள்- தேர் செய்யும் கலை சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசை கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம்- தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - III	நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்	3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம் தமிழர்களின் விளையாட்டுகள்.

அலகு - IV	தமிழர்களின் திணைக் கோட்பாடுகள்	3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் -தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு - V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத்	3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் கையெழுத்துப்படிகள் - தமிழ் புத்தகங்களின் அச்சு வரலாறு.

TOTAL PERIODS : 15

TEXT CUM REFERENCE BOOKS

1.தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2.கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3.கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

GE1209	HERITAGE OF TAMILS	L	T	P	C
	(Common for all Branches of B.E. / B. Tech Programmes)	1	0	0	1

UNIT I	**LANGUAGE AND LITERATURE**	**9**

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**	**9**

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, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils

UNIT III	**FOLK AND MARTIAL ARTS**	**9**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV	**THINAI CONCEPT OF TAMILS**	**9**

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**	**9**

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.
TOTAL PERIODS : 15

TEXT CUM REFERENCE BOOKS

1.தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2.கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3.கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

CS1208	PROGRAMMING IN C LABORATORY	L	T	P	C
	Common to CSE, IT, AI-DS & AI-ML	0	0	4	2

OBJECTIVES

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing

LIST OF EXPERIMENTS

1. C programming using simple statements and expressions.	**CO1**
2. Scientific problem-solving using decision making and looping.	
3. Generating different patterns using multiple control statements.	
4. Problems solving using one dimensional array.	
5. Mathematical problem solving using two dimensional arrays.	
6. Solving problems using string functions.	**CO2**
7. Solving problems with user defined functions.	
8. Solving problems using recursive function.	

9. Solving problems with dynamic memory allocation.	
10. Realtime application using structures and unions.	
11. Realtime problem solving using sequential and random-access file.	**CO3**
12. Solving problems with command line argument.	
	TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Problem Solving and Program Design in C, 4th edition, by Jeri R. Hanly and Elli B.Koffman.
2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
3. Programming in C by Pradip Dey, Manas Ghosh 2nd edition Oxford University Press. E.Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill.
4. A first book of ANSI C by Gray J.Brosin 3rd edition Cengagedelmer Learning India P.Ltd.
5. AL Kelly, Iraphol,Programming in C,4th edition Addison-Wesley – Professional.
6. Brain W.Kernighan & Dennis Ritchie, C Programming Language, 2nd edition, PHI.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop C programs for simple applications making use of basic constructs.
CO2	Develop C programs involving string, functions, recursion, pointers, and structures.
CO3	Design applications using sequential and random-access file processing.

BS1108	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
(Common for all branches of B.E. / B. Tech Programmes)		0	0	4	2

OBJECTIVES

- The students will be trained to perform experiments to study the following.
- The Properties of Matter
- The Optical properties, Characteristics of Lasers & Optical Fibre
- Electrical & Thermal properties of Materials
- Enable the students to enhance accuracy in experimental measurements.
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis
- Instrumental method of analysis such as potentiometry, conductometry and pHmetry

LIST OF EXPERIMENTS – PHYSICS

(A minimum of 5 experiments to be performed from the given list)

1. Determination of Young"s modulus of the material of the given beam by Non-uniform bending method.
2. Determination of rigidity modulus of the material of the given wire using torsion pendulum.
3. Determination of wavelength of mercury spectra using Spectrometer and grating.
4. Determination of dispersive power of prism using Spectrometer.
5. (a) Determination of wavelength and particle size using a laser.

(b) Determination of numerical aperture and acceptance angle of an optical fibre.

(c) Determination of width of the groove of compact disc using laser

6. Determination of Young"s modulus of the material of the given beam by uniformbending method.
7. Determination of energy band gap of the semiconductor.
8. Determination of coefficient of thermal conductivity of the given bad conductor usingLee"s disc.

DEMONSTRATION EXPERIMENT

1. Determination of thickness of a thin sheet / wire – Air wedge method

LIST OF EXPERIMENTS – CHEMISTRY

(A minimum of 6 experiments to be performed from the given list)

1. Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity inwater sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler"s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
10. Conductometric titration of strong acid vs strong base.

DEMONSTRATION EXPERIMENTS

1. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
2. Estimation of sodium and potassium present in water using flame photometer.

HS1201	PROFESSIONAL ENGLISH	L	T	P	C
(Common for all Branches of B.E. / B. Tech Programmes)		3	0	0	3

OBJECTIVES

- The Course prepares second semester engineering and Technology students to:
- Develop strategies and skills to enhance their ability to read and comprehendengineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT - I	INTRODUCTION PROFESSIONAL ENGLISH	9
Listening: Listening to technical talks with comprehension tasks - Speaking – conversation methods in real life occurrences using expressions of different emotions and imperative usages - Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – writing instructions – checklists-recommendations- Vocabulary Development- technical vocabulary Language Development – tenses- subject verb agreement - compound words.		CO1

UNIT - II	READING AND STUDY SKILLS	9
Listening-Listening Comprehension of a discussion on a technical topic of common interest by three or four participants (real life as well as online videos). -Speaking– describing a process- Reading: Practice in chunking and speed reading - Paragraphing- Writing- interpreting charts, graphs- Vocabulary Development: Important foreign expressions in Use, homonyms, homophones, homographs-easily confused words Language Development- impersonal passive voice, numerical adjectives.		CO2

UNIT - III	TECHNICAL WRITING AND GRAMMAR	9
Listening –listening to conversation -effective use of words and their sound aspects, stress, intonation & pronunciation - Speaking – mechanics of presentations -Reading: Reading longer texts for detailed understanding. (GRE/IELTS practice tests); Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Informal vocabulary and formal substitutes-Misspelled words. Language Development- embedded sentences and Ellipsis.		CO3

UNIT - IV	REPORT WRITING	9
Listening – Model debates & documentaries and making notes. Speaking – expressing agreement/ disagreement, assertiveness in expressing opinions-Reading: Technical reports, advertisements and minutes of meeting - Writing- email etiquette- job application – cover letter –Résumé preparation(via email and hard copy)- analytical essays and issue based essays--Vocabulary Development- finding suitable synonyms-paraphrasing- Language Development- clauses- if conditionals.		CO4

UNIT - V	GROUP DISCUSSION AND JOBAPPLICATIONS	9
Listening: Extensive Listening. (radio plays, rendering of poems, audio books and others) Speaking –participating in a group discussion - Reading: Extensive Reading (short stories, novels, poetry and others) – Writing reports- minutes of a meeting- accident and survey- Writing a letter/ sending an email to the Editor - cause and effect sentences -Vocabulary Development- verbal analogies. Language Development- reported speech.		CO5
	TOTAL PERIODS:	**45**

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
CO3	Read different genres of texts adopting various reading strategies.
CO4	Listen/view and comprehend different spoken discourses/excerpts in different accents
CO5	Identify topics and formulate questions for productive inquiry

TEXT BOOKS:

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

REFERENCE BOOKS:

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi, 2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad, 2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA1202	ENGINEERING MATHEMATICS –II	L	T	P	C
(Common for all branches of B.E. /B. Tech Programmes except AI&DS and AI&ML)		4	0	0	4

OBJECTIVES

- This course is designed to cover topics such as Differential Equation, Vector Calculus, Complex Analysis and Laplace Transform. Vector calculus can be widely used for modelling the various laws of physics.
- The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT - I	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 – System of simultaneous first order linear differential equations with constant coefficients		CO1

UNIT - II	VECTOR CALCULUS	12
Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Volume integral - Green,,s, Gauss divergence and Stoke,,s theorems – Verification and simple application in evaluating line, surface and volume integrals.		CO2

UNIT - III	COMPLEX VARIABLES	12
Analytic functions –Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates (C-R equations) - Properties– Harmonic conjugates – Construction of analytic function (Milne-Thomphson method) – Conformal mapping – Standard transformations W = Z + C, CZ, 1/Z - Bilinear transformation.		CO3
UNIT - IV	**COMPLEX INTEGRATION**	**12**
Cauchy integral theorem – Cauchy integral formula – Taylor and Laurent series – Singularities – Residues – Cauchy Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi circular contour(excluding poles on the real line).		CO4
UNIT - V	**LAPLACE TRANSFORMS**	**12**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function - Basic properties - Shifting theorems - transforms of derivatives and integrals –Transform of periodic functions - Inverse transforms using properties, partial fractions and Convolution theorem – Application to solution of linear second order ordinary differential equations with constant coefficients.		CO5
	TOTAL PERIODS:	**60**

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	The students were imbibed with techniques in solving ordinary differential equations that arises in most of the engineering problems
CO2	The student were acquainted with the concepts of vector calculus-like Gradient, Divergence, Curl, Directional derivative, Irrational vector and Solenoidal vector. The course gives an understanding of Vector integration, needed for problems in all engineering disciplines.
CO3	To develop an understanding of the standard techniques of complex variable and mapping so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current .
CO4	The student will be exposed to the concept of Cauchy"s integral theorem, Taylor and Laurent expansions, Singular points, Application of residue theorem to evaluate complex integrals.
CO5	To make the students to appreciate the purpose of using transforms to create new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOKS:

1. Grewal B.S., ―Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCE BOOKS:

1. Bali N., Goyal M. and Watkins C., ―Advanced Engineering Mathematics‖, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., ― Advanced Engineering Mathematics ‖, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. O,,Neil, P.V. ―Advanced Engineering Mathematics‖, Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, ―Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd,4th Edition, New Delhi, 2014.
5. T. Veerarajan. Engineering Mathematics – II, McGraw Hill Education; First edition 2017.

