1.1.3 Courses having focus on employability/ entrepreneurship/ skill development offered by the University during the year

Color Index	
Employability	Yellow
Entrepreneurship	Green
Skill Development	Pink

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

School: School of mechanical engineering	**Batch: 2019-2023**
Department: Mechanical engineering	**Year: I**
Course: B. Tech (ME/MAE)	**Semester: I**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	BSC	BSC-101	Physics	3	1	0	4	15	25	60			100
2	ESC	ESC-101	Basic Electrical Engineering	3	1	0	4	15	25	60			100
3	HSS	HSS-101	English	2	0	0	2	15	25	60			100
4	BSC	BSC-103	Mathematics-I	3	1	0	4	15	25	60			100
5	ESC	ESC-103	Introduction To Computer Systems & Internet Basics	3	0	0	3	15	25	60			100
6	MC	MC-101	Environmental Science	2	0	0	0	15	25	60			100
7	BSC	BSC-151	Physics Lab	0	0	2	1				60	40	100
8	ESC	ESC-151	Basic Electrical Engineering Lab	0	0	2	1				60	40	100
9	HSS	HSS-151	English Lab	0	0	2	1				60	40	100
10	ESC	ESC-153	Engineering Graphics & Design	0	0	6	3				60	40	100
11	PDP	PDP-101	Induction & Nurturing Hobbies	0	0	2	1						100
			Total---->				**24**						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

School: School of mechanical engineering	Batch: 2019-2023
Department: Mechanical engineering	Year: I
Course: B. Tech (ME/MAE)	Semester: II

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	BSC	BSC -102	Chemistry	3	1	0	4	15	25	60			100
2	ESC	ESC-102	Programming for problem solving	3	0	0	3	15	25	60			100
3	BSC	BSC-104	Mathematics-II	3	1	0	4	15	25	60			100
4	HSS	HSS-102	Effective Technical Communication	3	0	0	3	15	25	60			100
5	MC	MC-102	Constitution of India	2	0	0	0	15	25	60			100
6	BSC	BSC 152	Chemistry Lab	0	0	2	1				60	40	100
7	ESC	ESC-152	Programming for problem solving Lab	0	0	4	2				60	40	100
8	ESC	ESC-154	Workshop Practice	0	0	4	2				60	40	100
9	PDP	PDP-102	People Connect	0	0	2	1						100
			Total---->				**20**						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

School: School of mechanical engineering	**Batch: 2019-2023**
Department: Mechanical engineering	**Year: II**
Course: B. Tech (ME/MAE)	**Semester: III**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	BSC	BSC-201	Math-III (Numerical Methods)	3	1	0	4	15	25	60			100
2	ESC	ME-201C	Manufacturing Processes	3	1	0	4	15	25	60			100
3	ESC	ME-203C	Fluid Mechanics	3	1	0	4	15	25	60			100
4	ESC	ME-205C	Engineering Mechanics	3	1	0	4	15	25	60			100
5	ESC	ME-207C	Thermodynamics	3	0	0	3	15	25	60			100
6	ESC	ESC-201	Basics of Electronics Engineering	3	1	0	4	15	25	60			100
7	BSC	BSC-253	Math-III (Numerical Methods) Lab	0	0	2	1				60	40	100
8	ESC	ME-251C	Manufacturing Processes Lab	0	0	2	1				60	40	100
9	ESC	ME-253C	Fluid Mechanics lab	0	0	2	1				60	40	100
10	PDP	PDP-201	Personality Development and Grooming	0	0	2	1						100
			Total---->				**30**						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

School: School of mechanical engineering	Batch: 2019-2023
Department: Mechanical engineering	Year: II
Course: B. Tech (ME/MAE)	Semester: IV

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	ESC	ME -202 C	Applied Thermodynamics	3	1	0	4	15	25	60			100
2	ESC	ME -204 C	Strength Of Materials	3	0	0	3	15	25	60			100
3	ESC	ME- 206 C	Fluid Machinery	3	1	0	4	15	25	60			100
4	ESC	ME -208 C	Kinematics of Machines	3	1	0	4	15	25	60			100
5	ESC	HSS -202	Engineering Economics and Management	3	0	0	3	15	25	60			100
6	ESC	ME- 252 C	Applied Thermodynamics Lab	0	0	2	1				60	40	100
7	ESC	ME-254 C	Strength Of Materials- Lab	0	0	2	1				60	40	100
8	ESC	ME -256 C	Fluid Machinery Lab	0	0	2	1				60	40	100
9	ESC	ME-258C	Kinematics of Machines Lab	0	0	2	1				60	40	100
10	ESC	ME-260C	Machine Drawing	0	0	2	1				60	40	100
11	PDP	PDP-202	Life Skills	0	0	2	1						100
			Total---->				**27**						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

School: School of mechanical engineering	**Batch: 2019-2023**
Department: Mechanical engineering	**Year: III**
Course: B. Tech (ME/MAE)	**Semester: V**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	ESC	ME- 301 C	Dynamics of Machines	3	1	0	4	15	25	60			100
2	ESC	ME -303 C	Manufacturing Technology	3	0	0	3	15	25	60			100
3	ESC	ME -305 C	Heat Transfer	3	1	0	4	15	25	60			100
4	ESC	ME -307 C	Solid Mechanics	3	1	0	4	15	25	60			100
5	ESC	ME -309 C	Design of Machine Elements	3	1	0	4	15	25	60			100
6	ESC	ME -351 C	Dynamics of Machines Lab	0	0	2	1				60	40	100
7	ESC	ME- 353C	Manufacturing Technology Lab	0	0	2	1				60	40	100
8	ESC	ME -355 C	Heat Transfer Lab	0	0	2	1				60	40	100
9	MC	MC -III	Essence of Indian Traditional Knowledge	0	0	0	0				60	40	100
10	PDP	PDP-301	Leadership & Entrepreneurship Development	0	0	2	1						100
			Total---->				**23**						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

School: School of mechanical engineering	**Batch: 2019-2023**
Department: Mechanical engineering	**Year: III**
Course: B. Tech (ME)	**Semester: VI**

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	ESC	ME-302C	Material science	3	0	0	3	15	25	60			100
2	ESC	MES-304C	PLC for Automation	4	0	0	4	15	25	60			100
3	ESC	MES-306C	IoT for Smart Manufacturing	4	0	0	4	15	25	60			100
4	ESC	MES-308C	Python for automation	4	0	0	4	15	25	60			100
5	Elective	ME6E11C/ ME6E12C	Industry 4.0/ Computer integrated manufacturing	4	0	0	4	15	25	60			100
6	ESC	ME-352C	Material science lab	0	0	2	1				60	40	100
7	ESC	MES-354C	Automation Lab-I	0	0	2	1				60	40	100
8	ESC	MES-356C	IoT for Smart Manufacturing Lab	0	0	2	1				60	40	100
9	ESC	MES-358C	Python Lab	0	0	2	1				60	40	100
	PDP	PDP-302	Problem Solving Skills	0	0	2	1						100
			Total---->				23						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

School: School of mechanical engineering	Batch: 2019-2023
Department: Mechanical engineering	Year: IV
Course: B. Tech (ME)	Semester: VII

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	OE		Open elective	3	0	0	3	15	25	60			100
2	ESC	MES-403C	Smart Manufacturing Systems	4	0	0	4	15	25	60			100
3	ESC	MES-405 C	Additive Manufacturing	4	0	0	4	15	25	60			100
4	ESC	MES-407 C	Smart Sensors For Automation	4	0	0	4	15	25	60			100
5	ESC	MES-455 C	Additive Manufacturing Lab	0	0	2	1				60	40	100
6	ESC	MES-459 C	Automation Lab-II	0	0	2	1				60	40	100
7	PROJ	ME-400 C	Seminar	0	0	2	2						100
8	PROJ	ME-496 C	Project Work	0	0	8	4						100
9	PDP	PDP-401	Campus to Corporate	0	0	2	1						100
			Total---->				24						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2020-2024

Open Elective								Semester: VII					
SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	OE	MEOE-401C	INDUSTRIAL ROBOT	3	0	0	3	15	25	60			100
			Total---->	3	0	0	3						

School: School of mechanical engineering	Batch: 2019-2023
Department: Mechanical engineering	Year: IV
Course: B. Tech (MAE)	Semester: VIII

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks (IP+EXP)/2
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PROJ	ME -406C	INTERNSHIP	0	0	32	16						100
2	PEC	ME- 402 C	ONLINE MODE (MOOC)	3	0	0	3						100
			Total---->				19						

Abbreviations:

PCC: Programme Core Courses
PEC: Programme Elective Courses
PROJ: Project
PDP: Personality Development Programme
L: Lecture
T: Tutorial
P: Practical
BSC Basic Sciences
HSS: Humanities and Social Sciences
ESC: Engineering Sciences

ABQ: Assignment Based Quiz
MSE: Mid Semester Examination
ESE: End Semester Examination
IP: Internal Practical
EXP: External Practical
OE: Open Elective

BSC-101	PHYSICS	L-T-P	Credits
		3-1-0	4

1. **ELECTROSTATICS AND MAGNETOSTATICS (10 lectures)**

   Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential, Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.

   Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

2. **MECHANICS (8 lectures)**

   Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical Coordinates

3. **QUANTUM MECHANICS (8 lectures)**

   Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

4. **WAVE OPTICS (10 lectures)**

   Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer.

   Fraunhauffer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

5. **LASERS (8 lectures)**

   Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

SUGGESTED TEXT/REFERENCE BOOKS

i. David Griffiths, Introduction to Electrodynamics.
ii. W. H. Hayt and J. A. Buck. Engineering Electromagnetics.
iii. Engineering Mechanics, 2nd ed. — MK Harbola.
iv. Introduction to Mechanics — MK Verma
v. Eisberg and Resnick, Introduction to Quantum Physics
vi. D. J. Griffiths, Quantum mechanics

COURSE OUTCOMES:

Physics is one of the foundation subjects to all engineering disciplines and the study in engineering physics is aimed at blending a strong physics component with relevant engineering backgrounds. The core objective is to provide a coherent foundation of physics for all majors that are usually necessary to work in areas such as computer science, electronic industry, mechanical domains and communication technologies. The contents are based on the static and dynamic state of elementary physics resulting in the field theory and wave mechanics the matter.

BSC-103	MATHEMATICS-I	L-T-P	Credits
		3-1-0	4

MATHEMATICS-I CALCULUS AND LINEAR ALGEBRACOURSE

OBJECTIVE:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apartfrom some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineeringproblems.
- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

1. **MATRICES (10 lectures)**
   Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, Skew- symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

2. **SEQUENCES AND SERIES (12 lectures)**
   Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

3. **CALCULUS (8 lectures)**
   Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions andtheir properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

4. **CALCULUS (8 lectures)**
   Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

5. **MULTIVARIABLE CALCULUS (DIFFERENTIATION) (10 lectures)**
   Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

SUGGESTED TEXT/REFERENCE BOOKS

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

(ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(iii) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

(iv) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

(v) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

(vi) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,
2008.

COURSE OUTCOMES:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

ESC-101	BASIC ELECTRICAL ENGINEERING	L T P	Cr
		3-1-0	4

LEARNING OBJECTIVES:

- **To understand and analyses basic electric and magnetic circuits**
- **To study the working principles of electrical machines and power converters.**
- **To introduce the components of low voltage electrical installations**.

DETAILED CONTENTS:

1. **DC CIRCUITS (8 hours)**

   Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin, Norton and maximum power transfer Theorems.

2. **AC CIRCUITS (8 hours)**

   Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltageand current relations in star and delta connections.

3. **TRANSFORMERS (8 hours)**

   Construction, working principle of transformer, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and its comparison with ordinary transformer.

4. **ELECTRICAL MACHINES (8 hours)**

   Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of dc motor. Construction and working of synchronous generators.

5. **POWER CONVERTERS & ELECTRICAL INSTALLATIONS (8 hours)**

   DC-DC converters and AC-DC converters, Switches, Fuses, MCBs, Earthing and its types, Important Characteristics for Batteries and battery backup. Elementary calculations for energy consumption, power factor improvement.

SUGGESTED TEXT / REFERENCE BOOKS

(i) D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
(ii) D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
(iii) L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
(iv) E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
(v) V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

ESC-103	INTRODUCTION TO COMPUTER SYSTEMS & INTERNET BASICS	L-T-P	Credits
		3-0-0	3

PREREQUISITE: NA

OBJECTIVE: To give basic knowledge of Computer Hardware, Software systems & internets

1. **COMPUTER SYSTEMS:** Overview of Computer Systems, Evolution of Computer Systems, Generations of computers, Characteristics of Computer: speed, storage, Accuracy, Categories of computer: Micro Computers, Mini Computers, Main Frames, Super Computers, Computer Organization: Central processing unit, Arithmetic and Logic Unit, Control Unit, Memory System: Primary memory, secondary memory and Data Representation in a Computer System. Number system : decimal, Binary, Octal, Hexadecimal representation and conversion

2. **PROGRAMMING LANGUAGES & OPERATING SYSTEM BASICS:** Software Basics: Application software, System Software, Utility Software, Programming languages: Low level languages, Machine language, Assembly language, Limitations of Low level languages, High Level languages, Translator, Assembler, Interpreter, Compiler, Operating System: Need of Operating System, Function of Operating System, Types of Operating System

3. **NETWORK SYSTEMS, INTERNET & WEB:** Introduction to networking, Local and Wide Area Networks, communication media: wired and wireless, Network Topologies: Star, Ring, Bus, Networking devices: Switch, Hub, Bridge, Internet overview, Internet Architecture, The idea of hypertext and hyper media; how the browser works: MIME types, plug-ins and helper applications; XML, XHTML, XSLT and the W3C, Hosting and Domains:

4. **HYPERTEXT MARKUP LANGUAGE:** The anatomy of an HTML document; marking up for structure and style: ordered and unordered lists, Structuring content with HTML using natural divisions, Marquee, Anchor Tag, Email Link; embedding images and controlling appearance, table creation: Frames and Nesting, iframes, forms, Semantic elements of HTML5, HTML5 Form elements, Media tags in HTML5, HTML5 Data Storage

5. **COMPUTER SECURITY:** Security Threats: Intruders, Password Cracking, Different types of malicious Software: Virus, Worms, Trojan Horse, Prevention from malicious Software: Antivirus (Introduction)

TEXT BOOKS:

1. Computer Fundamentals: P. K. Sinha, BPB pub.
2. Fundamentals of Computer Science and Programming with C: A. K. Sharma, Dhanpat RaiPub.
3. Uttam K. Roy, “Web Technology”, Oxford Publication4.