PH1256	APPLIED MATERIAL SCIENCE	L	T	P	C
		3	0	0	3

UNIT - I	PHASE DIAGRAMS	12
Phase equilibrium – solubility limit – solid solution (interstitial and substitution)– intermediate phases – intermetallics – electron compound – Gibbs phase rule – Unary phase diagram (iron) – Binary phase diagrams: Isomorphous systems (Cu-Ni)– determination of phase composition and phase amounts– tie line and lever rule – binary eutectic diagram with no solid solution and limited solid solution (Pb-Sn)– eutectoid and peritectic reactions – other invariant reactions – microstructural development during the slow cooling: eutectic, hypereutectic and hypoeutectic compositions.		CO1

UNIT - II	MECHANICAL PROPERTIES	12
Tensile test – plastic deformation mechanisms – slip and twinning – role of dislocations in slip – strengthening methods – strain hardening – refinement of the grain size – solid solution strengthening – precipitation hardening – creep resistance – creep curves – mechanism of creep – creep-resistant materials – fracture – the Griffith criterion – critical stress intensity factor and its determination– Fatigue failure – fatigue tests – hardness – Rockwell and Brinell hardness – Knoop and Vickers micro hardness.		CO2

UNIT - III	ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS	12
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 –concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – exchange interaction and ferromagnetism – quantum interference devices – GMR devices.		CO3

UNIT - IV	SEMICONDUCTORS AND TRANSPORT PHYSICS	12
Intrinsic Semiconductors – Energy band diagram – Direct and Indirect Band gap Semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion– Hall effect and devices – Ohmic contacts – Schottky diode.		CO4

UNIT - V	NEW MATERIALS	12
Historical perspective – Material properties and qualities – Classification of Materials – Ceramics – Types and applications – Composites: classification, role of matrix and reinforcement, Processing of fibre reinforced plastics – metallic glasses: types , glass forming ability of alloys, melt spinning process, applications – shape memory alloys: phases, shape memory effect, pseudo elastic effect, Ni-Ti alloy, applications – nanomaterials: preparation (bottom up and top down approaches), properties and applications		CO5

TOTAL PERIODS:	45

TEXT BOOKS:

1. V.Raghavan. Materials Science and Engineering: A First Course, Prentice Hall India Learning Private Limited, 2015.
2. Safa Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 2018.
3. Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley (India), 2007.
4. Smith,W.F, Hashemi, J& Prakash, R.-Materials Science and Engineering, Tata McGraw Hill, Education Pvt. Ltd, 2014.
5. Sidney H Avner "Introduction to Physical Metallurgy" Tata Mc-Graw -Hill, 2017

REFERENCE BOOKS:

1. R.Balasubramaniam, Callister"s Materials Science and Engineering. Wiley (Indian Edition), 2014.
2. Wendelin Wright and Donald Askeland, Essentials of Materials Science and Engineering, CL Engineering,

2013.
3. Robert F.Pierret, Semiconductor Device Fundamentals, Pearson, 2006.
4. Simon Sze and Ming-kwei Lee, Semiconductor Devices: Physics and Technology, Wiley, 2015.
5. Harald Ibach, Hans Lüth, Solid-State Physics: An Introduction to Principles of Materials Science, Springer-Verlag Berlin Heidelberg. 2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Able to understand the various forms of solid solutions, equilibrium, and different phase diagrams and their applications in materials system.
CO2	Able to understand the mechanical properties of materials and their measurement.
CO3	Gain knowledge on classical, quantum electron theories, types of magnetic materials and its applications.
CO4	Understand the concentration of charge carriers in intrinsic and extrinsic semiconductors and importance of Hall effect.
CO5	Able to understand the importance of various newer materials, like ceramics, composite materials, metallic glass, SMA, and Nano materials. Their properties and fabrication and apply to develop alloys of various composition with desirable properties.

BE1252	**BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES

To impart knowledge on

- Electric circuit laws, single and three phase circuits and wiring
- Working Principles of Electrical Machines
- Various Electronic Devices and Measuring Instruments

UNIT - I	**ELECTRICAL CIRCUITS**	**9**
Basic circuit components -, Ohms Law - Kirchoff"s Law – Instantaneous Power – Inductors - Capacitors – Independent and Dependent Sources - steady state solution of DC circuits - Nodal analysis, Mesh analysis- Thevinin"s Theorem, Norton"s Theorem, Maximum Power transfer theorem,Linearity and Superposition Theorem.		CO1

UNIT - II	**AC CIRCUITS**	**9**
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring.		CO2

UNIT - III	**ELECTRICAL MACHINES**	**9**
Principles of operation and characteristics of ; DC machines, Transformers (single and three phase) ,Synchronous machines , three phase and single phase induction motors.		CO3

UNIT - IV	**ELECTRONIC DEVICES AND CIRCUITS**	**9**
Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction – Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics – Field Effect Transistors – Transistor Biasing –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier –DAC – ADC .		CO4

UNIT - V	**MEASUREMENTS AND INSTRUMENTATION**	**9**
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of		CO5

instruments - Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements – instrument transformers (CT and PT)	
TOTAL PERIODS:	**45**

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Explain the basic laws and theorems used in Electrical circuits
CO2	Impart knowledge on single phase and three phase AC circuit and wiring
CO3	Comprehend the construction and working principle of Electrical machines
CO4	Explain the fundamentals of semiconductor and applications.
CO5	Impart knowledge on different measuring instruments

TEXT BOOKS:

1. Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, 2013 2.
2. D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016 3.
3. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008

REFERENCE BOOKS:

1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
3. Allan S Moris, "Measurement and Instrumentation Principles", Elsevier, First Indian Edition,2006
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
6. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016

GE1206	ENGINEERING MECHANICS	L	T	P	C
	(Common to Civil and Mechanical Engineering)	3	1	0	4

OBJECTIVES

- To develop capacity to predict the effect of force.
- To develop motion in the course of carrying out the design functions of Engineering.

UNIT - I	**STATICS OF PARTICLES**	**9+3**
Type content here Introduction – Units and Dimensions – Laws of Mechanics – Lami"s theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.		CO1

UNIT - II	**EQUILIBRIUM OF RIGID BODIES**	**9+3**
Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon"s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions –		CO2

Equilibrium of Rigid bodies in three dimensions.		
UNIT - III	**PROPERTIES OF SURFACES AND SOLIDS**	**9+3**
Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration –T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula– Parallel axis theorem and perpendicular axis theorem– Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.		CO3
UNIT - IV	**DYNAMICS OF PARTICLES**	**9+3**
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton"s laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.		CO4
UNIT - V	**FRICTION AND RIGID BODY DYNAMICS**	**9+3**
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 – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.		CO5
	TOTAL PERIODS:	**45+15**

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Illustrate the vectorial and scalar representation of forces and moments
CO2	Analyse the rigid body in equilibrium
CO3	Evaluate the properties of surfaces and solids
CO4	Calculate dynamic forces exerted in rigid body
CO5	Determine the friction and the effects by the laws of friction

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 12th Edition, Tata McGraw-Hill Publishing company, (2017).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2018).

REFERENCE BOOKS:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 2017.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics - John Wiley &Sons, 2017.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition.

GE 1214	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L	T	P	C
		2	0	0	2

OBJECTIVES

- To develop capacity to predict the effect of force.
- To develop motion in the course of carrying out the design functions of Engineering.

UNIT - I	ENVIRONMENT AND BIODIVERSITY	6
Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow–ecological succession. Types of biodiversity: genetic, species and ecosystem diversity – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.		CO1

UNIT - II	ENVIRONMENTAL POLLUTION	6
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .		CO2

UNIT - III	RENEWABLE SOURCES OF ENERGY	6
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidalenergy conversion. Concept, origin and power plants of geothermal energy.		CO3

UNIT - IV	SUSTAINABILITY AND MANAGEMENT	6
Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals,and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change-Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.		CO4

UNIT - V	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, Green Engineering: Sustainable urbanization- Socio-economic and technological change.		CO5

TOTAL PERIODS:	30

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik"s "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, „Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, „Introduction to Environmental Engineering and Science", 2nd edition, PearsonEducation, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies,Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London

REFERENCE BOOKS:

1. R.K. Trivedi, „Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media. 38 . edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, „Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, „Environmental law", Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, „Environmental Studies-From Crisis to Cure", Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan

GE1210	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
	(Common for all Branches of B.E. / B. Tech Programmes)	1	0	0	1

அலகு - I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்

அலகு - II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு -சங்க காலத்தில்சுட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை

அலகு - III	உற்பத்தித் தொழில் நுட்பம்	3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு - IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்	3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்

அலகு - V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	3

அறிவியல் தமிழின் வளர்ச்சி -கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL PERIODS : 15

TEXT CUM REFERENCE BOOKS

1.தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3.கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

GE1210	TAMILS AND TECHNOLOGY	L	T	P	C
	(Common for all Branches of B.E. / B. Tech Programmes)	1	0	0	1

UNIT I	**WEAVING AND CERAMIC TECHNOLOGY**	**9**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**9**

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**	**9**

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 beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**9**

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**	**9**

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.

TOTAL PERIODS : 15

TEXT CUM REFERENCE BOOKS

1.தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3.கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International

Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

GE1207	ENGINEERING PRACTICES LABORATORY	L	T	P	C
(Common for all branches of B.E. /B. Tech Programmes)		0	0	4	2

OBJECTIVES

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.

(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning

(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 16

1. Study of electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) usingCR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR

Total Periods:	**30**

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Fabricate carpentry components and pipe connections including plumbing works.
CO2	Use welding equipments to join the structures, carry out the basic machining operations, and make the models using sheet metal works.
CO3	Illustrate on centrifugal pump, air conditioner, operations of smithy, foundry and fittings.
CO4	Carry out basic home electrical works and appliances, measure the electrical quantities.
CO5	Elaborate on the electronic components and gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. NO.	EQUIPMENT DETAILS	NO OF SETS
	CIVIL	
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets
2	Carpentry vice (fitted to work bench)	15 nos
3	Standard woodworking tools	15 Sets.
4	Models of industrial trusses, door joints, furniture joints	5 each
5	Power Tools: (a) Rotary Hammer	2 Nos
	(b) Demolition Hammer	2 Nos
	(c) Circular Saw	2 Nos
	(d) Planer	2 Nos
	(e) Hand Drilling Machine	2 Nos
	(f) Jigsaw	2 Nos
	MECHANICAL	
1	Arc welding transformer with cables and holders	5 Nos.
2	Welding booth with exhaust facility	5 Nos.
3	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5	Centre lathe	4 Nos.
6	Hearth furnace, anvil and smithy tools	2 Sets.
7	Moulding table, foundry tools	2 Sets.
8	Power Tool: Angle Grinder	2 Nos
	ELECTRICAL	
1	Assorted electrical components for house wiring	15 Sets
2	Electrical measuring instruments	15 Sets
3	Study purpose items: Iron box, fan and regulator, emergency lamp	10 Sets
4	Megger (250V/500V)	1 Each
5	Power Tools:	
	(a) Range Finder	2 Nos
	(b) Digital Live-wire detector	2 Nos
	ELECTRONICS	
1	Soldering guns	10 Nos.
2	Assorted electronic components for making circuits	50 Nos.
3	Small PCBs	10 Nos.
4	Multimeters	10 Nos.
5	Study purpose items: Telephone, FM radio, low-voltage power supply	

BE1258	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To validate the principles studied in theory by performing experiments in the laboratory

LIST OF EXPERIMENTS

1. Verification of Kirchhoff"s voltage and current laws.
2. Verification of Thevenin"s and Norton"s theorem.
3. Verification of Superposition theorem.
4. Verification of Maximum power transfer theorem.
5. Study of CRO and measurement of AC signals.
6. Measurement of three phase power by two-watt meter method.
7. Characteristics of LVDT.
8. Half wave rectifier with capacitive filter.
9. Characteristics of PN Diode
10. Characteristics of BJT
11. RTD and Thermistor
12. Transistor based application circuits

Total Periods: 60

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand and experimentally verify the basics of electric circuit laws
CO2	Understand and apply circuit theorems and concepts in engineering applications
CO3	Analyze the a.c. signals, understand the three phase electric networks and study the instruments used for commercial measurement of electrical power.
CO4	Understand and analyze the characteristics of diode, transistor and implement transistor based application
CO5	Understand and analyze the characteristics of different transducers

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Ammeter A.C and D.C	10
2	Voltmeters A.C and D.C	10
3	Watt meters LPF and UPF	4
4	Resistors & Breadboards	-
5	Cathode Ray Oscilloscopes	4
6	Dual Regulated power supplies	8
7	A.C. Signal Generators	4
8	Transistors (BJT, JFET)	-
9	LVDT, Diodes	-

SEMESTER III SYLLABUS

MA1301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
(Common to CIVIL, EEE, EIE, MECH, MECHATRONICS and BIO)		3	1	0	4

OBJECTIVES

- To introduce the basic concepts of Partial differential equation and to find its solutions.
- To introduce Fourier series analysis which is vital to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques to solve heat and wave flow problems in engineering.
- To familiarize the student with Fourier, transform techniques used in solving various practical engineering problems.
- To introduce the effective mathematical tools for the solutions of difference equations that model several physical processes and to develop transform techniques for discrete time systems.

UNIT - I	PARTIAL DIFFERENTIAL EQUATIONS	9+3

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations (except) – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types

UNIT - II	FOURIER SERIES	9+3

Dirichlet's conditions -Necessary and sufficient condition for existence of Fourier series – General Fourier series – Odd and even functions – Half range sine series –Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT - III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9+3

Classification of PDE – Method of separation of variables – Fourier Series Solutions of one-dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.

UNIT - IV	FOURIER TRANSFORMS	9+3

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+3

Z-transforms – Elementary properties – Inverse Z-transform (using partial fraction and residues) –Initial and final value theorems – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.

	Total Periods:	60

COURSE OUTCOMES
Upon completion of the course, the students will be able to

CO1	Understand how to solve the partial differential equations and apply these concepts in the field of engineering.
CO2	Learn Fourier series analysis which plays a vital role in the application of electrical engineering, vibration analysis, acoustics, optics, signal and image processing.

CO3	Appreciate the physical significance of Fourier series techniques in solving one and two-dimensional heat flow problems and one-dimensional wave equations and this concept is applied in the fields like elasticity, heat transfer, quantum mechanics and also extensively in physical phenomenon.
CO4	Understand the mathematical principles on transforms and gain the ability to formulate and solve some of the physical problems like designing electrical circuits, signal processing, signal analysis, image processing etc.
CO5	Learn to use the effective mathematical tools like Z- transform for the solving difference equations in discrete time signals etc.

Text Books:

1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
3. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.

Reference Books:

1. Dass, H.K., and Er.Rajnish Verma, "Higher Engineering Mathematics", S.Chand Private Ltd.,2011.
2. Peter O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012
3. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi,2016.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012

Mapping of COs with POs and PSOs

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	1	2	0	2	1	2	0	2	1	1
CO2	3	3	2	2	1	2	1	0	1	0	2	0	2	1	1
CO3	3	3	2	2	0	1	0	0	1	0	2	0	2	1	1
CO4	3	2	1	2	1	0	1	1	0	0	3	0	2	1	1
CO5	3	3	2	2	1	0	1	0	2	1	2	0	2	1	1

MT1301	DIGITAL ELECTRONICS AND MICROPROCESSOR	L	T	P	C
		3	0	0	3

OBJECTIVES

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems.
- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.
- To explain the various semiconductor memories and related technology.
- To introduce the electronic circuits involved in the making of logic gate.

UNIT - I	DIGITAL FUNDAMENTALS	9

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1‘s and 2‘s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT - II	COMBINATIONAL & SYNCHRONOUS SEQUENTIAL CIRCUITS	9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder -Multiplexer, Demultiplexer, Decoder, Priority Encoder. Flip flops – SR, JK, T, D, design of clocked sequential circuits – Design of Counters- Shift registers, Universal Shift Register.

UNIT - III	ASYNCHRONOUS SEQUENTIAL CIRCUITS AND MEMORY DEVICES	9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits. Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA).

UNIT - IV	8085 PROCESSOR	9

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT - V	PROGRAMMING PROCESSOR	9

Instruction - format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions – stack -8255 architecture and operating modes.

Total Periods:	**45**

COURSE OUTCOMES
Upon completion of the course, the students will be able to

CO1	State the fundamental operating concepts behind digital logic circuitsand microprocessors.
CO2	Recognize the use of various digital logic circuits and sub units in microprocessors.
CO3	Sketch the digital logic circuits and the architectures of microprocessors
CO4	Design the DLC and Microprocessor for the standard applications.
CO5	Create the circuits using DLC and Microprocessor for given applications

Text Books:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.
2. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.

Reference Books:

1. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
4. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013

Mapping of COs with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	1	-	-	-	-	-	1	3	3	3
CO2	3	2	1	1	-	1	-	-	-	-	-	1	3	2	3
CO3	3	2	1	1	-	1	-	-	-	-	-	1	3	2	3
CO4	3	2	1	1	-	1	-	-	-	-	-	1	3	2	3
CO5	3	2	1	1	-	1	-	-	-	-	-	1	3	2	3

MT1302	FLUID MECHANICS AND THERMAL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To knowledge in Fluid Properties and Statics
- To understand the concept of fluid kinematics and Dynamics.
- To learn about the flows in fluid, Viscous flows and flow through pipes
- To understand the basics laws of thermodynamics
- To understand the second law of thermodynamics and entropy

UNIT - I **FLUID PROPERTIES AND FLUID STATICS** **12**

Fluid Definition and Classification – Properties of fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension – Fluid statics: Concept of fluid static pressure – Pascal 's law –Absolute and Gauge pressures – Manometers: Types and Pressure measurement – Concept of Buoyancy and Floatation.

UNIT - II **FLUID KINEMATICS AND FLUID DYNAMICS** **12**

Fluid Kinematics: Types of fluid flow – Continuity equation in two and three dimensions – Velocity and Acceleration of fluid particle – Velocity potential function and Stream function. Fluid dynamics: Euler's equation along a streamline –Bernoulli's equation and applications – Venturi meter, Orifice meter and Pitot tube.

UNIT - III	VISCOUS FLOW, FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS	12
Viscous flow: Shear stress, pressure gradient relationship – Flow of viscous fluid through circular pipe – Flow through pipes: Loss of head due to friction – Minor head losses – Hydraulic gradient and Total energy lines – Flow through pipes in series and in parallel – Power transmission through pipes. Dimensional analysis: Buckingham's theorem.		
UNIT - IV	**BASICS OF THERMODYNAMICS AND FIRST LAW OF THERMODYNAMICS**	**12**
Thermodynamics – Microscopic and macroscopic point of view – Systems, properties, process, path, cycle. Thermodynamic equilibrium – Zeroth law of Thermodynamics – internal energy, enthalpy, specific heat capacities CV and CP, Relationship between CV and CP. First law of Thermodynamics – Application to closed and open systems – Steady Flow Energy Equation (SFEE) – Simple problems.		
UNIT - V	**SECOND LAW OF THERMODYNAMICS AND ENTROPY**	**12**
Second Law of thermodynamics – Kelvin Planck and Clausius Statements – Equivalents of Kelvin Planck and Clausius statements. Reversibility – Irreversibility, reversible cycle – Heat engine, heat pump and refrigerator. Carnot cycle and Clausius theorem, the property of entropy, the inequality of Clausius – Entropy principle – General expression for entropy – Simple problems in entropy.		
	Total Periods:	**60**

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Recognize the fluid properties, fluid statics and laws of thermodynamics
CO2	Interpret the problems related to kinematics and dynamics of fluids and thermal systems
CO3	Review the energy losses in flow through pipes and steady flow equation in thermal systems.
CO4	Analyse the fluid flow and thermal process
CO5	Solve the problems related to fluid and thermal systems.