REFERENCE BOOKS:

1. Computing Fundamentals & C Programming: E. Balaguruswamy, TMH.
2. Fundamentals of Computers: V Rajaraman, PHI

COURSE OUTCOMES:

On successful completion of this course students will be able to:

- Identify different application areas of computers.
- Distinguish hardware and software components of the computer system.
- Use Ms-windows operating system. Make use of the basic Microsoft office applications for office use.
- Identify information resources and services available on the Internet.
- Make use of search and retrieval services on subjects of their interest.

ESC-153	ENGINEERING GRAPHICS & DESIGN	L-T-P	Credits
		0-0-6	3

LEARNING OUTCOMES:

Engineering drawing is an effective language of engineers. It is the foundation block which strengthens the engineering and technological structure. Moreover, it's the transmitting link between ideas and realization. After learning the course the students should be able to understand conventions and the methods of engineering drawing and interpret engineering drawings, using fundamental technical mathematics, construct basic and intermediate geometric improve their visualization skills so that they can apply these skills in developing new projects improve their technical communication skill in the form of communicative drawings, comprehend the theory of projections and acquire basic knowledge of computer aided drafting.

UNIT 1: INTRODUCTION TO ENGINEERING DRAWING

Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Dimensioning.

UNIT2: ORTHOGRAPHIC PROJECTIONS

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes;

UNIT 3: PROJECTIONS OF SOLIDS

Projections of planes inclined Planes - Auxiliary Planes; Projection of Regular Solids covering those inclined to both the planes, Auxiliary Views; Section of such solids and the true shape of the section.

UNIT 4: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; objects from industry and dwellings (foundation to slab only) Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids Conversion of Isometric Views to Orthographic Views and Vice-versa

UNIT 5: OVERVIEW OF COMPUTER GRAPHICS

Introduction to Computer Aided Drafting and CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

SUGGESTED TEXT/REFERENCE BOOKS:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech
5. Publishers (Corresponding set of) CAD Software Theory and User Manuals

COURSE OUTCOMES:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice
- After learning the course the students should be able to To know and understand the conventions and the method of engineering drawing. Interpret engineering drawings using fundamental technical mathematics.
- Construct basic and intermediate geometry.

The student will learn:

Introduction to engineering design and its place in society

- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

HSS-101	ENGLISH	L T P	Cr
		2-0-0	2

Detailed contents

1. VOCABULARY BUILDING

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms and standard abbreviations.

2. BASIC WRITING SKILLS

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely
2.7 Jane Austen: Pride and Prejudice(novel)

3. IDENTIFYING COMMON ERRORS IN WRITING

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. NATURE AND STYLE OF SENSIBLE WRITING

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. WRITING PRACTICES

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing
5.4 Charles Dickens: Oliver Twist (novel)

6. ORAL COMMUNICATION

(This unit involves interactive practice sessions in Language Lab)

Listening Comprehension
Pronunciation, Intonation, Stress and Rhythm
Common Everyday Situations: Conversations and Dialogues
Communication at Workplace
Interviews
Formal Presentations

SUGGESTED READINGS:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

COURSE OUTCOMES:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

BSC-151	PHYSICS LAB	L-T-P	Credits
		0-0-2	1

LIST OF EXPERIMENTS:

1. To study response curve of a series LCR circuit.
2. To determine the Planck's constant using LEDs.
3. To determine the Rydberg's constant of Hydrogen atom.
4. To find the refractive index and Cauchy's constants of a prism.
5. To find the wavelength of light by Newton's rings experiment.
6. To determine the thickness of a thin wire by interference.
7. To determine the wavelength of LASER using diffraction grating.
8. To determine the resolving power of a telescope.
9. To find the numerical aperture of an optical fiber cable.
10. To find the wavelength of light using Michelson's interferometer

ESC-151	BASIC ELECTRICAL ENGINEERING LAB	L T P	Cr
		0-0-2	1

LIST OF EXPERIMENTS / DEMONSTRATIONS:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi – meter, oscilloscope. Resistors, capacitors and inductors.
2. Demonstration of cut – out sections of machines :
3. Torque speed characteristic of dc motor.
4. Parallel operation of single phase Transformer.
5. Open circuit & short circuit test on single phase transformer.
6. To verify the Thevenin's & Norton's theorem.
7. To verify the Superposition theorem.
8. To study frequency response of series & parallel RLC Circuit.
9. Load test on D.C. Shunt generator
10. Torque – speed characteristics of three phase Induction motor & direction reversal by change of phasesequence of connection.
11. To plot field current Vs Armature voltage characteristics of synchronous generator.

HSS-151	ENGLISH LAB	L T P	Cr
		0-0-2	1

ORAL COMMUNICATION

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialoguescommunication at Workplace
- Interviews
- Formal Presentations

MC-101	ENVIRONMENTAL SCIENCE	L T P	Cr
		2 -0 -0	0

1. **THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:** Basic definitions related to environment; Scope, vis-à-vis environmental science and environmental engineering; a uses of environmental degradation, atmospheric composition and associated spheres, habitat and climate; objective, goals and principals involved in environmental education, environmental awareness, Environmental ethics, environmental organization and their involvement.

2. **NATURAL RESOURCES:** Renewable and non-renewable resources; forest resources, over- exploitation, and deforestation / afforestation; water resources, impact of over-utilization of surface and ground water, floods, drought, conflicts over water, dams; mineral resources: dereliction of mines, environmental effects of extracting and using mineral resources; Food resources, modern agriculture and its impact, problem associated with fertilizer and pesticide, water logging, salinity ; energy resources, renewable, non-renewable energy sources, solar energy, wind energy, hydro energy,biomass energy, geothermal energy, nuclear energy and its associated hazards; land as a resource, land degradation, man induced landslides, soil erosion and desertification.

3. **ECOSYSTEMS:** Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids; characteristic features, structure and function of the following ecosystem -forest ecosystem, grassland ecosystem desert ecosystem and aquatic ecosystems.

4. **BIODIVERSITY AND ITS CONSERVATION:** Bio-geographical classification of India; biodiversity at global, national and local levels, India as a mega-diversity nation, hot-spots of biodiversity; value of biodiversity-consumptive use, productive use, social, ethical aesthetic and option values; threats to biodiversity; conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

5. **ENVIRONMENTAL POLLUTION:** Causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution; solid waste management, e-waste management; disaster management –floods, earthquake, cyclone and landslides.

6. **SOCIAL ISSUES AND THE ENVIRONMENT:** Water conservation, rain water harvesting, watershed management; climate change, global warming, acid rain, ozone layer depletion; Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.

7. **HUMAN POPULATION AND THE ENVIRONMENT:** Population growth, population explosion –family welfare programmes; role of information technology in environment and human health; case studies, Chipko movement, Sardar Sarovar dam, mining and quarrying in Udaipur, salinity and water logging in Punjab, Haryana and Rajasthan, Bhopal gas tragedy, Chernobyl nuclear disaster, arsenic pollution in ground water.

TEXT BOOK

Kaushik, Anubha, and Kaushik, C.P., "Perspectives in Environmental Studies", 4th Edition,New Age International Publishers, 2004

REFERENCE BOOKS

1. Agarwal, K.C., "Environmental Biology", 2nd Edition, Nidhi Publ. Ltd., Bikaner, 2001.
2. Bharucha Erach, "The Biodiversity of India", 2nd Edition, Mapin Publishing Pvt. Ltd., 2006.
3. Brunner R. C., "Hazardous Waste Incineration", 1st Edition McGraw Hill Inc., 1989.
4. Clark R.S., "Marine Pollution", 1st Edition Clanderson Press Oxford,1989
5. .Cunningham, W.P., Cooper, T.H. Gorhani, E. & Hepworth, M.T., Environmental Encyclopedia", 2nd Edition, Jaico Publ. House, 2001.
6. De, A. K., "Environmental Chemistry", 2nd Edition, Wiley Eastern, 1989
7. Jadhav, H. and Bhosale, V.M ., "Environmental Protection and Laws", 1st Edition, Himalaya Pub. House, Delhi, 1995.
8. Mckinney, M.L. and Schocl. R.M., "Environmental Science Systems & Solutions", 2nd Edition, Web enhanced edition, 1996.
9. Rao M.N. and Datta, A.K.,"Waste Water Treatment", 2nd Edition, Oxford & IBH Publ.Co., 1987.
10. Sharma B.K., "Environmental Chemistry", 2nd Edition, Goel Publ. House, Meerut, 2001
11. Trivedi R.K. and Goel, P.K., "Introduction to Air Pollution", 2nd Edition, Techno-science Publications, 1996

II Semester

BSC-102	Chemistry	L T P	Cr
		3 -1 -0	4

Unit-I PHASE RULE

Terminology, Definition of phase rule, Derivation of phase rule equation, One component system (H_2O system and CO_2 system), two components system, Simple eutectic system (Pb – Ag), Pattinson's Process, congruent system (Zn–Mg), incongruent system(Na-K system), Merits and demerits of phase rule.

UNIT-II THERMODYNAMICS

Second law of thermodynamics, **entropy** change for reversible & irreversible processes, Entropy change for ideal gas, variation of free energy with temperature & pressure, Gibbs-Helmholtz equation, Clapeyron- Clausius equation & it's integrated form Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications.

UNIT-III CORROSION AND ITS PREVENTION

Definition, Types of corrosion: Dry, wet corrosion (rusting of iron), galvanic corrosion, differential aeration corrosion, stress corrosion. Factors affecting corrosion, preventive measures (proper design, Cathodic and Anodic protection, sacrificial protection and barrier protection), Soil Corrosion.

UNIT-IV SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Part-A:Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques.

UNIT-V INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena, Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

UNIT-VI ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

UNIT-VII STEREOCHEMISTRY

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal
compounds

Suggested Text Books :

(i)University chemistry, by B. H. Mahan
(ii)Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
(iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv)Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

(v)Physical Chemistry, by P. W. Atkins
(vi)Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

BSC-104	Mathematics-II	L T P	Cr
		3 -1 -0	4

Detailed contents

Unit I: Basic Probability: (12 lectures)
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Unit II: Continuous Probability Distributions: (6 lectures)
Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Unit III: Complex Variable – Differentiation: (14 lectures)
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

Unit IV: First order ordinary differential equations: (8 lectures)
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Unit V: Ordinary differential equations of higher orders: (10 lectures)
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Suggested Text/Reference Books

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
(iii)S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
(vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
(vii)E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
(viii) E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

Course Outcomes

The objective of this course is to familiarize the students with statistical techniques. It Aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

The students will learn:

- The mathematical tools needed in evaluating multiple integrals and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The ideas of probability and random variables and various discrete and
- continuous probability distributions and their properties.
- The statistical methods of studying data samples.

ESC-102	PROGRAMMING FOR PROBLEM SOLVING	L T P	Cr
		3 -0 -0	3

Unit-1: BASICS OF PROGRAMMING AND OVERVIEW OF C PROGRAMMING: Programming Fundamental, Problem definition, Idea of Algorithm, steps to solve logical and numerical problems, Representation of Algorithms: Flow charts/ Pseudocode with example, Types of programming languages, Translators, From algorithms to programs; source code, variables and memory location, Introduction to C, Structure of C program, C character set, Identifier and Keywords, Data types, constants, variables, Declaration, Arithmetic expressions & precedence , statements, Symbolic constants, type conversion, Types of operators, Input and output functions in C, header files, common programming errors, Control Statements, Sequencing, Selection, Condition and iteration.

Unit-2: ARRAYS AND STRING: Declaring, Referencing and initializing arrays, array subscript, using for loop for sequential access, multi-dimensional array, String basics string library functions, assignment and substring, concatenation, string comparison.

Unit-3: FUNCTIONS AND POINTERS: Definition of function, function prototype, Purpose of main function, passing parameters, Scope of function, recursion, Call by value and reference, Types of storage classes, Scope of variable: Global and local, static variables, Recursion.. Pointer variables, initializing pointers, pointer operators, pointer expressions, pointers and arrays, pointer and functions,

Unit-4: STRUCTURES, UNIONS & RECURSION

Defining a structure, Declaring structure variables, Structure initialization, Copying and Comparing Structure variables, Array of structures, Arrays within structure, nested structures, Unions. Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

Unit-5: DYNAMIC MEMORY ALLOCATION AND FILE PROCESSING: C's dynamic allocation functions. Streams and file types, opening and closing a data file, input and output operations, text mode versus binary mode, formatted input output operations with files, random access to files.

Reference Books:-

1. Programming in C by Schaum Series, McGraw Hills Publishers, New Delhi.
2. Let Us C by YashwantKanetkar; BPB Publication, New Delhi.
3. Exploring C by YashwantKanetkar; BPB Publications, New Delhi.
4. Application Programming in C by RS Salaria, Khanna Book Publishing Co. (P) Ltd., New Delhi.
5. Programming in C by R Subburaj, Vikas Publishing House Pvt. Ltd., Jangpura, New Delhi.
6. Programming with C Language by C Balaguruswami, Tata McGraw Hill, New Delhi.
7. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi

HSS-102	EFFECTIVE TECHNICAL COMMUNICATION	L T P	Cr
		3 -0 -0	3

Module 1:
Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Module 2:
Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing,ocalization.

Module 3:
Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Module 4:
Communication and Technical Writing- Public speaking, Group discussion, Oral presentation, Interviews, Graphic presentation, Presentation aids, Personality Development.
Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Module 5:
Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text/Reference Books:
1.David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2.Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3.Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4.Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5.Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN:07828357-4)
6.Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7.Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

MC-102	CONSTITUTION OF INDIA	L T P	Cr
		2 -0 -0	0

Objective: Constitution of India is the lengthiest written Constitution in the world. Came into existence as a result of the independence, the Constitution strikes a perfect balance between the State (allocation of powers) and a citizen within his/her individual capacity (providing the rights). This paper will emphasize on some of the important provisions of the Constitution, giving an insight about the functioning of the State and its essential pillars.

UNIT – 1

- Making and Basic structure of the Constitution
- Salient features of the Constitution
- Citizenship

UNIT – 2

- Fundamental Rights of a citizen
- Fundamental Duties of a citizen
- Directives principles of State policy

UNIT – 3

- Union and the Executive (President, Vice-President, Judiciary)

UNIT – 4

- Emergency Provisions

UNIT – 5

State Liability

ESC-154	WORKSHOP PRACTICE	L T P	Cr
		0 -0 -4	2

Course Objectives:

- To teach students the practices of workshop management and maintenance.
- To familiarize students with workshop machinery like drills, lathes, welding torches, files, saws, hammers, etc.
- To teach students the need to economize materials when managing a workshop.
- To teach students the safety measures needed in a workshop and how to deal with accidents at work.
- To teach student welding and manufacture of selected items.
- To teach students the practice of plumbing.
- To teach students the basics of electrical installations.