Text Books:

1. Bansal R.K., ―Fluid Mechanics and Hydraulic Machines‖, 9th Edition, Laxmi Publications, New Delhi, 2015.

Reference Books:

1. Nag P.K., ―Engineering Thermodynamics‖, 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.
2. Cengel Yunus A. and Boles Michael A., ―Thermodynamics: An Engineering Approach, 7th Edition, McGraw-Hill, New York, 2011.
3. Frank M. White., ―Fluid Mechanics‖, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2009.

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	1	-	-	-	-	-	1	1	2	2	1
CO2	3	3	2	-	1	-	-	-	-	-	1	1	2	2	1
CO3	2	2	3	2	2	3	-	-	-	-	1	1	3	3	1
CO4	2	2	3	2	1	2	-	-	-	-	1	1	3	3	1
CO5	3	3	2	2	2	2	-	-	-	-	1	1	2	2	1

MT1303	**MANUFACTURING TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES

- To impart knowledge on metal casting, joining, and forming processes
- To impart knowledge on various products manufacturing methods for the metal and plastic component using manual and CNC methods.

UNIT - I	**CASTING AND WELDING**	**14**

Casting: Steps involved in making a casting - Its applications - Patterns and Types of patterns – Pattern allowances, Cores. Principle of special casting processes- Shell, investment – Ceramic mould–Pressure die casting–Centrifugal Casting.

Welding: Classification of Welding Processes - Arc welding, forge welding – Resistance welding, Thermit welding, Explosive Welding, Electron Beam Welding and Laser Beam Welding. Inert Gas Welding, TIG Welding, MIG welding, soldering and Brazing.

UNIT - II	**BULK DEFORMATION AND SHEET METAL PROCESS**	**12**

Forming: Hot working, cold working, Comparison of properties of Cold and Hot worked parts, rolling fundamentals – theory of rolling, types of Rolling mills and products- Extrusion process.

Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining –spinning – Hydro forming–Rubber pad forming- magnetic pulse forming.

UNIT - III	**MANUFACTURE OF PLASTIC COMPONENTS**	**10**

Types and characteristics of plastics – Molding of thermoplastics – working principles and typical applications – injection molding – Plunger and screw machines – Compression molding transfer molding –Typical industrial applications–introduction to blow-molding–Rotational-molding–Film-blowing – Extrusion – Vacuum bag Forming- Thermo-forming–Bonding of Thermo-plastics.

UNIT - IV	**MACHINE TOOLS**	**12**

Principle of working, specification of lathe – types of lathe – Taper turning, Thread turning. Capstan and turret lathes - tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle. Gear manufacturing -Gear cutting, gear hobbing and gear shaping process.

UNIT - V	COMPUTER NUMERICAL CONTROL MACHINE TOOLS	10
Computer Numerical Control (CNC) machine tools – Need, types, constructional details, special features - ball screws, ATC, sensors, machining centre, part programming fundamentals – G-codes and M-codes, manual part programming and computer assisted part programming.		
	Total Periods:	**58**

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Explain the working principles of various metal casting processes and metal joining process.
CO2	Explain the bulk deformation and sheet metal process.
CO3	Explain the manufacturing of plastic components.
CO4	Determine the machining parameters of turning process and select appropriate automates.
CO5	Develop CNC part programs for machining and turning centers.

Text Books:

1. Rao.P.N., Manufacturing Technology Foundry, Forming and Welding, 5thEdition, Tata McGraw Hill, 2018.
2. Kalpakjian.S, "Manufacturing Engineering and Technology", Pearson Education India Edition,8th edition 2020.
3. Rao. P.N "Manufacturing Technology," Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2003.

Reference Books:

1. Sharma,P.C.,A Textbook of Production Technology, S.ChandandCo.Ltd.,2006.
2. R.K.Jain Production Technology Manufacturing Systems Vol –I K.hanna Publishers.
3. Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; 3rd edition, 2013.
4. Elements of Work Shop Technology – Vol. II/Hajra Choudry/ Media Promoters.
5. Principles of Machine Tools/ Bhattacharya A and Sen.G.C/ New Central Book Agency.

Mapping of COs with POs and PSOs

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	2	2	1	-	-	-	2	3	2	3
CO2	3	3	3	3	-	-	2	1	-	-	-	1	3	2	3
CO3	3	3	3	3	-	-	2	1	-	-	-	1	3	2	3
CO4	3	3	3	3	2	-	-	-	-	-	-	1	3	3	-
CO5	3	3	3	3	3	-	2	2	-	-	-	2	3	3	1

CS1302	DATA STRUCTURES	L	T	P	C
	Common to CSE, IT, AI-DS, AI-ML, MECHATRONICS, ECE, MECHANICAL.	3	0	0	3

OBJECTIVES

- To understand the concepts of ADTs.
- To learn linear data structures like lists, stacks, and queues.
- To learn Non-linear tree data structures.
- To apply Graph structures
- To understand sorting, searching and hashing algorithms

UNIT I	LINEAR DATA STRUCTURES – LIST	9

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

UNIT II	LINEAR DATA STRUCTURES – STACKS, QUEUES	9

Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.

UNIT III	NON-LINEAR DATA STRUCTURES – TREES	9

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap.

UNIT IV	NON-LINEAR DATA STRUCTURES – GRAPHS	9

Definition – Representation of Graph – Types of graphs – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity –Graph Algorithms – Shortest Path Algorithms: Dijkstra's Algorithm – All pair shortest Path Algorithms: Floyds warshall Algorithm – Minimum Spanning Tree: Prim's Algorithm – Kruskal's Algorithm – Applications of Graph.

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	9

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C‖, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, ―Data Structures Using C‖, Second Edition, Oxford University Press, 2011.
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley,2013.
4. Bradley N. Miller, David L. Ranum, "Problem Solving with Algorithms and Data Structures using Python ", Second Edition, 2013.
5. Rance D. Necaise, Data Structures and Algorithms Using Python, John Wiley & Sons, 2011.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Implement abstract data types for linear data structures.
CO2	Apply the different linear data structures to problem solutions.
CO3	Implement abstract data types for non-linear data structures.
CO4	Apply Graph data structure for the real-world problems.
CO5	Critically analyze the various sorting, searching algorithms and hash functions that result in a collision free scenario for data storage and retrieval.

Mapping of COs with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	-	-	-	2	2	2	2	2	1
CO2	3	3	3	2	2	2	-	-	-	2	2	2	1	2	2
CO3	3	3	3	2	2	2	-	-	-	2	2	2	2	2	1
CO4	3	3	3	2	2	2	-	-	-	2	2	2	2	2	2
CO5	3	3	3	2	2	2	-	-	-	2	2	2	1	1	1

EE1352	ELECTRICAL DRIVES AND CONTROLS	L	T	P	C
	(Common to Mechanical Engineering)	3	0	0	3

OBJECTIVES

- To understand the basic concepts of different types of electrical machines.
- To impart knowledge on performance characteristics of drive motors.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state speed control of DC drives.
- To study the conventional and solid-state speed control of AC drives.

UNIT - I	INTRODUCTION	8

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	DRIVE MOTOR CHARACTERISTICS	9

Mechanical characteristics- Speed-Torque characteristics of various types of load and drive motors - Braking of electrical motors - DC motors: Shunt, series and compound - single phase and three phase induction motors - V and inverted V curve of synchronous motor - Regulation of alternator by EMF & MMF method.

UNIT - III	STARTING METHODS	8

Types of DC Motor starters - Typical control circuits for shunt and series motors - Types of A.C Motor starters - Three phase squirrel cage and slip ring induction motors.

UNIT – IV	CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES	10
Speed control of DC series and shunt motors - Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers -applications.		
UNIT - V	**CONVENTIONAL AND SOLID STATE SPEED CONTROL OF AC DRIVES**	**10**
Speed control of three phase induction motor - Voltage control, voltage / frequency control,slip power recovery scheme - Using inverters and AC voltage regulators - applications.		
Total Periods:		**45**

COURSE OUTCOMES
Upon completion of the course, the students will be able to

CO1	Understand the basic concepts of different types of electrical machines.
CO2	Understand and analyze different drive motors characteristics.
CO3	Understand the different methods of starting DC motors and induction motors.
CO4	Analyze the conventional and solid-state speed control of DC drives.
CO5	Analyze the conventional and solid-state speed of AC drives.

Text Books:

1. Nagrath.I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2006.
2. Vedam Subrahmanyam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 201

Reference Books:

1. Partab. H., “Art and Science and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 2017
2. Pillai.S.K, “A First Course on Electric Drives”, Wiley Eastern Limited, 2012
3. Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2006

Mapping of COs with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	1	1	2	2	3	3	2	3
CO2	3	3	2	2	2	1	1	1	1	2	2	3	3	2	3
CO3	3	3	2	2	2	1	1	1	1	2	2	3	3	2	3
CO4	3	3	2	2	2	1	1	1	1	2	2	3	3	2	3
CO5	3	3	2	2	2	1	1	1	1	2	2	3	3	2	3

MT1307	MANUFACTURING TECHNOLOGY LABORATORY	L	T	P	C
(Common to Mechanical Engineering)		0	0	4	2

OBJECTIVES

- To study and practice the various operations that can be performed in lathe machine, gear hobbing machine and to equip with the practical knowledge required in the core industries.
- To Study and acquire knowledge on various basic welding and its applications in real life manufacture of components in the industry.

1. Machining a Taper turning operation
2. Machining an External thread cutting operation
3. Machining an Internal thread cutting operation
4. Machining an eccentric turning operation
5. Machining a knurling operation
6. Joining of plates by horizontal, vertical and overhead welding (Arc Welding)
7. Joining of plates and pipes using Gas Metal Arc Welding / Arc Welding /Submerged arc welding
8. Helical Gear Hobbing
9. Turning and Drilling using FANCU
10. Linear and Circular interpolation FANUC

Total Periods:	**60**

List of Equipment's for a Batch of 30 Students

1. Machining a Taper turning operation
2. Machining an External thread cutting operation
3. Machining an Internal thread cutting operation
4. Machining an eccentric turning operation
5. Machining a knurling operation
6. Joining of plates by horizontal, vertical and overhead welding (Arc Welding)
7. Joining of plates and pipes using Gas Metal Arc Welding / Arc Welding /Submerged arc welding
8. Helical Gear Hobbing
9. Turning and Drilling using FANCU
10. Linear and Circular interpolation FANUC

COURSE OUTCOMES
Upon completion of the course, the students will be able to

CO1	Demonstrate the safety precautions exercised in the mechanical workshop
CO2	Make the workpiece as per given shape and size using lathe
CO3	Join two metals using arc welding
CO4	Use different machine tools to manufacturing gears
CO5	Develop CNC part programming

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1	3	3	2	1	1	1	1	1	1	-
CO2	3	2	2	1	3	2	2	2	2	3	1	3	2	2	2
CO3	3	3	3	3	3	3	3	2	2	2	1	2	3	1	2
CO4	3	2	1	1	2	2	1	2	2	2	1	2	3	1	2
CO5	3	2	1	1	2	2	2	2	1	1	1	2	3	-	2

EE1358	**ELECTRICAL ENGINEERING LABORATORY**	**L**	**T**	**P**	**C**
	(Common to Mechanical and Chemical)	0	0	4	2

OBJECTIVES

- To validate the principles studied in theory by performing experiments in the laboratory.
- To perform no load and load test on DC and AC motors and determine their performance parameters.

1. Load test on DC Shunt & DC Series motor.
2. O.C.C & Load characteristics of DC Shunt and DC Series generator.
3. Speed control of DC shunt motor (Armature, Field control).
4. Load test on single phase transformer.
5. O.C & S.C Test on a single-phase transformer.
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor.
8. Load test on three phase squirrel cage Induction motor.
9. Speed control of three phase slip ring Induction Motor.
10. Study of DC & AC Starters.

Total Periods: 60

List of Equipment's for a Batch of 30 Students

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. DC Shunt Motor Coupled with DC Compound Generator – 2 nos
7. DC Shunt Motor Coupled with DC Shunt Motor – 1 No.
8. Tachometer -Digital/Analog – 8 nos
9. Single Phase Auto Transformer – 2 nos
10. Three Phase Auto Transformer – 1 No.
11. Single Phase Resistive Loading Bank – 2 nos
12. Three Phase Resistive Loading Bank – 2 Nos.

COURSE OUTCOMES Upon completion of the course, the students will be able to	
CO1	Ability to perform DC Shunt and Series Motor characteristics and to analyse the speed control behaviour of DC shunt Motor.
CO2	Ability to perform the characteristics of DC Shunt generator on O.C and Load conditions.
CO3	Ability to perform Open circuit, Short Circuit and Load test on Single Phase Transformer.
CO4	Ability to perform regulation characteristics on the alternator and to analyse the V-curve and Inverted V-curve of a Synchronous motor.
CO5	Ability to perform the speed control behaviour of an induction motor and also to know the working principles of AC and DC motor starters.

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	3	1	3	2	1	2	2	2	3	3	2	3
CO2	3	3	1	3	1	3	2	1	2	2	2	3	3	2	3
CO3	3	3	1	3	1	3	2	1	2	2	2	3	3	2	3
CO4	3	3	1	3	1	3	2	1	2	2	2	3	3	2	3
CO5	3	3	1	3	1	3	2	1	2	2	2	3	3	2	3

HS1310	PROFESSIONAL SKILLS LABORATORY	L	T	P	C
	(Common to all branches)	0	0	2	1

OBJECTIVES

- Enhance the employability and career skills of students
- Orient the students towards grooming as a professional
- Make them employable graduates
- Develop their confidence and help them attend interviews successfully.

UNIT - I

Introduction to Soft Skills - Hard skills & soft skills - employability and career Skills - Grooming as a professional with values - Making an Oral Presentation-Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language General awareness of Current Affairs.

UNIT - II

Introduction to Group Discussion - Participating in group discussions - understanding group dynamics - brainstorming the topic - questioning and clarifying -GD strategies- Structure and dynamics of a GD; Techniques of effective participation in group discussion; Preparing for group discussion; Accepting others' views / ideas; Arguing against others' views or ideas, etc.

UNIT - III	
Basics of public speaking; Preparing for a speech; Features of a good speech; Speaking with a microphone. (Famous speeches may be played as model speeches for learning the art of public speaking). Interview etiquette - dress code - body language - attending job interviews - telephone/skype interview - one to one interview & panel interview - Job Interviews: purpose and process; How to prepare for an interview; Language and style to be used in an interview; Types of interview questions and how to answer them.	
UNIT - IV	
Self-Introduction - organizing the material - Introducing oneself to the audience - introducing the topic - answering questions - individual presentation practice - Making a Power Point Presentation - Structure and format; Covering elements of an effective presentation; Body language dynamics. Making an Oral Presentation - Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language.	
UNIT - V	
Recognizing differences between groups and teams- managing time-managing stress - networking professionally - respecting social protocols-understanding career management - developing a long- term career plan - making career changes.	
Total Periods:	**60**

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Make effective presentations appropriate communicative strategies.
CO2	Participate confidently in group discussions.
CO3	Attend job interviews and be successful in them.
CO4	Develop adequate soft skills required for the workplace.
CO5	Develop their speaking skills to enable them speak fluently in real contexts.

Reference Books:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2. Interact English Lab Manual for Undergraduate Students, Orient Balck Swan: Hyderabad, 2016.
3. E.Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014 5. S.Hariharan et al. Soft Skills. MJP Publishers: Chennai, 2010.

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1	3	3	2	1	1	1	1	1	1	-
CO2	3	2	2	1	3	2	2	2	2	3	1	3	2	2	2
CO3	3	3	3	3	3	3	3	2	2	2	1	2	3	1	2
CO4	3	2	1	1	2	2	1	2	2	2	1	2	3	1	2
CO5	3	2	1	1	2	2	2	2	1	1	1	2	3	-	2

SEMESTER IV SYLLABUS

MA1401	**STATISTICS AND NUMERICAL METHODS**	**L**	**T**	**P**	**C**
	(**Common to EEE, EIE, MECHANICAL AND MECHATRONICS)**	3	1	0	4

OBJECTIVES

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the Interpolation operators and numerical techniques of interpolation in various intervals, numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT - I	**TESTING OF HYPOTHESIS**	**9+3**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) -Goodness of fit.

UNIT - II	**DESIGN OF EXPERIMENTS**	**9+3**

One way and two-way classifications - Completely randomized design – Randomized block design –Latin square design - 2^2 factorial design.

UNIT - III	**SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**	**9+3**

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

UNIT - IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	9+3
Interpolation operators (Forward, Backward, shifting operators and its properties) -– Newton's forward and backward difference interpolation for equal intervals – Lagrange's and Newton's divided difference interpolations for unequal intervals - Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.		
UNIT - V	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**9+3**
Finite difference methods for solving second order two - point linear boundary value problems 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 and Adams- Bash forth predictor corrector methods for solving first order equations.		
	Total Periods:	**60**

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Students will gain knowledge on Large Samples and Small Samples. These concepts are very useful in Biological, Electric power management, Social experiments and also in all kinds of generalizations based on information about a smaller sample and larger samples. Apply the appropriate test in the problems related with sampling.
CO2	ANOVA's statistical significance result is independent of constant bias and scaling of errors. It is used in testing the difference between several treatments in the Design of experiments. It checks the impact of one or more factors in any experiment in Engineering.
CO3	Students will learn on nonlinear (algebraic or transcendental) equations and linear equations. Students learn to solve the Eigen value problem of a matrix numerically when analytical methods tend to fail to give solution and apply all these in the fields like Vibrating systems, fluid dynamics.
CO4	Students will learn to construct approximate polynomials that can be used in data representation using interpolation techniques to find the intermediate values. In particular, interpolation methods are extensively applied in the models of the different phenomena where experimental data must be used in computer studies where expressions of those data are required. The learners are introduced to numerical differentiation and integration techniques. The techniques are useful when the function in the analytical form is complicated**.**
CO5	Students get an insight on ordinary differential equations which will be useful in solving engineering problems. Students learn about the different methods for solving first order and second order differential equations. It will be useful in attempting any engineering problems. ODE is applied in specific mathematical fields like Electrical, Geometry, Analytical mechanics, Celestial mechanics and Weather modelling.

Text Books:

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference Books:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.

4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and scientists" 8th edition, Pearson Education, Asia, 2007.

Mapping of COs with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	-	2	-	2	2	2	1	1
CO2	2	3	3	3	3	2	2	-	2	-	2	2	2	1	1
CO3	2	3	2	2	1	-	-	-	-	-	-	2	2	1	1
CO4	3	3	3	2	2	1	-	-	-	-	-	2	2	1	1
CO5	3	3	2	1	2	1	-	-	-	-	-	2	2	1	1

MT1401	KINEMATICS AND DYNAMICS OF MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the fundamentals of the theory of kinematics and dynamics of machines
- To identify and enumerate different link-based mechanisms with basic understanding of motion
- To interpret and analyse various velocity and acceleration diagrams for various mechanisms
- To design and evaluate the performance of different cams and gears.
- Impart knowledge on dynamic analysis and balancing of mechanisms
- Familiarize with gyroscopes and governors
- Familiarize with mathematical modelling and analysis of mechanical vibration systems

UNIT - I **VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS** **12**

Introduction - Simple mechanisms - Velocity of a point on a link by relative velocity method - Velocities in a slider crank mechanism - Rubbing velocity of a pin joint - Forces acting in a mechanism - Velocity of a point on a link by instantaneous centre method - Acceleration of a point on a link - Acceleration in a slider crank mechanism - Coriolis component of acceleration - Mechanisms with lower pairs - Straight line motion mechanisms - Universal or Hooke's joint - Forces on the reciprocating parts of an engine

UNIT - II **CAMS AND GEARS** **12**

Cams – classification of cams and followers, nomenclature, description and analysis of follower motion, pressure angle – Determine of basic dimensions and synthesis of cam profiles, graphical and analytical methods, cams with specified contours.