Course Outcomes: Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. Upon completion of this course, the students will gain knowledge of the different manufacturing processes and day to day industrial as well domestic life which are commonly employed in the industry, to fabricate components using different materials.

(A) Fitting Trade:

1. Preparation of T-Shape Work piece as per the given specifications.
2. Preparation of U-Shape Work piece which contains: Filing, Sawing, Drilling, Grinding.

(B) Machine shop: Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools)

1. To obtain required diameters (steps) on a cylinder work piece with the given lengths.
2. To obtain the required diameters (taper) on a cylinder work piece with the given dimensions.

(C) Carpentry: Study of Carpentry Tools, Equipment and different joints

1. To make a dovetail lap joint.
2. To make a cross half lap joint.

(D) Foundry Trade: Introduction to foundry, Patterns, pattern allowances, ingredients of molding sand and melting furnaces. Foundry tools and their purposes

1. To prepare a sand mold, using the given single piece pattern.
2. To prepare a sand mold, using the given split piece pattern.

(E) Welding: Introduction, Study of Tools and welding Equipment (Gas and Arc welding)

1. To make a single v-butt joint, using the given mild steel pieces and by arc welding.
2. To make a T-joint using the given mild steel pieces and by arc welding.

(F) Electrical and Electronics: Introduction to House wiring, different types of cables. Types of power supply, types of motors, Starters, distribution of power supply, types of bulbs, parts of tube light, Electrical wiring symbols.

1. Two lamps connected in series - measure and check the voltage and current using multimeter.
2. Two lamps connected in parallel - measure and check the voltage and current using multimeter.

(G) CNC Machining: To study the working principle of CNC machining.

Reference Books:

1. Mechanical Workshop Practice by K C John, PHI Learning

2. Workshop Technology Vol. 1 and 2 by Raghuvanshi B.S. DhanpatRai& Sons 1998

3. Workshop Technology by Chapman W.A. J and Arnold E. Viva low priced student edition, 1998

ESC-152	PROGRAMMING FOR PROBLEM SOLVING LAB	L T P	Cr
		0 -0 -4	2

LIST OF EXPERIMENTS

(Students have to do at 3-4 programs from each section)

SEQUENTIAL CONTROL STATEMENTS

1. Write a program to Print HELLO
2. Write a program to add two numbers
3. Write a program to calculate simple interest
4. Write a program to calculate average of three numbers
5. Write a program to swap two numbers
6. Write a program to illustrate mixed data types
7. Write a program to calculate area and circumference of circle
8. Write a program to evaluate a polynomial expression
9. Write a program to add digits of a four digit number
10. Write a program to check whether the person if eligible for voting or not

CONDITIONAL CONTROL STATEMENTS

11. Write a program to find greatest of two numbers
12. Write a program to find out which type of triangle it is
13. Write a program to find out greatest of three numbers
14. Write a program to evaluate performance of the student
15. Write a program to make a basic calculator

LOOP CONTROL STATEMENTS

16. Write a program to print Fibonacci up-to the given limit
17. Write a program to find the sum of digits of a number
18. Write a program to find factorial of a number
19. Write a program to print table of any number
20. Write program for printing different pyramid pattern

ARRAYS AND STRINGS

21. Write a program to enter the elements in a one dimensional array
22. Write a program to find the sum and average of five numbers
23. Write a program to sort the array elements
24. Write a program to enter the marks of 50 students an calculate the average
25. Write a program to add 2 matrix
26. Write a program to multiply 2 matrices
27. Write a program to calculate the length of string

28. Write a program to concatenate 2 strings
29. Write a program to reverse the string
30. Write a program to count the numbers of characters in a string
31. Write a program that converts lower case characters to upper case
32. Write a program without using predefined functions to check whether the string is palindrome or not

FUNCTIONS & POINTERS

33. Write a program using function to find the largest of three numbers
34. Write a program using function to sum the digits of a number
35. Write a program to calculate factorial of a number using recursive function
36. Write a program to print first n Fibonacci using recursive function
37. Write a program to illustrate the concept of chain of pointers
38. Write a program using function to swap two numbers using call by reference
39. Write a program to calculate the area and perimeter of circle using pointers
40. Write a program to copy the contents of one array into another in the reverse order using pointers

STRUCTURES

41. Write a program to read an employee record using structure and print it
42. Write a program to prepare salary chart of employee using array of structures
43. Write a program to print the name and percentage of 20 students (array of structures and arrays within structures).
44. Write a program to demonstrate structure within structure.

FILE HANDLING

45. Write a program to create, open, and close files.
46.
    a. Write a program to demonstrate the purpose of different file opening modes.
    b. Write a program to count the number of characters, spaces, tabs, new line characters in a file.
    c. Write a program to receive strings from keyboard and write them to a file.
    d. Write a program to copy a file to another.
    e. Write a program to read strings from a file and display them on screen.

(III SEMESTER)

Course code	Course title	L	T	P	Credits
BSC-201	**MATH-III (NUMERICAL METHODS)**	3	1	0	4

Course objective:

CO1. The objective of this course is to familiarize the students with statistical techniques.
CO2. It aims to equip the students with standard concepts and tools at an intermediate to advanced Level that will serve them well towards tackling various problems in the discipline.

UNIT I: SOLUTION OF NONLINEAR EQUATIONS

Introduction to numbers and their accuracy; absolute, relative and percentage errors and their analysis; Bisection method; Regula- falsi method; secant method; Newton- Raphson method.

UNIT II: SOLUTION OF SIMULTANEOUS LINEAR EQUATIONS

Gauss elimination method; Gauss-Jordan method; Jacobi's iteration method; Gauss-Seidal iteration method.

UNIT III: INTERPOLATION

Introduction to interpolation; Newton's forward and backward interpolation formulae; Stirling formula; Lagrange interpolation; Newton's divided difference formula, Central Difference and average operators..

UNIT IV: NUMERICAL DIFFERENTIATION AND INTEGRATIONEQUATION

Numerical differentiation formulae, differentiation by using forward interpolation formula; backward interpolation formula, Newton-Cotes formula for numerical integration: Trapezoidal rule; Simpson's 1/3 & 3/8th rules.

UNIT V SOLUTION OF ORDINARY DIFFERENTIAL

Taylor series method, Euler method; Euler modified method; Runge kutta method 2nd order & 4th order

TEXT BOOK

Grewal, B. S., "Numerical methods in Engineering and Science",9th Edition, 2010, Khanna publishers. And Higher Engineering Mathematics: B. S. Grewal

REFERENCE BOOK

1. Jain, R.K. and Iyengar, S.R.K., "Numerical Methods for Scientific and Engg. Computations" ,5th Edition,2007, New Age International publishers.
2. Sastry, S.S.," "Introductory Methods of Numerical Analysis",3rd Edition,1999, Prentice Hall of India.

Course outcomes:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical Processes.

Course code	Course title	L	T	P	Credits
ME –201 C	**MANUFACTURING PROCESS**	3	1	0	4

Course Objectives:
1. To provide an overview of the basic production techniques and allied / supporting techniques used to produce finished products from raw materials.
2. In addition to theory, students will be given practical training on various basic production techniques. After going through this course, the students will be in a position to understand the working of a mechanical workshop.

UNIT -I

INTRODUCTION: Basic manufacturing processes and safety in workshop. Classification of materials–their general mechanical properties and their selection

UNIT-II

CASTING PROCESSES: Sand casting process; pattern making; types of moulding sands, cores, mould making, melting and pouring of metal; Casting defects. **MACHINING PROCESSES:** Production of components involving turning; facing; taper turning; milling; shaping; planning and drilling operations.

UNIT-III

METAL FORMING PROCESSES: Sheet metal forming operations; shearing, bending, punching and blanking, forging processes as upsetting, drawing down, bending etc.

UNIT-IV

JOINING PROCESSES: Metal arc welding; gas welding; resistance welding; soldering **and mechanical fastening processes.**

UNIT-V

FITTING AND MAINTENANCE: Study of fitting tools, marking tools and measuring instruments like micrometer, vernier calipers and height gauge; introduction to some basic maintenance techniques/processes.

Course outcomes:

CO1-Select appropriate Manufacturing Processing to manufacture any component.
CO2-Interpret foundry practices like pattern making, mold making, Core making and Inspection ofdefects.
CO3-Differentiate various metal forming processes such as Hot and Cold Working, Rolling, Forging,Extrusion and Drawing Processes.
CO4-Classify different plastic molding processes, Extrusion of Plastic and Thermoforming.
CO5-Select appropriate Joining Processes to join Work piece.

TEXT BOOK

Raghuwanshi, B.S., “A course in Workshop Technology, Vol. I & II”, Dhanpatrai & Co.

EFERENCE BOOK

Hazra &Chaudhary, “Workshop Technology Vol. I & II”, Asian Book Co

Course code	Course title	L	T	P	Credits
ME-203 C	FLUID MECHANICS	3	1	0	4

Course Objectives:

It imparts the basic concept; knowledge and laws of fluid flow; Fluid dynamics and kinematics and idea of estimation of various losses encountered in fluid flow PRE REQUISITES Knowledge of Thermodynamics

UNIT-1: FLUID PROPERTIES AND FLUID STATICS

Concept of fluid and flow; ideal and real fluids; Continuum concept; properties of fluids; Newtonian and non-Newtonian fluids; Pascal's Law; hydrostatic equation; hydrostatic forces on plane and curved surfaces; stability of Floating and submerged bodies; relative equilibrium; Problems

UNIT-2: FLUID KINEMATICS AND DYNAMICS

Eulerian and Lagrangian description of fluid flow; stream; streak and path lines; types of flows; flow rate and continuity equation; differential equation of Continuity; rotation; vorticity and circulation; stream and potential functions; Problems Concept of system and control volume; Euler's equation; Bernoulli's equation; venturimeter; pitot tubes; orifice meter; kinetic and momentum correction factors; Impulse momentum relationship and its applications; Problems

UNIT-3: VISCOUS FLOW

Flow regimes and Reynolds's number; Relationship between shear stress and pressure gradient; uni-directional flow between stationary and moving parallel plates; Counter flow; laminar flow through pipes.

UNIT-4: FLOW THROUGH PIPES

Friction loss in pipe flow; Darcy-Weisbach formula co-efficient of friction and friction factor: Major and minor losses in pipes; hydraulic Gradient and total energy lines; series and parallel connection of pipes; branched pipes; Equivalent pipe; power transmission through pipes; Problems

UNIT-5: BOUNDARY LAYER CONCEPT

displacement; momentum and energy thickness; von-karman momentum integral equation; laminar and turbulent boundary layer flows; drag on a flat plate; boundary layer separation; Stream lined and bluff bodies; lift and drag on a cylinder and an airfoil; Problems

TEXT BOOKS

Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publication House, 2002

REFERENCE BOOKS:

1. Kumar, D. S., "Fluid Mechanics and Fluid Power Engineering", SK Kataria and Sons,1998
2. Wylie, E. B, Streeter VL; "Fluid Mechanics";McGrawHill1983
3. SomSKandBiswasG.,"IntroductiontoFluidMechanicsandFluidMachines",TataMcGrawHill, 1998
4. Bansal RK, "A Text Book of Fluid Mechanics" Laxmi Publications

Course outcomes:

CO 1-Students will be able to understand basic knowledge of the definition and the fundamental concepts of fluid mechanics including continuum, velocity field, surface tension, flow visualization etc.

CO 2-Students will able to apply the basic equation of fluid statics to determine forces on planer and curved surfaces that are submerged in a static fluid.

CO 3-Students will able to use conservation laws in integral form and apply them to determine forces and moments on surfaces of various shapes and simple machines

CO 4-Students will able to use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and in viscid fluids

CO 5- Students will able design simple pipe systems to deliver fluids under specified conditions and also the loosed during the flow of the fluid.

Course code	Course title	L	T	P	Credits
ME – 205 C	**ENGINEERING MECHANICS**	3	1	0	4

Course Objectives:
Engineering Mechanics is one of the core subjects that introduces the student to analysis of forces and motion and prepares the student for studying strength of materials and theory of machines.

UNIT-1: FORCE SYSTEMS

Basic concepts of space, time, mass, force, particle and rigid body; scalars and vectors; principle of transmissibility; force classification; Representation of force in vector form; rectangular components of two dimensional force systems; resultant of two dimensional and concurrent force systems. moment about a point; Varignon's theorem; Representation of moment in vector form; couple. Numerical.

UNIT-2: EQUILIBRIUM

Equilibrium in two dimensions; Lame's Theorem; system isolation and the free-body-diagram; modeling the action of forces; equilibrium conditions; Numerical.

UNIT-3: PROPERTIES OF SURFACES/CROSS SECTIONS

Centre of mass; determining the center of gravity; center of gravity of areas including composite sections; moments of inertia; MI of plane figures; parallel axis & perpendicular axis theorem;; MI of composite figures. Numerical.

UNIT-4: RECTILINEAR AND CURVILINEAR MOTION

Types of motion, definitions of displacement, distance, velocity, speed, acceleration Newton's laws of motion, Uniform and non-uniform motion equations of motion, motion under gravity. Numerical.

UNIT-5: PROJECTILES

Angle of projection, Trajectory , Range of projectile , Duration of flight , Path of Projectile, Greatest height attained by a projectile. Numerica

TEXT BOOKS

Meriam, J. L. "Engineering Mechanics", John Wiley & S

REFERENCE BOOKS:

1. Beer, F.P. and Johnston, E.R. "Mechanics of Materials", Tata McGraw Hill
2. Shames, I.H. "Engineering Mechanics", 4th Edition, Pearson Education, 2003
3. Pytel, A and Kiusalaas, J. Thomsom, "Mechanics of Materials", Brooks & Cole, 2003

Course Outcome:
CO1. Solve engineering problems involving the equilibrium of particles and rigid bodies.
CO2. Solve the problems involving dry friction and virtual work.
CO3. Determine the centroid, center of gravity, and moment of inertia of various surfaces and solids.
CO4. Solve problems related to kinematics and kinetics of a rigid body.
CO5. Solve problems using the energy-momentum principle for a particle and rigid bodies in plane motion.