Gears – terminology, fundamental law of gearing, involute profile. Interference and undercutting, minimum number of teeth, contact ratio, bevel helical, spiral and worm gears. Gear Trains – simple, compound and epicyclic gear trains.

UNIT - III **GOVERNORS AND GYROSCOPES** **12**

Introduction to governors - Types of governors - Terms used in governors - Watt governor - Porter governor - Proell governor - Hartnell governor - Sensitiveness of governor - Stability of governor - Effort and Power of governors

Introduction to gyroscpes - Precessional angular motion - Gyroscopic couple -Effect of gyroscopic couple on an aeroplane - Effect of gyroscopic couple on naval ship - Stability of a four wheel drive and two wheel vehicle.

UNIT - IV	**VIBRATIONS**	**12**

Introduction - Longitudinal and transverse vibrations - Natural frequency of longitudinal and transverse vibrations - Critical or whirling speed of shaft - Frequency of free damped vibrations - Damping factor - Logarithmic decrement - Frequency of underdamped forced vibrations - Magnification factor - Vibration isolation

Torsional vibrations - Natural frequency of free torsional vibrations - Free torsional vibrations of single, two and three rotor system - Torsionally equivalent system - Free torsional vibration of a geared system.

UNIT - V	**BALANCING OF ROTATING AND RECIPROCATING MASSES**	**12**

Introduction - Balancing of rotating masses - Balancing of single rotating mass by a single mass rotating in same plane - Balancing of a single rotating mass by two masses rotating in different planes - Balancing of several masses rotating in same plane - Balancing of several masses rotating in different planes.

Introduction - Primary and Secondary unbalanced forces - Partial balancing of unbalanced primary force in reciprocating engine - Partial balancing of locomotives - Effect of partial balancing of reciprocating parts of two cylinder locomotives - variation of tractive forces - Swaying couple - Hammer blow.

Total Periods:	**60**

COURSE OUTCOMES

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

CO1	To identify and enumerate different link-based mechanisms with basic understanding of motion
CO2	Construct and analyze cam profiles for a specified motion of follower and also analyze different types of gear trains
CO3	Analyze the different types of governors experienced in real life situation and also analyze the effect of gyroscopic couple on automobiles, ships, and airplanes
CO4	Formulate the dynamic equilibrium equations of single and two degrees of freedom vibration systems and solve for the response under free and forced conditions
CO5	Estimate the magnitude and position of balancing masses for unbalanced rotating and reciprocating masses

Text Books:

1. Khurmi, R. S., and J. K. Gupta. *Theory of machines*. S. Chand Publishing, 2005. Reprint 2024.
2. Uicker, John Joseph, John J. Uicker Jr, Gordon R. Pennock, and Joseph E. Shigley. *Theory of machines and mechanisms*. Cambridge University Press, 2023.
3. Singh, Sadhu. *Theory of Machines*. Pearson Education India, 2005. Reprint 2024.
4. S. S. Rattan, *Theory of Machines*, 4th Ed., Tata McGraw Hill, 2014. Reprint 2024.

Reference Books:

1. Bevan, Thomas. *The theory of machines*. Pearson Education India, 2010. Reprint 2024
2. Singh, Sadhu. *Theory of Machines*. Pearson Education India, 2005. Reprint 2024.
3. K. J, Waldron and G. L Kinzel, Sunil K. Agrawal, *Kinematics, Dynamics and Design of Machinery*, 3rd Ed., Wiley Student Edition, 2016. Reprint 2024
4. A. Ghosh and A. K. Mallik, *Theory of Mechanisms, and Machines*, 3rd Ed., East West Press Pvt Ltd, 2009. Reprint 2021

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	3	1	1	2	1	1	3	3	1	2
CO2	3	3	3	2	2	3	1	1	2	1	1	3	3	1	2
CO3	3	3	3	2	2	2	1	1	2	1	1	3	3	1	2
CO4	3	3	3	3	2	2	2	1	2	1	1	3	3	1	2
CO5	3	3	3	3	2	2	2	1	2	1	1	3	3	1	2

MT1402	**HYDRAULICS AND PNEUMATICS**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES

- Provide detailed knowledge of the working principles of fluid power components and their applications in various industries, including process, construction, and manufacturing sectors.
- Equip students with a thorough understanding of fluid components utilized in contemporary industrial fluid power systems.
- Develop advanced skills in the design, construction, and operation of fluid power circuits, fostering a high level of competence that allows students to effectively manage and troubleshoot real-world systems.

UNIT - I	**BASICS OF FLUID POWER SYSTEMS**	**9**

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Sources of Hydraulic power: Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

UNIT - II	**HYDRAULIC ACTUATORS AND CONTROL COMPONENTS**	**9**

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories: Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems – pumps and motors.

UNIT - III	**HYDRAULIC CIRCUITS**	**9**

Accumulators – types and application circuits, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT - IV	**DESIGN OF PNEUMATIC CIRCUITS**	**9**

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method –

Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.		
UNIT - V	**APPLICATIONS OF HYDRAULIC AND PNEUMATIC SYSTEM**	**9**
Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.		
	Total Periods:	**45**

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Understand the applications of Fluid power system and operation of different types of pumps.
CO2	Summarize the features and functions of Hydraulic motors, actuators and Flow control valves.
CO3	Gain complete knowledge of different types of Hydraulic circuits.
CO4	Understand and design of different pneumatic circuits and systems.
CO5	Be proficient in troubleshooting and acquire the knowledge in applications of automation, robotics, hydraulic and pneumatic system.

Text Books:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.
3. Srinivasan R, "Hydraulics and Pneumatic Control", Vijay Nicole,2004

Reference Books:

1. Anthony Lal, "Oil hydraulics in the service of Industry", Allied publishers, 1982.
2. Dudley, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
3. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4. Michael J, Pinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5. Andrew Parr, "Hydraulics and Pneumatics", Jaico Publishing House, 2003.

Mapping of COs with POs and PSOs

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	-	-	-	-	-	2	3	1	2	2
CO2	3	2	2	-	1	-	-	-	-	-	1	2	2	2	3
CO3	3	2	3	-	1	-	-	-	-	-	1	2	2	2	3
CO4	3	3	3	2	3	-	-	-	-	-	1	2	2	3	2
CO5	3	3	3	3	2	-	-	-	-	-	1	2	2	3	2

MT1403	SENSORS AND INSTRUMENTATION (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES

- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development
- To learn about the optical, pressure and temperature sensor
- To understand the signal conditioning and DAQ systems

UNIT - I	INTRODUCTION	9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT - II	MOTION, PROXIMITY AND RANGING SENSORS	9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT - III	FORCE, MAGNETIC AND HEADING SENSORS	8

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT - IV	OPTICAL, PRESSURE AND TEMPERATURE SENSORS	10

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT - V	SIGNAL CONDITIONING AND DAQ SYSTEMS	9

Operational Amplifiers – Inverting and Non-Inverting Amplifier – Wheatstone bridge – Instrumentation Amplifier – PID Controller, Protection Circuits, Filtering Circuits, Multiplexer, Switching Loads by Power Semiconductor Devices Circuits – Thyristors – TRIAC – Darlington Pair – MOSFET and Relays-Amplification – Filtering – Sample and Hold circuits Data Logger and Data Acquisition System, – Data Acquisition: Single channel and multi- channel data acquisition – Data logging - applications

Total Periods:	45

LIST OF EXPERIMENTS

1. Determination of Load, Torque and Force using Strain Gauge.
2. Determination of the characteristics of Pressure Sensor and Piezoelectric Force Sensor
3. Determination of Displacement using LVDT.
4. Determine the Characteristics of Various Temperature Sensors.
5. Determine the Characteristics of Various Light Detectors (Optical Sensors).
6. Distance Measurement using Ultrasonic and Laser Sensor.
7. Determine angular velocity of gyroscope
8. Vibration measurement using Accelerometer.
9. Direction measurement using Magnetometer.
10. Speed, Position and Direction Measurement Using Encoders.

11. Force measurement using 3 axis force sensor.
12. Force Measurement using tactile sensors.
13. Data acquisition, visualization and analysis of signals.

Total Periods:	**60**

List of Equipments for a Batch of 30 Students

Sl.No	Name of the Instrument	Quantity
1	Strain gauge module.	1
2	Pressure sensor & Force sensor module.	1
3	LVDT Trainer setup.	1
4	Temperature Sensors module (RTD, Thermocouple, Thermister).	1
5	Optical sensors trainer setup.	1
6	Ultrasonic and Laser Sensor.	1
7	Gyroscope.	1
8	Accelerometer.	1
9	Magnetometer.	1
10	Speed, Position and Direction Measurement.	1
11	3 axis force sensor module.	1
12	Tactile sensor module.	1
13	Data Acquisition card.	1

COURSE OUTCOMES
Upon completion of the course, the students will be able to

CO1	Recognize with various calibration techniques and signal types for sensors.
CO2	Describe the working principle and characteristics of force, magnetic, heading, pressure and temperature, smart and other sensors and transducers.
CO3	Apply the various sensors and transducers in various applications
CO4	Select the appropriate sensor for different applications.
CO5	Acquire the signals from different sensors using Data acquisition systems.