Course code	Course title	L	T	P	Credits
ME-207 C	**THERMODYNAMICS**	3	0	0	3

Course Objectives:

This course introduces the student to the fundamental laws of thermodynamics, the interaction between Energy and matter, the quantitative and qualitative aspects of energy

UNIT-1: FUNDAMENTALS AND BASIC CONCEPTS

System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & In exact Differentials, Quasi–static Process, Reversible and Irreversible Process, Causes of Irreversibility, Energy and its forms, Work and heat (sign convention), Equality of Temperature, Zeroth Law of Thermodynamic and its utility, Problems.

UNIT-2: FIRST LAW OF THERMODYNAMICS

Thermodynamic definition of work ,Displacement work and flow work, Displacement work for various non-flow processes, Joules' experiment, First law analysis for closed system(non-flow processes),Internal energy and enthalpy, PMM-I, Numericals Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc., Numericals.

UNIT-3: SECOND LAW OF THERMODYNAMICS AND ENTROPY

Limitations of Ist law, Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, Thermodynamic Temperature Scale, PMM-II. Clausius inequality ,Concept of Entropy, Entropy change of pure substance indifferent thermodynamic processes, Tds equation, Principle of entropy increase, Statement of the third law of thermodynamics, Availability and Irreversibility Problems

UNIT-4: PROPERTIES OF PURE SUBSTANCES

Pure substance, Property of Pure Substance (steam),Triple point, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T &P- V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier chart, Dryness fraction and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

UNIT-5: THERMODYNAMIC RELATIONS, IDEAL AND REAL GASE

Maxwell Relations, Clapeyron Equation, Relations for changes in Enthalpy and Internal Energy & Entropy, Specific Heat Capacity Relations, Joule Thomson coefficient & inversioncurve. Idealgases,Idealgaslaws, realgases,compressibility factor, compressibility charts.

TEXT BOOKS

Nag, P.K., “Engineering Thermodynamics”, Tata McGraw Hill.

REFERENCE BOOKS:

1. Rao, Y VC., “Theory and Problems of Thermodynamics”, Wiley Eastern Ltd, 2007
2. Arora C P., “Engineering Thermodynamics”, Tata McGraw Hill; 2008
3. Domkundwar., “Thermal Engineering”, Dhanpat Rai & Company, 2006
4. Estope, TD and Meconkey A., “Applied Thermodynamics for Engineers Technologists”, AWL, 1999

Course outcome:

Course Outcome:
CO1-Students will be able to explain the basic principles and applications of the thermody0mics to the various real life systems.
CO2-Students will be able to describe fundamental laws of thermodynamics.
CO3-Students will be able to apply the concepts such as Entropy, Energy Balance also the calculations of heat, work and other important thermodynamic properties for various ideal gas processes.
CO4-Students will be able to estimate performance of various thermody0mic gas power cycles and gas refrigeration cycle and availability in each case.
CO5-Students will be able to examine the condition of steam and performance of vapour power cycle and vapor compression cycle

Course code	Course title	L	T	P	Credits
ME-251C	MANUFACTURING PROCESS LAB	0	0	2	1

LIST OF EXPERIMENTS

1. Prepare a pattern for given casting with all the necessary allowances.
2. Make a green sand mold and prepare it for the casting; investigate the casting defects and suggest the remedies.
3. Make a casting by shell molding process.
4. Make a component involving horizontal and vertical welding (Arc welding)
5. Cut a sheet with gas welding and investigate the defects.
6. To join two sheets using resistance spot welding.
7. Make a job using turning; taper turning and facing and boring operations on lathe.
8. Prepare a job on surface grinder.
9. Development and manufacture of sheet metal component such as elbows and transition pieces.
10. Cut external threads on a lathe

Course outcomes:

CO1.To build practical knowledge about Pattern Making; pattern material, pattern allowances and types of patterns casting processes

CO-2: To apply practical understanding for use of moulding tools: green sand moulding, gating system, risering system, core making;

CO-3: To plan and create jobs using forging processes;

CO-4: To understand and plan for machining of gears;

CO-5: To relate the job manufactured from practical relevance point of view

Course code	Course title	L	T	P	Credits
ME-253 C	FLUID MECHANICS LAB	0	0	2	1

Course Objectives:
Students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS

1. To determine the meta-centric height of a floating Body
2. To verify Bernoulli's theorem
3. To find critical Reynolds number for pipe flow
4. To determine the coefficient of discharge; contraction and velocity; of an orifice
5. To determine the coefficient of discharge of a venturimeter
6. To determine the coefficient of discharge of "V" and Rectangular notches
7. To determine the friction factor for pipes
8. To determine the minor losses due to sudden enlargement; sudden contraction and bends;In pipe flow
9. To determine the coefficient of impact of jet
10. To determine the velocity and pressure variation with radius in a forced vortex flow

Course outcomes:

1. Utilize basic measurement techniques of fluid flow
2. Demonstrate practical understanding and applications of Bernoulli's Equation
3. Analyze the friction losses in pipes.
4. Gaining knowledge to calculate and design engineering applications involving fluid.
5. Understanding of analyzing flow systems in terms of mass, momentum, and energy balance.

IV SEMESTER

Course code	Course title	L	T	P	Credits
ME-202 C	**APPLIED THERMODYNAMICS**	3	1	0	4

Course Objectives:
It enables the students to understand the use of thermodynamic laws in design and functioning of Various equipment used in steam power systems and compressors.

UNIT-1: CLASSIFICATION OF FUELS

Classification of fuels –solid; liquid and gaseous fuels; Combustion equations; Stoichiometric air-fuel ratio; Excess air. Calorific values of fuel; Exhaust gas analysis; Orsat apparatus; Enthalpy and internal energy of combustion; Enthalpy of formation; Adiabatic flame temperature; Problems

UNIT-2: BOILER

Boiler:-Classification ;comparison between fire and water tube boilers Essentials of a good boiler; Constructional and operational details of Babcock - Wilcox; Cochran; Locomotive and Lancashire Boilers;Highpressureboilers-Benson;Lamont;LoefflerandVeloxboilers;Boilermountings and accessories; Boiler performance; Natural and Artificial Drafts; Chimney height; Maximum draft and chimney efficiency; Boiler heat balance Sheet; Problems

UNIT-3: BASIC POWER CYCLES & NOZZLES & TURBINES

Carnot and Rankine vapor cycles effect of operating Conditions on thermal efficiency of Rankine cycle; Rankine cycle with superheat; reheat And regeneration Binary Vapor cycle Problems Classification of nozzles ,Velocity and heat drop; mass discharge through a nozzle; critical pressure ratio and its significance effect of friction and nozzle efficiency; Supersaturated flow; design pressure ratio; Problems

UNIT-4: STEAM TURBINES

Classification; Impulse Turbine Flow through blades; velocity Diagram; power output and efficiency maximum blade efficiency of single stage impulse Turbine; Blade friction; compounding of impulse turbine. Reaction Turbine-Flow through Impulse reaction blades degree of reaction; velocity diagram; power output; efficiency And blade height comparison of impulse and impulse reaction turbines; Losses in steam Turbines; stage efficiency; overall efficiency and reheat factor; Governing of steam Turbines Problems

UNIT-5: CONDENSER & COMPRESSOR

Elements of a condensing plant; types of condensers and their studies comparison of jet and surface condensers; Condenser vacuum; sources of air leakage and its Disadvantages; vacuum efficiency and condenser efficiency; Problems. Working of a single stage reciprocating air compressor; calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression;

Two stage compressor with Inter-cooling; Perfect Inter cooling; Optimum intercooler pressure Problems

TEXT BOOKS

Eastop, T. D, and McConkey., “Applied Thermodynamics for Engineering Technologists”, Pearson

REFERENCE BOOKS:

1 Domkundwar., “Thermal Engineering”, Dhanpat Rai and Company.

2 Vasandani, V. P., and Kumar, D. S., “Heat Engineering”, Metropolitan Book Co

3 Ballaney, P. L., “Thermal Engineering”, Khanna Publishers,

Course outcomes:

CO1-Students will be able to explain the basic principles and applications of the thermody0mics to the various real life systems.
CO2-Students will be able to describe fundamental laws of thermodynamics.
CO3-Students will be able to apply the concepts such as Entropy, Energy Balance also the calculations of heat, work and other important thermodynamic properties for various ideal gas processes.
CO4-Students will be able to estimate performance of various thermody0mic gas power cycles and gas refrigeration cycle and availability in each case.
CO5-Students will be able to examine the

Course code	Course title	L	T	P	Credits
ME-204 C	STRENGTH OF MATERIALS	3	0	0	3

Course Objectives:

The strength of materials is one of the core subjects and aim is to provide a sound foundation to design various element of mechanical equipment

UNIT-1: SIMPLE STRESSES AND STRAINS

Resistance to deformation; Hook's law and stress-strain diagram; types of stresses; stresses and strains in bars of varying sections; stresses in composite bars; lateral strain and Poisson's ratio; volumetric strain, modulus of rigidity and bulk modulus; relation between elastic constants. Numerical

UNIT-2: TORSION OF CIRCULAR SHAFTS AND REACTION OF BEAMS

Torsion formula of circular shaft, power transmission by shaft, types of beams and loads, reaction produced on supports for beams with point load uniformly distributed load, uniformly varying load and combined loads. Numerical.

UNIT-3: SHEAR FORCE & BENDING MOMENT

Definitions: SF and BM diagrams for cantilevers, simply supported beams with or without overhang and calculation of max. BM and SF and point of contra-flexure under i) concentrated loads, ii)uniformly distributed loads over wholes pan or part of it iii) combination of concentrated and uniformly distributed loads

UNIT-4: ANALYSIS OF PERFECT FRAMES

Types of frames, Assumptions made in finding out the forces in frames, Reactions of supports of a frame, Analysis of frame by Method of Joint, Analysis of frames by Method of Section.

UNIT-5: MOHR CIRCLE OF STRESSES

Mohr's circle of stress for a material under similar stresses in two mutually perpendicular plane, Mohr's circle of stress for a material under dissimilar stresses in two mutually perpendicular plane Mohr's circle of stress for a material under similar stresses in two mutually perpendicular plane along with shear stresses acting on all the planes, Mohr's circle for a material under dissimilar stresses in two mutually perpendicular plane along with shear stresses acting on all the planes. Numerical

TEXT BOOKS

Ferdinand P Beer &Russel E Johnston;—Mechanics of Materials‖, Tata McGraw Hill;2009

REFERENCE BOOKS:

1. Hibbeler, R. C.,—Mechanics of Materials ,Pearson Education, 2005
2. Ryder,G H., —Strength of Materials‖, Macmillan, 2001
3. Srinath LS,—Strength of Materials‖, Macmillan, 2001
4. Andrew / Kiusalaas, Jaan., —Mechanics of Materials‖, Thomson, 2003

Course outcomes:

CO1-Students will be able to predict mechanical behavior of the member by determining the stresses, strains and deflections produced by the loads up to the elastic limit.
CO2- Students will be able to solve the stresses in determinate and indeterminate, homogeneous and composite bars under concentrated loads, self-weight and thermal loads.
CO3-Students will be proficient to construct Shear Force and Bending Moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load and couple.
CO4-Students will be able to determine bending and shear stresses in machine elements
CO5-Students will be able to Evaluate Slope and Deflection of Statically Determi0te beams subjected to concentrated load, uniformly distributed load, uniformly varying load and couple and also strain energy in members subjected to Gradual, sudden and impact loads

Course code	Course title	L	T	P	Credits
ME-206 C	**FLUID MACHINERY**	3	1	0	4

Course Objectives: The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbine

UNIT-1: IMPACT OF FREE JETS

Impulse– momentum principle; jet impingement-on a stationary flat plate; inclined plate and a hinged plate; at the center of a stationary vane; on a moving flat plate; inclined plate; a moving vane and a series of vanes; Jet striking tangentially at the tip of a stationary vane and moving vane(s); jet propulsion of ships Problems

UNIT-2: IMPULSE TURBINES

Classification – impulse and reaction turbines; water wheels; component parts; construction; operation and governing mechanism of a Pelton wheel; work done; effective head; available head and efficiency of a Pelton wheel; design aspects; speed ratio; flow ratio; jet ratio; number of jets; number of buckets and working proportions; Performance Characteristics; governing of impulse turbines. Problems

UNIT-3: REACTION TURBINE

Francis Turbines: Component parts; construction and operation of a Francis turbine; governing mechanism; work done by the turbine runner; working proportions and design parameters; slow; medium and fast runners; degree of reaction; inward/outward flow reaction turbines; Performance Characteristics; Problems.

Propeller and Kaplan turbines: Component parts; construction and operation of a Propeller; Kaplan turbine; differences between the Francis and Kaplan turbines; draft tube-its function and different forms; Performance Characteristics; Governing of reaction turbine;

UNIT-4: CENTRIFUGAL PUMPS

Centrifugal Pumps: Classification; velocity vector diagrams and work done; manometry efficiency; vane shape; head capacity relationship and pump losses; pressure rise in impeller; minimum starting speed; design considerations; multi-stage pumps. Similarity relations and specific speed; net positive suction head; cavitation and maximum suction lift; performance characteristics; Brief introduction to axial flow; mixed flow and submersible pumps; Problems.

UNIT-5: RECIPROCATING PUMPS

Reciprocating Pumps: Construction and operational details; discharge coefficient; volumetric efficiency and slip; work and power input; effect of acceleration and friction on indicator diagram (pressure–stroke length plot); separation; air vessels and their utility; rate of flow into or from the air vessel; maximum speed of the rotating crank; characteristic curves; centrifugal V/S reciprocating pumps; brief introduction to screw; gear; vane and radial piston pumps; Problems.

Hydraulic systems: Function; construction and operation of Hydraulic accumulator; hydraulic intensifier; hydraulic crane; hydraulic lift and hydraulic press; Fluid coupling and Torque converter; Hydraulic ram; Problems.

TEXT BOOKS

1. Hydraulics & Fluid Mechanics– Modi & Seth; Pub.-Standard Book House; N. Delhi
2. Hydraulic Machines–Jagdish Lal; Metropolitan

REFERENCE BOOKS:

1. Fluid Mechanics and Hydraulic Machines – SS Rattan; Khanna Publishers
2.Introduction to Fluid Mechanics and Fluid Machines– SK Som and G Biswas; Tata McGraw Hill
3. Fluid Mechanics and Fluid Power Engineering– D S Kumar; SK Kataria and Sons

Course outcomes:

CO1.Students can able to Examine Single Acting &Double Acting Compressor
CO2.Students can able to understand the basic concepts of Gas power cycles
CO3. Students can able to compare various steam Turbine & Steam Nozzle
CO4. An overall idea about fluid machinery and the knowledge about the calculation of efficiency, power developed by a turbines and power required by a pump.
CO-5: Able to understand basic working principles of various hydraulic machines

Course code	Course title	L	T	P	Credits
ME-208 C	**KINEMATICS OF MACHINES**	3	1	0	4

Course Objectives:

1. To understand the basic components and layout of linkages in the assembly of a system / machine.
2. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
3. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT-1: INTRODUCTION OF MECHANISMS AND MACHINES

Concepts of Kinematics and Dynamics, Mechanisms and Machines, Planar and Spatial Mechanisms, Kinematic Pairs, Kinematic Chains, Kinematic Diagrams, Kinematic Inversion, Four bar chain and Slider Crank Mechanisms. And their Inversions, Degrees of Freedom, Mobility and range of movement-Kutzbach and Grubler's criterion, Number Synthesis, Grashoff's criterion Position analysis of Four bar, slider crank mechanisms, transmission angle, Mechanical Advantage.