Text Books:

1. Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

Reference Books:

1. C. Sujatha ... Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2001
2. Hans Kurt Tönshoff (Editor), Ichiro, “Sensors in Manufacturing” Volume 1, Wiley-VCH April 2001.

3. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999.
4. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2011.
5. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015

Mapping of COs with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO2	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO3	3	2	1	1	2	1	-	-	-	-	-	1	2	1	3
CO4	3	2	1	3	2	1	-	-	-	-	-	1	2	1	3
CO5	3	2	1	3	2	1	-	-	-	-	-	1	2	1	3

MT1404	EMBEDDED SYSTEMS AND IoT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To familiarize fundamentals of Embedded Systems and IoT.
- To know the microcontroller programming methodology and to acquire the interfacing skills and data exchange methods.
- To design the interface circuit and programming of I/O devices, sensors and actuators.
- To understand Arduino and Raspberry Pi architecture and its functions to meet out the computational and interface needs of growing mechatronic systems.
- To acquaint the knowledge of real time embedded operating system for advanced system developments.

UNIT - I **FUNDAMENTALS OF IOT AND EMBEDDED SYSTEMS** **9**

The Internet of Things (IoT) - Introduction to the IoT Framework – IoT Enabling Technologies-The Effective Implementation of IoT: The Detailed Procedure. Embedded Systems: An Introduction - Single-Chip Microcontroller Systems -8051 Single- Board Microcontroller Systems - Single-Board Computer Systems

UNIT - II **PROGRAMMING AND COMMUNICATION** **9**

Fundamentals of Assembly Language Programming – Instruction to Assembler – Compiler and IDE - C Programming for 8051 Microcontroller – Basic Arithmetic and Logical Programming - Timer and Counter - Interrupts – Interfacing and Programming of Serial Communication.

UNIT - III **PERIPHERAL INTERFACING** **9**

I/O Programming – Interfacing of Memory, Key Board and Displays – Alphanumeric and Graphic, RTC, interfacing of ADC and DAC, Sensors - Relays - Solenoid Valve and Heater - Stepper Motors, DC Motors - PWM Programming – Closed Loop Control Programming of Servomotor – Traffic Light Control

UNIT - IV	ARDUINO AND RASPBERRY Pi	9
Arduino: The Arduino Boards - Arduino Peripherals- Arduino IDE – ESP8266 Wi-Fi module. Raspberry Pi: The Raspberry Pi Boards - The Raspberry Pi Peripherals - The Raspberry Pi Operating System. Interfacing and Controlling I/O devices by Arduino and Raspberry Pi: LEDs - Push buttons - Light intensity sensor - Ultrasonic distance sensor – Temperature sensor- Humidity sensor - Sensor and Actuator interactions		
UNIT - V	**IoT CASE STUDIES**	**9**
IoT case studies: Remote Monitoring Systems- Remotely Operated Autonomous Systems - Centralized Water Management System - IoT Enabled Robotic Camera Dolly - Portable, Wireless, Interactive IoT Sensors for Agriculture - IoT Vehicle Management System with Network Selection.		
	Total Periods:	**45**

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Elucidate the fundamentals of IoT and Embedded Systems.
CO2	Develop basic Programming skills in Microcontrollers
CO3	Elucidate the Peripheral Interfacing with microcontrollers.
CO4	Implement Arduino and Raspberry Pi as controllers for automated systems.
CO5	Design and develop an apt mechatronics/IoT based system for the given real- time application.

Text Books:

1. Frank Vahid and Tony Givagis, “Embedded System Design”, 2011, Wiley.
2. Kenneth J. Aylala, “The 8051 Microcontroller, the Architecture and Programming Applications”, 2003.
3. Sami S.H and Kisheen Rao G, “The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers”, CRC Press, 2022.

Reference Books:

1. Muhammad Ali Mazidi and Janice GillispicMazdi, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, 2006.
2. James W. Stewart, “The 8051 Microcontroller Hardware, Software and Interfacing”, Regents Prentice Hall, 2003.
3. John B. Peatman, “Design with Microcontrollers”, McGraw Hill International, USA, 2005.
4. 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.
5. Nitin G and Sharad S, “Internet of Things: Robotic and Drone Technology”, CRC Press, 2022.
6. Bell C., “Beginning Sensor Networks with Arduino and Raspberry Pi”, Apress, 2013.
7. Simon Monk, Programming the Raspberry Pi, Second Edition: Getting Started with Python McGraw Hill TAB; 2nd edition,2015

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	2	2	-	-	-	-	-	1	3	1	3
CO2	3	2	1	1	2	2	-	-	-	-	-	1	3	1	3
CO3	3	2	1	1	2	2	-	-	-	-	-	1	3	1	3
CO4	3	2	1	1	2	2	-	-	-	-	-	1	3	1	3
CO5	3	2	1	1	2	2	-	-	-	-	-	1	3	1	3

MT1407	**EMBEDDED SYSTEMS AND IOT LABORATORY**	**L**	**T**	**P**	**C**
		0	0	4	2

OBJECTIVES

- To learn about Programming, Peripheral Interfacing in 8051.
- To learn about Programming, Peripheral Interfacing in Arduino.
- To learn about Programming, Peripheral Interfacing in Raspberry Pi.

1. Assembly Language Programming and Simulation of 8051.
2. Alphanumeric and Graphic LCD Interfacing using 8051 Microcontroller.
3. Input switches and keyboard interfacing of 8051.
4. Sensor Interfacing with ADC to 8051 and DAC & RTC Interfacing with 8051.
5. Timer, Counter and Interrupt Program Application for 8051.
6. Step Motor (Unipolar & Bipolar Motor) and PWM Servo Motor Control to Interfacing with 8051.
7. UART Serial and Parallel Port Programming of 8051.
8. Measurement of Physical Quantities – Arduino & Raspberry Pi.
9. DC Stepper & Servo Control – Arduino & Raspberry Pi.
10. LCD & Keyboard Interface- Arduino & Raspberry Pi.
11. 10.Remote Based Data Acquisition using IoT.
12. IoT Based Home Automation.
13. Sensor Interfacing – Arduino & Raspberry Pi.

Total Periods: 60

List of Equipments for a Batch of 30 Students

1.8051 Microcontroller Boards	5 nos
2. LCD Module	1 no
3. Keyboard Module	1 no
4.ADC and DAC module	1 no
5. Timer Module	1 no
6. Stepper Motor module	1 no
7. Arduino Board	1 no
8. Raspberry Pi	1 no

9. Moisture Sensor	1 no
10. Temeperature Sensor	1 no
11. Servo motor	1 no

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Demonstrate various programming concepts and the peripheral interfacing with 8051.
CO2	Demonstrate various programming concepts and the peripheral interfacing with Arduino.
CO3	Demonstrate various programming concepts and the peripheral interfacing with Raspberry Pi.
CO4	Demonstrate Arduino & Raspberry bi to acquire data.
CO5	Demonstrate the integration of IoT with Cloud.

Mapping of COs with POs and PSOs

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO2	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO3	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO4	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO5	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3

MT1408	**Hydraulics and Pneumatics Laboratory**	**L**	**T**	**P**	**C**
		0	0	4	2

OBJECTIVES

- To equip students with the skills to design, model, and analyze basic electrical, hydraulic, and pneumatic systems, enabling a comprehensive understanding of mechatronics concepts.

1. Identify the components and Draw ISO symbols of hydraulic and pneumatic trainers.
2. Construct and actuate hydraulic circuit for the given sequencing of operations.
3. Construct and actuate hydraulic circuit for Single acting cylinder and double acting cylinder.
4. Construct and actuate Meter-in, Meter out Hydraulic circuit for the given purpose.
5. Construct and actuate Pneumatic circuit for the given Logic functions (AND/OR/TIME DELAY)
6. Study of Synchronizing circuit on Hydraulic Trainer.
7. Simulation and modeling of flow and pressure of Pneumatic system - MATLAB/ LAB VIEW.
8. Simulation and modeling of flow and pressure of Hydraulic system - MATLAB/ LAB VIEW.

Total Periods: 60

List of Equipments for a Batch of 30 Students

1. Hydraulic trainer – 1
2. Pneumatic trainer – 1
3. Single /Multistage Reciprocating Compressor – 1

COURSE OUTCOMES Upon completion of the course, the students will be able to	
CO1	Identify various components of hydraulic & pneumatic systems.
CO2	Select pump and actuators for fluid operated systems.
CO3	Design different hydraulic circuits for simple applications.
CO4	Develop different pneumatic circuits for simple applications
CO5	Troubleshoot and maintenance of the hydraulic and pneumatic systems

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	-	-	-	-	-	2	3	1	2	2
CO2	3	2	2	-	1	-	-	-	-	-	1	2	2	2	3
CO3	3	2	3	-	1	-	-	-	-	-	1	2	2	2	3
CO4	3	3	3	2	3	-	-	-	-	-	1	2	2	3	2
CO5	3	3	3	3	2	-	-	-	-	-	1	2	2	3	2

MT1409	**DESIGN STUDIO**	**L**	**T**	**P**	**C**
		0	0	2	1

OBJECTIVES

- To inculcate the problem solving and innovation mindset.
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product.
- To enable hands on experience for active learning.
- To enhance teamwork, communication, and project management skills in a multidisciplinary setting.
- To apply design thinking and prototyping for sustainable solutions aligned with UNSDG.

Module 1: Design thinking, system thinking, UN Sustainable Development Goals (UNSDG), problem identification, team formation, mentor guidance.

Module 2: Problem statement validation, skill mapping, Technology Readiness Level (TRL), self-learning, mentor support.