UNIT-2: VELOCITY AND ACCELERATION ANALYSIS

Velocity and Acceleration Analysis: Velocity and Acceleration Diagrams, Instantaneous Centre of Velocity, Rubbing Velocity, Corioli's component of acceleration. **Special Mechanisms:** Straight line mechanisms, Hooke's Joint, Steering Mechanisms.

UNIT-3: CAMS AND FOLLOWERS

Cams and Followers: Introduction: Classification of cams and followers, nomenclature, displacement diagrams of follower motion. Synthesis and Analysis: Determine of basic dimensions and synthesis of cam profiles using graphical methods, cams with specified contours.

UNIT-4: Gears & Gears Train

Gears: Terminology, Law of Gearing, Characteristics of involute and cycloidal action, Interference and undercutting, center distance variation, minimum number of teeth, path of contact, contact ratio, **Gear Trains:** Synthesis of Simple, compound &reverted gear trains, Analysis of epicyclic gear trains.

UNIT-5:

Friction: Types of friction, laws of friction, motion along inclined plane, screw threads, efficiency on inclined plane, friction in journal bearing, friction circle and friction axis, pivots and collar friction, uniform pressure and uniform wear.

Belts and pulleys: Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, chain length, classification of chains.

TEXT BOOKS

1. Rattan S.S, Theory of Machines,Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edition, 2014.
2. Ambekar A. G., Mechanism and Machine Theory, PHI, 2009.

REFERENCE BOOKS:

- Shigley, J.E and Uicker, J.J: Theory of Machines and Mechanisms, Oxford University Press
- Rattan S.S.: Theory of Machines Tata McGraw-Hill Publishing Co. Ltd. NewDelhi
- Rao J.S. and Dukkipati R.V: Mechanisms and theory Machines theory, Wiley Eastern Ltd.
- Mabie H.H and Ocvirk, F.W: Kinematic and Dynamics of Machinery, 3rd EditionJohn wiley and sons.
- Green, W.G: Theory of Machines, 2nd Edition, Blackie, London, 1992.
- Hollowenko, A.R: Dynamics of Machinery, John wiley and sons. Inc. NewYork, 1955.
- Wilson, Kinematics and Dynamics of Machinery, 3rd Edition, Pearson Education.
- Bevan Thomas, Theory of Machines

Course outcomes:	
1.	Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyze them for optimum design.
2.	Students can able to understand the effects of friction in motiontransmission and in machine components.
3.	Understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions
4.	It enables design of **cam** mechanisms for specified output motions and solving of problems in toothed gear trains and the effects of friction in machine components.
5.	Gain knowledge on the basic concepts of mechanisms, cam, gear train and their kinematics.

Course code	Course title	L	T	P	Credits
HSS-202	**ENGINEERING ECONOMICS AND MANAGEMENT**	3	0	0	3

Course Objectives:
To gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing/service firms. To develop skills necessary to effectively analyze and synthesize the many inter-relationships inherent in complex socio-economic productive systems.

UNIT 1: WORKSTUDY

Method study; Principle of motion economy; techniques of method study– various charts; THERBLIGS; Work measurement–various methods; time study PMTS; determining standard time; work sampling; Numerical.

UNIT 2: PRODUCTIVITY AND MANUFACTURING COST ANALYSIS

Productivity– Definition; various methods of measurement; Factors affecting productivity; Strategies for improving productivity; various methods of job evaluation and meritrating; Various incentive payments schemes; behavioral aspects; financial incentives
Fixed and variable costs; Direct; indirect and overhead costs; Process and Job costing; Recovery of overheads; Standard costing; cost control; cost variance Analysis; Labour; material overheading volume; rate and efficiency; breakeven analysis; marginal costing and contribution; numerical

UNIT 3: MATERIALS M A N A G E M E N T

Relevant costs; inventory control models– economic order quantity (EOQ); Economic batch quantity (EBQ) with and without shortage; Purchase discounts; sensitivity analysis; inventory control systems– PQSs Systems; Service level; Stock out risk; determination of order point and safety stock; selective inventory control– ABC; FSN; SDE; VED and three dimensional; Numerical.

UNIT 4: QUALITY MANAGEMENT

Definition of quality; various approaches; concept of quality assurance systems; costs of quality; statistical quality control (SQC); Variables and Attributes; X;R;P and C– charts; Acceptance sampling; OC–curve; concept of AOQL; Sampling Plan– single; double and sequential; introduction to TQM and ISO 9000

UNIT 5: PRODUCTION PLANNING & CONTROL

Basic concept its relations with other decision areas; decision options – Basic and Mixed strategies; Master production schedule (MPS) Scheduling Operations Various methods for line and intermittent production systems; Gantt chart; sequencing– Johnson algorithm for n- Jobs-2 machines ;n-jobs-3 machines; 2 jobs machines n-Jobs m-machines; various means of measuring effectiveness of PPC; Introduction to JIT; Numerical.

TEXT BOOK:
Chary. "Production and Operations Management", Tata McGraw Hill.

REFERENCE BOOKS:

1 Buffa, S. S., "Modern Production Management", John Wiley
2 Sadagopan,"Management Information Systems", Prentice Hall of India.
3 Schroeder., "Operations Management", McGraw Hill ISE.
4 Monks., "Operation Management", McGraw Hill ISE.
5 Martinich. "Production and Operations Management", John Wiely SE
6 Turner, MIZE, CHASE. ,"Industrial and Systems Engineering", Prentice Hall of India.

Course outcomes:	
1.	Explain the various parts of the operations and production management processes and their interaction with other business functions (strategy, engineering, finance, marketing, HRM, project management and innovation)
2.	Develop the ability to identify operational methodologies to assess and improve an organizations performance

Course code	Course title	L	T	P	Credits
ME-252 C	APPLIED THERMODYNAMICS LAB	0	0	2	1

Course Objectives:
To supplement the principles learnt in Energy conversion. To understand how turbines are working.

LISTOF EXPERIMENTS

1. To study low pressure boilers with their accessories and mountings
2. To study high pressure boilers with their accessories and mountings
3. To prepare heat balance sheet for a given boiler
4. To study impulse and reaction steam turbines
5. To find out dryness fraction of steam by throttling calorimeter
6. To calculate power output and efficiency of a steam turbine
7. To study and determine the condenser efficiency
8. To study and determine the volumetric efficiency of a reciprocating air compressor
9. To study cooling tower and determine its efficiency
10. To determine calorific value of a sample of fuel using bomb calorimeter
11. To determine composition of flue gases by orsat Apparatus

Course outcomes:

CO1. To apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.
CO2. To identify and formulate power production based on the fundamentals laws of thermal engineering
CO3.Students can able to understand the basic concepts of Gas power cycles
CO4.Students can able to compare various steam Turbine & Steam Nozzle
CO5. Students can able to Examine Single Acting &Double Acting Compressor

Course code	Course title	L	T	P	Credits
ME-254 C	STRENGTH OF MATERIALS LAB	0	0	2	1

Course Objectives:
To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS

1. To perform the Brinell Hardness Test
2. To perform the Rockwell Hardness Test
3. To study the Impact Testing Machine and perform the Impact Tests (IZOD &CHARY)
4. To study UTM and Torsion Testing Machine
5. To perform the Tensile Test on UTM
6. To perform the Shear Test on UTM
7. To perform the torsion test on Torsion Testing Machine
8. To determine the Moment of Inertia of a Flywheel about its own axis of rotation
9. To study the Erichsen Sheet Metal Testing Machine and Perform the Erichsen Sheet Metal Test;
10. To verify support reactions for different types of loads at different locations on the beam

Course outcomes:

CO1 Able to study the stress-strain curves of different materials used in the field under differentloading conditions.
CO2. Ability to function on multi-disciplinary teams in the area of materials testing.
CO3. Students will have the required knowledge in the area of testing of materials and components of structural elements experimentally
CO4. Test the different materials under the action of various forces and determine their characteristics experimentally
CO5Apply theoretical knowledge about the Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads.

Course code	Course title	L	T	P	Credits
ME-256 C	FLUID MACHINERY LAB	0	0	2	1

Course Objectives:
To have hands on experience in flow measurements using different devices and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS

1. To study the constructional details and draw characteristic and constant efficiency curves of Pelton turbine
2. To study the constructional details and draw characteristic and constant efficiency curves of a Francis turbine
3. To study the constructional details and draw characteristic and constant efficiency curves of a Kaplan turbine
4. To study the constructional details and draw characteristic curve of centrifugal pump
5. To study the constructional details and draw characteristic curve of a reciprocating pump
6. To study the constructional details and draw performance curve of gear oil pump
7. To study the constructional details and determine the efficiency of a hydraulic Ram
8. To study the constructional details of a centrifugal compressor
9. To study the model of hydro power plant and draw it's layout
10. To determine the volumetric efficiency of a reciprocating compressor

Course outcomes:

CO1.Ability to use the measurement equipment's for flow measurement
C O2.Ability to use the measurement equipment's for flow measurement
CO3.Ability to do performance trust on different fluid machinery
CO4. Identify importance of various fluid properties at rest and in transit. Understand the concept of boundary layer theory and flow separation. Plot velocity and pressure profiles for any given fluid flow.

CO5. Evaluate the performance characteristics of hydraulic turbines and pumps

Course code	Course title	L	T	P	Credits
ME-258 C	KINEMATICS OF MACHINE LAB	0	0	2	1

Course Objectives:
To supplement the principles learnt in kinematics and Dynamics of Machinery. To understand how certain measuring devices are used for dynamic testing.

1. To study inversions of four bar chain: Coupling Rod, Beam Engine
2. To study Steering Mechanisms; Davis and Ackerman.
3. Study of quick return mechanism and draw velocity and acceleration diagram.
4. Study of inversion of Double slider chain Oldham Coupling, Scotch Yoke and Elliptical Trammel.
5. Study of various cam-follower arrangements.
6. To plot displacement v/s angle of rotation curve for various cams
7. To determine co-efficient of friction using two roller oscillating arrangement.
8. Study of various types of dynamometers, Brakes and Clutches.
9. To determine moment of inertia of the given object using of Trifler suspension.
10. Perform study of the following using VirtualLabhttp://www.vlab.co.in/
11. Position, velocity and acceleration analysis of Grash off our bar mechanism
12. Position, velocity and acceleration analysis of Slider Crank mechanism

Course outcome:
CO1. Ability to demonstrate the principles of kinematics and dynamics of machinery CO2. Ability to use the measuring devices for dynamic testing CO3. To provide a foundation for the study of machine design. CO4. To provide a foundation for the study of machine design. CO5. Development of individual and team communications skills.

Course code	Course title	L	T	P	Credits
ME-260 C	**MACHINE DRAWING**	0	0	2	1

Course Objectives:
This course makes the student to learn the presentation of components and assemblies in to various views and vice versa. This will enable the student to learn to conceive an object and go For its production. AutoCAD is introduced to facilitate this process.

1. INTRODUCTION

Introduction to Graphic language, Sectional views, Types of sectional views, Hatching, Isometric scale, Isometric drawing of Circles; Conversion of isometric to orthographic and vice versa.

2. TOLERENCE AND MACHINE COMPONENTS

Standard abbreviation – Limits , Fits and Tolerance, Surface finish; Gear terminology, types of gear; Draw the gear profile; Springs, Belts & Pulleys, Bearings.

3. KEYS AND COTTERS

Various types of keys and cotters, Spigot and socket joint, Gib and cotter joint, Knuckle joint

4. JOINTS AND COUPLINGS

Rivets and Riveted Joints, Caulking and fullering of riveted joints, Types of riveted joints, Bolts and nuts, Welded Joint, Flange coupling (Protected and non-protected), muff coupling and half-lap muff Coupling.

5. ASSEMBLY DRAWING

Assembly of Lathe Tail stock, Machine vice; Cylinder, Piston, rings and Connecting rod; Steam stop valve, Stuffing box, Drill jigs and Milling fixture, Screw Jack.

LIST OF EXERCISES

1. Introduction of AUTOCAD and drawing simple figures by using Draw and Modify tools in AUTOCAD
2. To make complex / Engineering; Objects by using Layers with proper dimensioning tools
3. Conversion of Isometric views to orthographic views
4. Conversion of Orthographic views to Isometric views
5. Objects are given in Isometric views and that are to be converted in sectional views
6. Excises on Threads; Bolts and nuts
7. Excises on Riveted Joints and welded joints
8. Excises on Shafts; keys cotter and pin joints
9. Excises on Couplings
10. Geometrical tolerance; Limits and fits
11. Excises on springs; belts and Pulleys
12. Excises on Gears and bearings

13. Assembly drawing of Cylinder; Piston; rings and connected rod And part drawing of crank shaft
14. Assembly drawing of screws Jack
15. Block Diagrams;(Power plant; Civil ;Electronics etc)
16. Assembly drawing of stop valve
17. Assembly drawing of spring loaded safety Valve
18. Assembly drawing of Tailstock of Lathe
19. Assembly drawing of Shaper tool slide
20. Conversion of Assembly drawing to part drawing sand vice versa

TEXT BOOK

Singh, Ajeet., "Machine Drawing", McGraw-Hill2008

REFERENCE BOOKS

1. Gill, P. S., "Machine Drawing", SK Katariaand Sons, 2008

2. Bhatt, N. D, and Panchal, V. M., "Machine Drawing", Charotar Publishing House, 2008

Course outcomes:

CO1. Upon completion of this course, the students can able to perform free hand sketching of basic geometrical constructions and multiple views of objects.
CO2. Students can able to prepare isometric and perspective sections of simple solids
CO3. Students can able to demonstrate computer aided drafting
CO4. Students will get insight of technical skills regarding assembly, production and part drawings.
CO5. Students will be familiarized with various limits, fits and tolerances.