Module 3: Low-fidelity prototyping, design thinking application, prototype development, rapid prototyping tools, feedback integration.

Module 4: Project management, teamwork, collaboration, version control, documentation, milestone tracking, progress reporting.

Module 5: Technical report writing, presentations, project demonstration, peer review, reflection, project improvement.
Total Periods: 30

List of Equipments for a Batch of 30 Students

1. 3D Printers (FDM/Resin) – 3-5 units
2. Laser Cutter/Engraver – 1 unit
3. CNC Milling Machine – 1 unit
4. Arduino Kits – 10-15 kits
5. Raspberry Pi Kits – 5-10 kits
6. Prototyping Tools (Soldering kits, breadboards, wires) – 10 sets
7. Basic Hand Tools (pliers, screwdrivers, wrenches, etc.) – 5-10 sets
8. Workbenches – 10-15 units
9. Computers with Design Software (SolidWorks, Siemens NX, AutoCAD) – 10-15 units
10. Oscilloscopes – 2-3 units
11. Multimeters – 5-10 units
12. Power Supplies – 3-5 units
13. Digital Calipers – 5 units
14. Measuring Tapes and Rulers – 10 units
15. 3D Scanners – 1-2 units
16. Prototyping Materials (PLA, ABS, PETG filaments, acrylic sheets, etc.)
17. Whiteboard and Presentation Tools – 1 set
18. VR/AR Kits (optional for advanced prototyping) – 1-2 units

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Utilize *design thinking* and *system thinking* methodologies to develop innovative solutions for complex mechatronic systems.
CO2	Create and evaluate functional *low-fidelity prototypes* that demonstrate key design principles, aligning with *Technology Readiness Level)* standards.
CO3	Implement *project management strategies* in a team setting to organize, execute, and deliver design projects, incorporating iterative feedback for improvement.
CO4	Demonstrate proficiency in *technical documentation* and *report writing* by presenting detailed project analyses, results, and design evaluations.
CO5	Exhibit effective *communication skills* through the presentation of design concepts and solutions, ensuring clarity and technical depth for various audiences.

Mapping of COs with POs and PSOs															
COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	0	2	0	1	3	2	0	3	0	2	0	3
CO2	2	3	0	2	0	2	3	0	0	3	0	2	3	2	0
CO3	1	2	3	0	2	0	2	2	3	2	3	0	2	3	3
CO4	0	3	2	3	2	3	0	1	1	0	1	3	0	3	2
CO5	3	0	2	1	3	2	1	0	2	2	3	2	3	0	3

OPEN ELECTIVES

OEI101	**BASICS OF ARDUINO AND RASPBERRY Pi**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES

- To familiarize fundamentals of Arduino.
- To know the programming methodology and to acquire the interfacing skills and data exchange methods with Arduino
- To familiarize fundamentals of Raspberry Pi.
- To know the programming methodology and to acquire the interfacing skills and data exchange methods with Raspberry Pi
- To acquaint the knowledge of real time system through case studies.

UNIT - I	**FUNDAMENTALS OF ARDUINO**	**9**

Arduino: The Arduino Boards – Arduino Architecture - Arduino IDE – ESP8266 Wi-Fi module. Creating an Arduino program, Using Libraries, Interfacing and Communicating with devices.

UNIT - II	**INTERFACING I/O DEVICES WITH ARDUINO**	**9**

Interfacing and controlling I/O devices by Arduino LEDs - Push buttons - Light intensity sensor - Ultrasonic distance sensor – Temperature sensor- Humidity sensor - Sensor and Actuator interactions Raspberry Pi: The Raspberry Pi Boards - The Raspberry Pi Peripherals - The Raspberry Pi Operating System.

UNIT - III	**FUNDAMENTALS OF RASPBERRY Pi**	**9**

Raspberry Pi: The Raspberry Pi Board – Architecture of Raspberry Pi - IDE – The Raspberry Pi Operating System - Creating a Raspberry Pi program, Using Libraries, Interfacing and Communicating with devices.

UNIT - IV	**INTERFACING I/O DEVICES WITH RASPBERRY Pi**	**9**

Interfacing and Controlling I/O devices by Raspberry Pi: LEDs - Push buttons - Light intensity sensor - Ultrasonic distance sensor – Temperature sensor- Humidity sensor - Sensor and Actuator interactions Connecting to the Cloud.

UNIT - V	**IoT CASE STUDIES**	**9**

IoT case studies: Smart Home, Smart Cities, Smart Agriculture and Smart Mobility.

Total Periods:	**45**

COURSE OUTCOMES Upon completion of the course, the students will be able to	
CO1	Elucidate the fundamentals of Arduino.
CO2	Develop basic Programming skills with Arduino
CO3	Elucidate the fundamentals of Raspberry Pi
CO4	Implement Raspberry Pi as controllers for automated systems.
CO5	Design and develop an IoT based system for the given real- time application.

Text Books:

1. Frank Vahid and Tony Givagis, "Embedded System Design", 2011, Wiley.
2. Sami S.H and Kisheen Rao G, "The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers", CRC Press, 2022.

Reference Books:

1. John B. Peatman, "Design with Microcontrollers", McGraw Hill International, USA, 2005.
2. 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.
3. Nitin G and Sharad S, "Internet of Things: Robotic and Drone Technology", CRC Press, 2022.
4. Bell C., "Beginning Sensor Networks with Arduino and Raspberry Pi", Apress, 2013.
5. Simon Monk, Programming the Raspberry Pi, Second Edition: Getting Started with Python McGraw Hill TAB; 2nd edition,2015

OEI102	GRAPHICAL SIMULATION USING LabVIEW	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concepts of VI
- To learn the various concepts of Programming in VI
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in VI
- To learn about the development of various meters in LabVIEW
- To understand the Applications of LabVIEW

UNIT - I	INTRODUCTION TO VIRTUAL INSTRUMENTATION	9

Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Software in virtual instrumentation - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT - II	BASICS OF LabVIEW	9

Numericals, Booleans and Comparators;Vls and sub-Vis, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, State machine, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT - III	DATA ACQUISTION	8

Introduction to data acquisition, Sampling fundamentals, Input/Output techniques and Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards

- Data acquisition cards with serial communication - VI Chassis requirements. SCSI, PCI, PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.		
UNIT - IV	**VI TOOLSETS**	**10**
Application of VI in process control designing of equipments like oscilloscope, Digital Multimeter, Design of Digital Voltmeters with Transducer input, Virtual Laboratory, Web based Laboratory.		
UNIT - V	**VI APPLICATIONS**	**9**
Distributed I/O modules - Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Motion control. Development of Virtual Instrument using GUI		
	Total Periods:	**45**

COURSE OUTCOMES **Upon completion of the course, the students will be able to**	
CO1	Recognize the basic concepts of Virtual Instrumentation.
CO2	Describe the Programming concepts in LabVIEW.
CO3	Learn the concepts of Data Acquisition
CO4	Learn the toolsets in VI.
CO5	Analyse various applications of LabVIEW.

Text Books:

1. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey 1997.

Reference Books:

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000

Mapping of COs with POs and PSOs

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO2	3	2	1	2	2	1	-	-	-	-	-	1	2	1	3
CO3	3	2	1	1	2	1	-	-	-	-	-	1	2	1	3
CO4	3	2	1	3	2	1	-	-	-	-	-	1	2	1	3
CO5	3	2	1	3	2	1	-	-	-	-	-	1	2	1	3

OCS108	INTRODUCTION TO PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of python programming.
- To learn control structures in python.
- To decompose programs in Python into functions and use Strings.
- To construct programs in Collection classes.
- To develop python programs using files and exception handling.

UNIT I	INTRODUCTION TO PYTHON PROGRAMMING	9
Introduction to Python, Demo of Interactive and script mode, Tokens in Python – Variables, Keywords, Comments, Literals, Data types, Indentation, Operators and its precedence, Expressions, Input and Print functions, Type Casting.		CO1
UNIT II	**CONTROL STRUCTURES**	**9**
Control Structures: Selective statements – if, if-else, nested if, if – elif ladder statements; Iterative statements - while, for, range functions, nested loops, else in loops, break, continue and pass statements.		CO2
UNIT III	**FUNCTIONS AND STRINGS**	**9**
Functions: function definition, function call, flow of execution, parameters and arguments, return values, local and global scope, recursion and Lambda functions. Strings: string slices, immutability, string functions and methods, string module. Regular expression: Matching the patterns, Search and replace.		CO3
UNIT IV	**COLLECTIONS**	**9**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, nested lists, list comprehension; Tuples: tuple assignment, tuple as return value, tuple operations. Dictionary: Create, add, and replace values, operations on dictionaries. Sets: Create and operations on set.		CO4
UNIT V	**FILES AND EXCEPTION HANDLING**	**9**
Files: Open, Read, Write, Append and Close. Tell and seek methods. Illustrative programs: word count, copy file. Command line arguments, Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Exception Chaining, User-defined Exceptions, Defining Clean-Up actions.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Allen B. Downey, –Think Python: How to Think Like a Computer Scientist _, 2nd edition, Updated for Python 3, Shroff/O_Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, —– An Introduction to Python — Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford UniversityPress, 2019.

REFERENCE BOOKS

1. John V Guttag, ―Introduction to Computation and Programming Using Python‖, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning,2012.
5. Charles Dierbach, ―Introduction to Computer Science using Python: A ComputationalProblem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop simple console application in python.
CO2	Develop and execute simple Python programs using conditionals and loops for solving problems.
CO3	Express proficiency in the handling of strings and functions
CO4	Represent compound data using python lists, tuples, and dictionaries.
CO5	Read and write data from/to files in Python.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	2	1	1
CO2	3	3	3	3	2	-	-	-	-	2	2	2	2	1	1
CO3	3	3	3	3	2	-	-	-	-	2	2	2	1	2	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	1	2	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	1	2	1