V- SEMESTER

Course code	Course title	L	T	P	Credits
ME-301 C	DYNAMICS OF MACHINES	3	1	0	4

Course Objectives:

To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.

To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.

UNIT-1: SATIC AND DYNAMIC FORCE ANALYSIS

Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms.

Dynamics of Reciprocating Engines : engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces. Introduction to flywheel

UNIT-2: GOVERNORS

Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability, inertia effects. Hunting of governors and Isochronism, Intertia Governors

UNIT-3: BRAKES

Types of brakes, shoe brake, band brake, band and block brake, internal expanding shoe brake and effect of braking

Dynamometers: types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

UNIT-4: GYROSCOPE

Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, gyroscopic stabilization, stabilization of sea vessels stability of four wheel and two wheel vehicles moving on curved paths.

UNIT-5: BALANCING OF ROTATING COMPONENTS

Static/dynamic balancing; Balancing of rotating masses; Two plane balancing –graphical and analytical methods; balancing of rotors; field balancing; balancing machines.

BALANCING OFRECIPROCATING PARTS: Balancing of single cylinder engine, balancing of multi- cylinder inline/radial/V-type engines, firing order.

TEXT BOOKS

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms" ,3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill,

REFERENCE BOOKS

1. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros.,
2. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, "Theory of Vibrationwith Application", 5th edition, Pearson Education, 2011
3. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House,
4. Khurmi, R.S.,"Theory of Machines", 14th Edition, S Chand Publications,

Course outcomes:

CO1. Upon completion of this course, the Students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem.
CO2. Implement the concept of Cam systems and their analysis of Forced vibration.
CO3. Apply principles of governors and gyroscopes.
CO4. Students will be equipped with fundamental knowledge of dynamics of machines so that student canappreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.

CO5. Develop knowledge of analytical and graphical methods for calculating balancing of rotary andreciprocating masses.

Course code	Course title	L	T	P	Credits
ME- 303 C	**MANUFACTURING TECHNOLOGY**	3	0	0	3

Course Objectives:

1. To gain theoretical and practical knowledge in material casting processes and develop an understanding of the dependent and independent variables which control materials casting in a production setting.
2. Introduce students to good foundry practices and product design considerations.
3. Provide an overview of joining processes; discuss in detail the weld the welding process and the physics of welding.
4. Introduce students to different welding processes weld testing and advanced processes to be able to appreciate the practical applications of welding.

UNIT-1: SAND CASTING PROCESSES

Advantages and limitations; sand mold making procedure; patterns And core; pattern materials; pattern allowances; types of patterns; color coding; molding materials; Molding sand composition; sand preparation; sand properties and testing; sand molding processes

UNIT-2: MOULD MAKING AND INSPECTION

Types of cores; core prints ; chaplets and chills; Gating system; gates and risers; Melting practice; cupola and induction furnace; charge calculations; casting cleaning and casting defects; fettling; defects in casting and their remedies; methods of testing of casting for their soundness

UNIT-3: SPECIAL CASTING PROCESSES

Shell molding; precision investment casting; permanent mold casting; die casting; centrifugal casting; and continuous casting.

UNIT-4: PLASTICS

Classification and Properties of Plastics, Principle, Selection Operation, Advantages and Limitations of various Moulding Processes, Design Considerations for plastic moulded parts.

UNIT-5: WELDING

Classification; oxy-acetylene welding equipment sand techniques; Electric arc welding Electrodes; manual metal arc welding; inert gas shielded arc welding ;tungsten inert gas welding (TIG); metal inert gas welding (MIG); Submerged arc welding (SAW) Principle; resistance spot welding; resistance seam welding; upset welding; flash welding Other welding processes; introduction of thermit welding; electro slag welding; electron beam welding; friction welding; diffusion welding; brazing and soldering.

TEXT BOOKS

Rao PN., "Manufacturing Technology – Foundry, Forming and Welding", Tata McGraw Hill

REFERENCE BOOKS:

1. Ghosh. A. Mallik A.K., "Manufacturing Science", Affiliated East West Press, 2005
2. Sinha, K P, Goel D B., "Foundry Technology", Standard Publishing, New Delhi, 2005
Richard, L Little., "Welding and Welding Technology", Tata McGraw Hill, 2000
3. Rosenthal; "Principle of Metal Casting", Tata McGraw Hill, 2001 Raghuwanshi B S., "
Workshop Technology", VolI., Dhanpat Rai, 2004

Course outcomes:

CO1. Upon completion of this course, the students can able to apply the different manufacturing Process and use this in industry for component production.
CO2. Students can able to understand the concepts of basic manufacturing processes and fabrication techniques
CO3.The main objective of this course is to emphasize the importance manufacturing sciences in the day-to-day life, and to study the basic manufacturing processes and tools used.
CO4. The course is delineated particularly to understand the conventional manufacturing processes like casting, metal forming, and welding process.

Course code	Course title	L	T	P	Credits
ME-305 C	**HEAT TRANSFER**	3	1	0	4

Course Objectives:
This course imparts basic knowledge of heat transfer and the knowledge imparted will enable him to reduce or increase heat transfer in existing equipment as the need may be and be able to go for preliminary design of heat exchanger.

UNIT-1: BASICS AND LAWS

Modes of heat transfer, Steady State Heat Conduction: Boundary conditions in heat transfer; I-D heat conduction: a plane wall; long hollow cylinder; hollow sphere and composite structures; Overall htc. Conduction equation in Cartesian; polar and spherical co-ordinate systems; Initial and Boundary conditions; Critical Thickness of Insulation, Log Mean Area of Cylinder sand Spheres, Numerical

UNIT-2: STEADY STATEANDUNSTEADY STATEHEAT CONDUCTION

Introduction;1–D heat conduction with heat sources; Plane wall; hollow cylinder and sphere; Current carrying conductor ;Extended surfaces(fins);Fin effectiveness Numericals, Systems with negligible internal resistance; Transient heat conduction in plane walls; cylinders; spheres with convective boundary Conditions; Chart solutions only; Periodic heat transfer in one dimension; Numericals

UNIT-3: CONVECTION (WITH AND WITHOUT PHASE CHANGE)

Forced convection-Thermal and hydro-dynamic boundary layers; Equation of continuity; Momentum and energy equations; some results for flow over a flat plate and flow through tube; Fluid friction and heat transfer (Colburnanalogy);Use of; Empirical relations for free convection from vertical and horizontal planes and cylinders; Numericals, Laminar film condensation on a vertical plate; Drop-wise condensation; Boiling regimes; Free convective; Nucleate and film boiling; Numericals

UNIT-4: THERMAL RADIATION

Absorptivity; Reflectivity; Transmissivity; Black body; emissive power; radiosity; laws of thermal radiation; intensity of radiation; Shape factor and its properties; Hottel's Method; Radiation exchange between black and gray surfaces; Two body; three body enclosures; Radiation shielding; Numericals

UNIT-5: HEAT EXCHANGERS

Classification; Performance variables; Analysis of a parallel and counter flow heat exchanger using LMTD and NTU; Heat exchanger effectiveness; Use of charts for multipass exchanger and
Cross flow heat exchanger; Fouling factor; Compact heat exchangers; Plate heat exchangers; Heat Pipe, Numericals

TEXT BOOK

NAG, P. K., “Heat Transfer”, McGraw Hill

REFERENCE BOOKS

1. Arpasi, VS., “Conduction Heat Transfer”, Addison Wesley
2. Domkundwar., “Heat Transfer”,
3. Holman, J. P., “Heat Transfer”, Tata McGraw Hill
4. Goshdastidar, P.S., “Heat Transfer”, Oxford Univ Press
5. Lienhard, J.V, J. H. Lienhard. V., “ A Heat Transfer Text Book

Course outcomes:

CO-1: To develop solutions for transient heat conduction in simple geometries, without heat generation.
CO-2: Understand the fundamentals of convective heat transfer process; evaluate heat transfer coefficients for natural and forced convection; deriving and analysing momentum and energy equations in two dimensions.
CO-3: Analysis of dimensionless quantities of heat transfer.
CO-4: Upon completion of this course, the students can able to understand and apply different heat and mass transfer principles of different applications.
CO-5. Students can able to understand the various heat transfers and also the Heat exchangers.

Course code	Course title	L	T	P	Credits
ME-307C	SOLID MECHANICS	3	1	0	4

Course Objectives:
The strength of materials is one of the core subjects and aim is to provide a sound foundation to design various elements of mechanical equipment

UNIT-1: BENDING STRESS

Flexural formula for straight beam under pure bending, Flexural formula for curved beam under pure bending, Development of bending stress in rectangular, I-sectional and T-sectional beams. Numerical

UNIT-2: TRANSVERSE SHEAR AND BIAXIAL STRESSES

The shear formula; shear stress in beams for rectangular cross section , shear stress in beams for I-section , Shear flow in rectangular section ,I-Section , C-section , T-section. . Numerical

UNIT-3: SLOPE AND DEFLECTION OF BEAMS

Relationship between bending moment; slope and deflection, Calculations of slope and deflection by method of integration; Calculations of slope and deflection by Macauley's method, Castigliango's theorem to find slope; deflection of beams. Numerical.

UNIT-4: COLUMNS AND STRUTS

Column under axial load, Concept of instability and buckling, slenderness ratio; Euler's formula for elastic buckling load for a column hinged at both the ends, Euler's formula for elastic buckling load for a column fixed at one end and free at other end, Euler's formula for elastic buckling load for a column fixed at both ends, Euler's formula for elastic buckling load for a column fixed at one end and hinged at other end, Equivalent length of a column, Slenderness Ratio, Rankines formula. Numerical.

UNIT-5: THIN & THICK CYLINDERS

Thin walled pressure vessels; Hoop stress and longitudinal stress for A thin cylindrical vessel ,Hoop stress and longitudinal stress for a thin spherical vessel, Derivations of Lame's equations for thick cylinders; Radial and hoop stresses and strains in thick cylinders,

TEXT BOOKS

Ferdinand P Beer & Russel E Johnston;—Mechanics of Materials, Tata McGraw Hill;2009

REFERENCE BOOKS:

1. Hibbeler, R. C.,— Mechanics of Materials ,Pearson Education, 2005
2. Ryder,G H., —Strength of Materials‖, Macmillan, 2001
3. Srinath LS, —Strength of Materials‖, Macmillan, 2001
4. Andrew / Kiusalaas, Jaan., —Mechanics of Materials‖, Thomson, 2003

Course outcomes:

1. Learn about the elastic and plastic behavior of material and evaluate stress invariants, principal stresses and their directions.
2. Determine strain invariants, principal strains and their directions.
3. Develop constitutive relationships between stress and strain for linearly elastic solid.
4. Analyze theories of failure and design components for safe operation.
5. Examine the properties of ideally plastic solid and apply the concepts of energy methods in solving structural problems.

Course code	Course title	L	T	P	Credits
ME-309 C	**DESIGN OF MACHINE ELEMENTS**	3	1	0	4

Course Objectives:
The objectives are to study characteristics of principle types of mechanical elements under variable loading and to prevent their failure under static and variable loading.

UNIT-1: DESIGN PHILOSOPHY

Design procedure, Preferred numbers; Stress-Strain Curves of various materials; Static loading; Factor of safety; Limits, Fits and Tolerances; Hole basis and shaft basis system; Types of fits; Numericals.

UNIT-2: MECHANICAL JOINTS

ISO Metric screw threads ; Bolted joints intension; Eccentrically Loaded bolted Joints in shear and under combined stresses; Design of spigot and Socket joints; Design of knuckle joints; Design-case study.

UNIT-3: WELDED AND RIVETED JOINTS (UNDER STATIC LOADING):

Introduction to Welding and Riveting; their advantages, disadvantages and applications; Types of Welded Joints; Design of various types of welded joints; eccentric loaded welded joints; Types of Rivets; caulking and fullering; Design of various types of riveted joints under different static loading conditions; eccentrically loaded riveted joints; Design- case study.

UNIT-4: DESIGN OF POWER TRANSMISSION COMPONENTS:

Belts; chains; ropes; design of belt drives; Flat and V Belt drives; condition for transmission of max. power; selection of belt; design of rope drives; design of chain drives with sprockets; Design of Power screws; Design of Screw Jack; Case Study

UNIT-5: DESIGN OF CLUTCHES AND BRAKES:

Types of clutches in use; Design of friction clutches- Disc; Multidisc; Cone and centrifugal; Torque transmitting capacity of clutches; various types of brakes; Self energizing condition of brakes; design of shoe brakes- Internal and external expanding; band brakes; thermal considerations in brake designing; design-case study common alloys.

TEXT BOOK

Bhandari, V. B., "Design of machine elements", Tata McGraw Hill, 2nd edition, 2007

REFERENCE BOOKS:

1. Chitale, A. K, & Gupta, R. C., "Product Design and Manufacturing", Prentice Hall of India.
2. Robert, L. Norton., "Machine Design An Integrated Approach", Addison Wesley
3. Robert, C. Juvinall., "Fundamentals of Machine Component Design"
4. Shigley, J.E., "Mechanical Engg Design", Tata McGraw Hill 8th edition.

Course outcomes:

CO1. Gain knowledge of Steady Stresses and Variable Stresses in Machine Members.
CO2. Study characteristics of Temporary and Permanent Joints and analyze simple joints.
CO3. Upon completion of this course, the students can able to successfully design machine components
CO4. To inculcate an ability to design belt drives and selection of belt, rope and chain drives
CO5. To achieve an expertise in design of Sliding contact bearing in industrial application.

Course code	Course title	L	T	P	Credits
ME-351 C	**DYNAMICS OF MACHINES LAB**	0	0	2	1

Course Objectives:
To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS

1. To study various types of links; pairs; chains and mechanisms
2. To study planar four bar mechanism and its inversions (four bar mechanism; single and double slider crank mechanism Graphical synthesis of i)4barmechanismii) radial cam with roller follower Kinematic study of mechanisms i) shaper machine mechanism ii) power hacksaw mechanism
3. To study various types of cam and follower arrangement and plot follower displacement v/scam rotation for various cam follower systems
4. To study various types of gears and generate spur gear involute tooth profile using simulated gear shaping process and study standard and non-standard involute gear tooth profile
5. To study various types of gear laws; simple; compound; reverted; epicyclic and differential
6. To perform experiment for static balancing /dynamic balancing on balancing apparatus
7. Determine M O I of connecting rod by compound pendulum method and tri filer suspension pendulum
8. Determine gyroscopic couple on motorized Gyroscope.

Course outcomes:

CO1.Ability to demonstrate the principles of kinematics and dynamics of machinery.
CO2.Ability to use the measuring devices for dynamic testing.
CO3. To equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
CO4. Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
CO5. Understand balancing of reciprocating and rotary masses.

Course code	Course title	L	T	P	Credits
ME-353 C	MANUFACTURING TECHNOLOGY LAB	0	0	2	1

Course Objectives:
To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry

LIST OFEXPERIMENTS

1. To make a pattern for a given casting with all the necessary allowances
2. To make a component involving gas welding joints and to study the welding defects and suggesting their remedies.
3. To make a component involving MIG welding and study the welding defects and suggest their Remedies.
4. Development and manufacture of a Complex sheet metal component such as, five piece elbow
5. To make a casting of aluminum material.
6. To study defects in a casting and suggest the remedial measures.
7. To make a sand mold with a core for making a hollow job.

Course outcomes:

1. Students will understand lathe and its working
2. Students will get aware about different tools used in manufacturing.
3. Student will understand the concept of tool wear.
4. Students will learn the use of machineries.
5. Students will learn the different methods of manufacturing

Course code	Course title	L	T	P	Credits
ME-355 C	HEAT TRANSFER LAB	0	0	2	1

Course Objectives:
To study the heat transfer phenomena predict the relevant coefficient using implementation. To study the performance of refrigeration cycle / components.

LIST OF EXPERIMENTS

1. To determine the thermal conductivity of a metallic Rod. To determine the thermal conductivity of an insulating power
2. To find out the heat transfer and effectiveness of a pin fin under natural convection condition
3. To calculate the heat transfer and effectiveness of a pin fin under forced convection condition
4. To determine the emissivity of a given specimen body
5. To verify the Stefen-Boltzman constant for thermal radiation
6. To determine the overall heat transfer coefficient and effectiveness of a given heat exchanger under parallel flow condition
7. To determine the overall heat transfer coefficient and effectiveness of a given heat exchanger under counter flow condition
8. To determine the convective heat transfer coefficient for a horizontal rod
9. To determine the overall thermal resistance of a composite wall

Course outcomes:

- Ability to demonstrate the fundamentals of heat and predict the coefficient used in that transfer application and also design refrigeration cycle.
- Students can apply their heat transfer knowledge in industries.
- Analyze different methods to calculate the heat transfer coefficient in various heat transfer problems.
- Analyze the theoretical knowledge and apply it in conducting experiments in the forms of heat transfer
- Test Emissivity, Stefan Boltzmann Constant and Critical Heat flux. Asses the performance of Refrigeration and Air conditioning and to determine the overall heat transfer coefficient for a composite slab.

B. Tech Mechanical Engineering (VI SEMESTER)

Course code	Course title	L	T	P	Credits
ME 302C	MATERIAL SCIENCE	3	0	0	3

Course Objectives:

The course provides the knowledge on the composition; testing and applications of materials; It also provides knowledge about the structure of materials and the effect of temperature; composition and time on various metallurgical processes. The study of this course will help the students to identify and select suitable materials for various engineering applications.

UNIT-1: METALS & STRUCTURE OF MATERIALS

Ferrous Metals: Plain carbon steel; high speed steel and cast iron; Crystal structure; Crystal imperfections and their classifications; point defects; line defects; edge & screw dislocations; surface defects; volume defects & effects of imperfections on metal properties

UNIT-2: SOLID SOLUTIONS AND PHASE DIAGRAM

Solid solution and its types; importance and objectives of phase diagram; systems; phase and structural constituents; cooling curves; Gibbs's phase rule; Lever rule; Iron Carbon equilibrium diagram and TTT diagram.

UNIT-3: HEAT TREATMENT

Principles; purpose; classification of heat treatment processes; annealing; normalizing; hardening; tempering; carburizing;nitriding;cyaniding; flame and induction hardening. Allotropy of iron. Martempering and Austempering

UNIT-4: DEFORMATION OF METALS

Elastic and plastic deformation; mechanism of plastic deformation; yield point phenomena; strain ageing; work hardening; Bauschinger effect; season cracking. Recovery; re-crystallization and grain growth.

UNIT-5: CORROSION, CREEP, FATIGUE & ALLOY PROPERTIES

Phenomenon of Corrosion ; Creep concept and creep curve; mechanism of creep; creep testing and prevention against creep ; fatigue; fatigue limit; mechanism of fatigue; factors affecting fatigue; fatigue testing and SN curve. Effect of alloying elements on steel and stainless steel; Properties and applications of non ferrous metals – Aluminium; Copper and their common alloys.

TEXT BOOKS

Narula, Narula and Gupta., “Material Science”, Tata McGraw Hill, 2009

REFERENCE BOOKS

1 Budinski, K. G, & Budinski MK., ”Engineering Materials Properties and Selection”, PMI; 2010
2 VanVlack., “Elements of Material Science and Engineering”, Wesley Pub Comp 1998
3 Raghuwanshi, B. S., “Workshop Technology”, VolI Dhanpat Rai & Co.

Course outcomes:	
1.	Understand the constitution of alloys and phase diagrams and Phase rules.
2.	Understand the deformation mechanisms of materials.
3.	Upon completion of this course, the students can able to apply the different materials, their processing, heat treatments in suitable application in mechanical engineering fields.

Course code	Course title	L	T	P	Credits
MES-304C	**PLC for Automation**	4	0	0	4

Course Objectives:
1 To learn the basic concepts of PLC 2 Learning of ladder programming for PLC

UNIT I- INTRODUCTION:
Introduction to hardware & software in automation

Hardware identification, PLC, Parts of PLC, PLC Hardware components (I/O section, Discreate I/O module Analog I/O module,special I/O module,I/O specifications,CPU memory design.

UNIT II- PLC PROGRAMMING
Fundamentals of logics, AND,OR,NOT,XOR,NAND,NOR Boolean algebra functions,Hardware Logics verses Programmed logic.
Programming languages, Relay type instructions, Instruction Addressing Branch instruction

UNIT III- PROGRAMMING SOFTWARE
RX logics, studio 5000, TIA, GX WORKS3, Ladder programming examine if closed and examine if open modes of operation, PLC operated water filling and discharge process.

UNIT IV - DEVELOPING FUNDAMENTAL PLC WIRING DIAGRAMS & LADDER LOGIC PROGRAM
Smart sensors, Electromagnetic control relays, Proximity sensor, Magnetic read switch. light sensor, Ultrasonic sensor, strain /weight sensors, temp, flow , velocity & position sensors.converting relays schematics into PLC ladder programs.

UNIT V
PROGRAMMING TIMERS & COUNTERS,MECHANICAL TIMING RELAY TIMER INSTRUCTION, COUNTER INSTRUCTION,CASCADING COUNTER.

TEXT BOOK
Programmable Logic Controllor Frank D. Petrusella Tata McGraw –Hill Publication.
Introduction to programming logic controller Gary dunning.Thomson Asia pvt Ltd.

Course outcomes:	
1.	Configure the I/O for a PLC project using PLC software
2.	Restore and monitor a PLC processor file using PLC programming software. Identify the basic components of the PLC and how they function

MES-306C	IOT for Smart Manufacturing	L T P	Cr
		4 0 0	4

Course Objectives:

- To understand and have a clear vision to IOT. Data and Knowledge Management and use of Devices in IOT Technology. To build State of the Art architecture
- Application of IOT in real world, understand IOT Design Constraints and Industrial Automation. To meet the evolving IOT industry needs by addressing the challenges in Security in IOT, Integration of large scale heterogeneous network, Integration and interaction of uncertain data, and Service adaptation in the dynamic system environment.

Unit 1:

Smart Manufacturing; Introduction, advantages, key characteristics, Corporate Adaption process, manufacturing challenges vs technologies. Introduction to Internet of Things IOT, Sensing, Actuation, Machine to Machine Communication (M2M), Industrial Internet of Things (IIOT)

Unit-2:

Sensors and Data Acquisition for IOT, Wireless Sensors and Transducers, Signal Conditioning Circuits, Data Acquisition Systems, Analog-to-Digital Converter (ADC) and – Digital-to-Analog Converter (DACs), Microcontrollers Interfaces for Data Communication

Unit -3:

Sensors interfacing, Actuators interfacing, Communication Protocol study for IOT: UART Communication, RS485 Communication, I2C Protocol, Introduction to Arduino, Integration of Sensors and Actuators with Arduino, Fundamental of IoT Development with ThingWorkx

Unit -4:

Case study & advanced IOT Applications: Case Study: Agriculture, Healthcare, Activity Monitoring Sensors, Smart Environment Sensors, Smart Industrial Sensors, Smart Water Sensors, Smart Home Automation, Smart Security Solutions

Unit- 5:

Implementation of Real Time IOT Based Projects

Textbook & Reference Books:

[1] Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ―From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
[2] Vijay Madisetti and ArshdeepBahga, ―Internet of Things (A Hands-on-Approach)‖, 1stEdition, VPT, 2014.
[3] Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013
[4] https://nptel.ac.in/courses/106105166/
[5] https://www.ptcu.com/enrollment/student/fundamentals-of-iot-development-with-thingworx

Course outcome:

CO1. Students are encouraged to do Real Time Projects related to IOT based on above Course Learning and Understanding.

CO2. The students will be thorough about the technology behind the IOT and associated technologies.

CO3.The students will be able to use the IOT technologies in practical domains of society.

CO4.The students will be able to gain knowledge about the state of the art methodologies in IOT application domains.

CO5. Energy Efficiency and Cost Savings with IOT

MES-308C	Python for Automation	L-T-P	Credit
		4-0-0	4

OBJECTIVE

To build programming logic and thereby developing skills in problem solving using Python programminglanguage.

UNIT 1: Introduction to Python:

Structure of a Python Program, Elements of Python. Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms,

UNIT 2: Overview of Python Programming:

Identifiers and keywords, Literals, Strings, Operators; Arithmetic Operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator.

UNIT 3: Creating Python Programs:

Input and Output Statements, Control Statements; Looping- while Loop, for Loop, Loop Control, Conditional Statement-if...else, Difference between break, continue and pass.

UNIT4: Structures & Functions:

Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules, Defining Functions, Exit function, default arguments.

UNIT 5: Classes, Object-oriented Programming and Exception:

Abstract Data Types and Classes, Inheritance, Encapsulation and information hiding, Handling exceptions

Reference Books;

1. Numerical Python by Robert Johansson, published by Apress
2. Python Data Analysis by Fabio Nelli, published by Apress
3. Introduction to Computation and Programming Using Python by John V Guttag, published by Prentice Hall of India

Websites for references;

1. Scientific Computing using Python; NUMPY, SCIPY, PANDAS, SCIKIT-LEARN
2. Python Tutorial/Documentation www.python.org. 2010
3. http://docs.python.org/3/tutorial/index.html

a) Account class and call different method to test the class

Course outcome

CO1. Explain basic principles of Python programming language

CO2. Implement object oriented concepts,

CO3. Implement database and GUI applications.

CO4. Students will be able to develop the skill of designing Graphical user Interfaces in Python

CO5. To develop the ability to write database applications in Python

ME 6E11C	Industry 4.0	L-T-P	Credit
		3-0-0	3

Learning Objectives

This course is designed to offer learners an introduction to Industry 4.0, its applications in the business world. Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.

Module 1: Introduction to Industry 4.0

The various Industrial Revolutions, Internet of Things (IoT) & Industrial Internet of Things, Overview on Technologies of Industry 4.0. Comparison of Industry 4.0 Factory and Today's Factory

Module 2: Drivers and Enablers

Drivers, Enablers, Reference Architecture and Standards

Module 3: Convergence of Automation & IoT

Smart Manufacturing**;** key characteristics, challenges, stages. Smart Machines; Characteristics, Technologies, interfaces, augmented reality. Cyber physical system (CPS). **IIoT;** smart factory connectivity, key ingredients, Digital Twins, Predictive Maintenance

Module 4: Data Exchange With Machines

Communication Protocols; OPC-UA, MQTT, Ethernet/IP, ProfiiNet, EtherCat IT infrastructure, databases, Cloud Computing Basics, Cloud Computing and Industry 4.0

Module 5: Smart Manufacturing Applications and Opportunities

Internet of things & Internet of Services, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics. Opportunities, Challenges, and skills for workers in the Industry 4.0, Supply Chain Management, Readiness of Industry.

Course Outcomes

1. Understand the journey of Industry 4.0 and its drivers, enablers and roadmap.
2. Appreciate the smartness in smart factories, smart manufacturing, smart products, smart services and smart cities,
3. Able to understand various technologies associated with industry 4.0.
4. Understand the opportunities, challenges and future skills required for Industry 4.0.
5. Appreciate the power of Cloud Computing in a networked economy

Reference Books;

1 The Fourth Industrial Revolution by Klaus Schwab

2 The Industries of Future by Alec Ross

3. A course on "industry 4.0: How to Revolutnize your business" on edx

Course outcomes:	
1.	Design and validate technological solutions to defined problems and communicate clearly and effectively for the practical application of their work.
2.	Review and document the knowledge developed by scholarly predecessors and critically assess the relevant technological issues
3	Students will be able to apply knowledge about Computer Aided Quality control and ProcessPlanning Control
4	Students will be able to Design Flexible manufacturing cell after carrying out Group technology study and finally creating FMS
5	To develop habit of individual critical thinking in analyzing a complex problem in the computer aided designing, manufacturing and optimization.

Course code	Course title	L	T	P	Credits
ME-352C	**MATERIAL SCIENCE LAB**	0	0	2	1

Course Objectives:
To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS

1. To study the creep deformation of the solder wire
2. To study the Bravais Lattices
3. To study the arrangement of atoms in simple crystal with the aid of models
4. To study the chemical methods of corrosion
5. To normalize a given specimen and check its toughness
6. To temper the given hardened steel specimen at 300°C and measure hardness
7. To temper the given hardened steel specimen at 500°C and measure hardness
8. To study the microstructure of heat treated steel
9. To harden a given specimen and check its hardness
10. To anneal a given specimen and check its hardness

Course outcomes:	
1.	Interpret the hardness values obtained from differentheat treatment processe
2.	Identify the materials based on their microstructures.

ourse code	Course title	L	T	P	Credits
ME-354C	**Automation Lab**	0	0	2	1

List of Experiments

1.PLC Program to Implement Various Logic Gates

2.PLC Program to Implement Binary to BCD Converter

3.PLC Program for a Car Parking System

4.PLC Program to Control Traffic Lights

5.PLC Program for Burglar Alarm Security System

6. PLC Program to Control Mixing in a Tank.

7. PLC Program to Operate Light as an Emergency Signal

8. PLC Program to Implement an Automatic Car-Wash Process

9. PLC Program to Operate Drilling of Parts

10. PLC Program to Operate Screwing of Parts

Course code	Course title	L	T	P	Credits
ME-356C	**IoT for smart manufacturing Lab**	0	0	2	1

LIST OF EXPERIMENTS:-

1 Security Access using MFRC522 RFID Reader with Arduino.

2 Securely connecting an Arduino MKR Wi-Fi 1010 to AWS IoT core.

3 Temperature Sensor with Arduino UNO

4 Temperature data logger using ESP8266 and LM35 and monitoring using Thing speak IoT server

5 Interfacing of Moisture sensor with Arduino.

6 Use an Arduino and an ultrasonic sensor to make a door alarm.

7 Use an Arduino and gas sensor.

8 DHT11 interfacing with Arduino weather station.

9 Heart beat sensor interfacing using Arduino.

10 Switch on/off an electric bulb using Relay interfacing with Arduino.

MES-358C	Python Prog. Lab 0	L-T-P -0-2	Credits:1

List of Experiments

Program 1: Programs using if else structure

Program 2: programs using for and while loop

Program 3: Program using List and String data structure

Program 5: Using Function in Python:

Program 6: Program using concept of Class, object, class variable, class method, static method

Program 7: Program using the concept of Inheritance

Program 8: Program using the concept of Polymorphism, operator overloading

Program 9: Program on file handling in Python

Program 10: Program on Exception handling

Program 11: Program on Multithreading

Reference Books:

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011

2 . Allen Downey, Jeffrey Elkner, Chris Meyers ,How to think like a computer scientist :Learning with Python,Freelyavailableonline.2012

4. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall ofIndia

SYSTEM REQUIREMENTS:

Hardware Requirement:

Intel Pentium IV processor based CPU or faster min. 128 MB of RAM, min 2 GB space on your HDD

Software Requirement:
Microsoft Windows 9x or higher with PyChem /Eclipse with python or any other environment, oracle/MYSQL database
Or
UNIX/LINUX OS with Compatible python environment

B.Tech Mechanical Engineering (VII SEMESTER)

Course code	Course title	L	T	P	Credits
MEOE-401C	**INDUSTRIAL ROBOTS**	4	0	0	4

Course Objectives:

1. To impart knowledge on numerical methods to find the numerical solution of the problems thatarises in engineering and technology.
2. To familiarize the advanced mathematical methods to solve engineering research problems.

UNIT – I

Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, robot activation and feedback components.

UNIT – II Motion Analysis and Control: Manipulator kinematics, position representation, robot dynamics, configuration of robot controller, Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT – III

End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. SENSORS: Desirable features, tactile, proximity and range sensors, uses sensors in robotics.

UNIT – IV:

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations. Robot Languages: Textual robot Languages, Generation, Robot language structures, Elements in function

UNIT – V

Collaborative Robots, Need of COBOTS, Difference between COBOTS and traditional industrial robots, Automation solutions with collaborative Robots.

Robot Application: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application

TEXT BOOKS

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.
3. Robotics / Fu K S/ McGraw Hill.
4. Robotic Engineering / Richard D. Klafter, Prentice Hall
5. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.

Reference Books:

1. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pte Ltd.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH3
3. Industrial Automation and robotics, Er. A.K. Gupta and S.K. Arora, University Science

Course outcomes:	
1.	Acquire more knowledge in basic concept of engineering mathematics.
2.	Improvement in problem evaluation technique.
3	Choose an appropriate method to solve a practical problem
4	Upon completion of this course, the students can able to apply the basic engineering
5	To learn about application of robot

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MES 403C	SMART MANUFACTURING SYSTEMS	L T P	Cr
		4 0 0	4

Course Objectives:

- To understand the basics of smart manufacturing systems in context of Industry 4.0
- To understand the Architecture of Cyber- Physical system (CPS)
- Overall brief description of some associated technologies of smart manufacturing systems
- To understand IoT connectivity for Industry 4.0

Unit-I

Concepts of Smart Manufacturing: Definition and key characteristics of smart manufacturing**,** Corporate adaptation processes, manufacturing challenges, challenges vs technologies, Stages in smart manufacturing. Minimizing Six big losses in manufacturing with Industry 4.0, and their benefits

Unit-II

Smart Machines and Smart Sensors: Concept and Functions of a Smart, Machine Salient features and Critical Subsystems of a Smart Machine, **Smart sensors;** smart sensors ecosystem, need, benefits and applications of sensors in industry, Sensing for Manufacturing Process in IIoT, Block Diagram of a IoT Sensing Device, Sensors in IIoT Applications, Smart Machine Interfaces

Unit-III

Architecture of Cyber- Physical system (CPS): Functions of CPS, 5C Architecture; Smart Connection Level, Data-to- Information Level, Cyber Level, Cognition Level, Configuration Level. Design of PHM based CPS systems. Comparison of today's factory and Industry 4.0 factory by the implementation of 5C CPS architecture

Unit-IV

Digital Twin: Introduction, applications of digital twins, impact zones of digital twins in manufacturing (factories/plants and OEMs), advantages of digital twins, basic steps of digital twin technology

Machine Learning (ML) and Artificial Intelligence (AI) in Manufacturing: Introduction, benefits and applications of ML in industries, common approaches of ML; supervised and unsupervised, semi-supervised and reinforced ML

Predictive Maintenance: Introduction of predictive maintenance, difference between preventive and predictive maintenance, working and various components of predictive maintenance, benefits and tools of predictive maintenance. Common approaches to IoT predictive maintenance; Rule-based (condition monitoring) and AI (artificial intelligence) based predictive maintenance.

Condition Monitoring (CM): Introduction and benefits of CM, CM techniques, Condition monitoring vsCondition assessment,

Augmented Reality in Maintenance (Electrical & Mechanical)

Unit-V

IoT connectivity for Industry 4.0: Industrial communication requirement and its infrastructure, an overview of different types of networks, mesh network in industrial IoT, IoT protocols and the internet, TCP/IP (transmission control protocol/internet protocol) model, IoT connectivity standards: common protocols, application layer protocols, internet/network layer protocols, physical layer IoT protocols, choosing the right IoT connectivity protocol

Reference Books

1. Industry 4.0 the Industrial Internet of Things by Alasdair Gilchrist, Apress

2. Industrial Internet of Things, Cyber Manufacturing System by Sabina Jeschke, Christian Brecher, Houbing Song Danda B. Rawat, Springer

Course Outcomes:

On successful completion of this course, the students should be able to:

- Have a knowledge of smart manufacturing systems' components and can handle it more effectively.in context of Industry 4.0
- After understanding the Architecture of Cyber- Physical system (CPS) they can make machines more oriented towards Industry 4.0, which increases productivity
- Overall brief description of associated technologies of smart manufacturing systems enhance their workability knowledge in the industries

- After understanding IoT connectivity for Industry 4.0 they are able to make a system Taylor made as per requirement of the industry
- Eventually knowledge of smart manufacturing systems enhances their employability opportunities as a whole.

Course Code	Course title	L	T	P	Credits
MES-405C	ADDITIVE MANUFACTURING	4	0	0	4

Course Objectives	
1.	Additive Manufacturing (AM) is an economically viable alternative to conventional manufacturing technologies for producing highly complex parts.
2.	The objective of the course is to impart fundamentals of additive manufacturing processes along with the various file formats, software tools, processes, techniques and applications.
3.	The main objective of this course is to acquaint students with the concept of AM, various AM technologies, selection of materials for AM, modeling of AM processes, and their applications in various fields.

UNIT-1: INTRODUCTION OF AM

Introduction to the Basic Principles of Additive Manufacturing, Additive Manufacturing Processes, Extrusion, Beam Deposition.

UNIT-2: OPERATIONS IN AM

Jetting, Sheet Lamination, Direct-Write, Photo-polymerization, Sintering, Powder Bed Fusion

UNIT-3: DESIGN/FABRICATION PROCESSES

Data Sources, Software Tools, File Formats, Model Repair and Validation, Pre- & Post-processing, Designing for Additive Manufacturing, Multiple Materials, Hybrids, Composite Materials, current and future directions.

UNIT-4: PROCESS AND MATERIAL

Process & Material Selection, Direct Digital Manufacturing and Distributed Manufacturing, Related Technologies: Mold-making, Rapid Tooling, Scanning.

UNIT-5: APPLICATIONS OF AM

Aerospace, Automotive, Biomedical Applications of AM. Product Development, Commercialization, Trends and Future Directions in Additive Manufacturing.

TEXT BOOKS:

1. Ian Gibson, David W. Rosen and Brent Stucker, Additive manufacturing technologies: rapid prototyping to direct digital manufacturing, Springer, 2010.
2. C.K. Chua, K.F. Leong and C.S. Lim, Rapid prototyping: Principles and applications, 3rd Edition, World Scientific, 2010.

REFERENCE BOOKS:

1. Hopkinson, Hague, Dickens, Rapid Manufacturing: An Industrial Revolution for the Digital Age. Wiley, 2005.
2. Gibson, Advanced Manufacturing Technologies for Medical Applications. Wiley, 2005
3. Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers, 2011.
4. J.D. Majumdar and I. Manna, Laser-assisted fabrication of materials, Springer Series in Material Science, 2013.
5. L. Lu, J. Fuh and Y. S. Wong, Laser-induced materials and processes for rapid prototyping, Kluwer Academic Press, 2001.
6. Zhiqiang Fan and Frank Liou, Numerical modeling of the additive manufacturing (AM) processes of titanium alloy, lnTech, 2012.

Course Outcomes:	
1.	Students will be able to decide between the various trade-offs when selecting AM processes, devices and materials to suit particular engineering requirements.
2.	Students will have in-depth knowledge in latest trends and opportunities in AM, including distributed and direct digital manufacturing, mass customization, and how to commercialize their ideas.
3	Students will demonstrate a basic technical understanding of the physical principles, materials, and operation of the types of AM processes
4	Students will demonstrate the ability to identify characteristics of parts that are fabricated by AM processes
5	Explain the processes used in additive manufacturing

Course code	Course title	L	T	P	Credits
MES- 407 C	**Smart Sensors for Automation**	4	0	0	4

Course Objectives:

To makes students familiar with the constructions and working principle of different types of sensors.

To make students aware about the measuring instruments and the methods of measurement and the use of different sensors in automation.

Unit-I

Introduction: Definition and characteristics of sensors, static characteristics, dynamic characteristics, sensor classification, Definition of actuator, classification of actuators, electro-hydrostatic actuation, electro-pneumatic systems

Unit-II

Next Generation Sensors: Need for Next Generation Sensors, Definition, Limitations of smart sensors, intelligent sensors, advantages of intelligent sensors, applications of next generation sensors, design challenges

Unit-III

Smart sensors: Definition, configurations involved in smart sensors, smart sensor node, and Smart sensors functions, accessing sensors and actuators, utility in industrial subunits, Examples of industrial sensors: navigation industry, agricultural industries, healthcare industry, retail industry

Unit-IV

Smart sensors in industrial automation: temperature sensor, accelerometer sensor, gas sensor and their interfacing circuit, sensors in industrial applications: magnetostrictive sensors, torque sensor, speed sensor, PIR sensor, image sensor,

Unit-V

Measurement of proximity, pressure, velocity and displacement: proximity sensors, pressure sensor/flow sensors, ultrasonic sensor, photoelectric sensors, photomicro sensors, industrial applications and control

TEXT BOOKS

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI

Reference Books:

2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill

Course outcomes:	
1.	Use concepts in common methods for converting a physical parameter into an electrical quantity
2.	Classify and explain with examples of transducers, including those for measurement of temperature, motion and gas
3	Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc

Course code	Course title	L	T	P	Credits
MES-455C	**ADDITIVE MANUFACTURING LAB**	0	0	2	1

Course Objectives:
Students will gain a practical knowledge of various manufacturing processes in a hands-on environment through experiments and simulations.

LIST OF EXPERIMENTS

1. Measurement of Cutting Force and Temperature in Turning
2. Experiments on Wire-EDM
3. Experiments on Laser Beam Machining
4. Design and manufacture of products using Additive Manufacturing
5. Study of Temperature distribution in arc welding
6. Weld quality tests
7. Part to CAD comparison using contact/non-contact digitization methods
8. Sheet metal bending experiments
9. Mechanical properties of powder compacts
10. Experiments on Rolling, Deep Drawing, Extrusion
11. Mold Flow simulation for Injection molding process planning
12. Design and representation of assembly of objects. Assembly sequencing, disassemblysequencing.

Course outcomes: At the end of the course, a student will be able to:	
1	Study cutting forces in machining processes
2	Develop a practical understanding of advanced manufacturing processes.
3	Identify and rectify defects in parts and manufacturing processes related problems.
4	Simulate flow of molten polymer materials to identify the problems in injection moulding Processes.
5	Additive manufacturing allows the creation of lighter, more complex designs that are too difficult or too expensive to build using traditional dies, molds, milling and machining.

Text Books:

1. M. P. Groover, Principles of Modern Manufacturing, 5th edition, Wiley, 2014. ISBN: 978-1-118-47420-4.
2. E. P. DeGarmo, J. T. Black, R. A. Kohser, DeGarmo's materials and processes in manufacturing, 11thedition, John Wiley & Sons, 2011. ISBN: 978-0470924679.

Reference Book:

1. S. Kalpakjian, and Schmid, Manufacturing processes for engineering materials, 5th edition, Pearsoneducation, 2010. ISBN: 978-0132272711.

Course code	Course title	L	T	P	Credits
MES 459 C	**AUTOMATION LAB-II**	0	0	4	1
Course Objectives:					
Students will gain a practical knowledge of various Automation systems and IoT					

List of Experiments

1. To Study the Pneumatic control components
2. Pneumatic control of single Acting Cylinder through 3/2 Push button valve and 3/2 Lever operated valve
3. Pneumatic control of Double Acting Cylinder through 5 Port double pilot valve and is operated through limit switches
4. Pneumatic control of Double Acting Cylinder through Solenoid operated valves
5. Hydraulic control of Single Acting Cylinder through 4 Way Manifold Block
6. Digital and Analog LED Glow with the help of Nodemcu esp8266
7. Working of InfraRed (IR) sensor with LED Glow with the help of Nodemcu esp8266
8. Making of Server and Remotely control the devices
9. Control the devices through Blynk App
10. Control the devices through Google Assistant

Course outcomes: At the end of the course, a student will be able to:	
1	Knowledge of Pneumatic systems
2	Knowledge of Hydraulic systems
3	Knowledge of IoT applications in Home Automation