School of Engineering and Technology

Programme Structure & Syllabus

MECHANICAL Engineering

2023-24

K.K. University

Bihar Sharif, Nalanda - 803115

Pro Vice Chancellor
KK University
Berauti, Nepura, Bihar Sharif
Nalanda - 803115 (Bihar)

OBJECTIVE OF THE PROGRAM:

The Department of Mechanical Engineering, KK University shall strive hard to impart knowledge and state-of-the-art training to our students and expose them to broad areas of Mechanical Engineering, namely Design, Manufacturing, Energy, Thermal Sciences and currently related interdisciplinary areas, so that they can later practice their profession at home or abroad keeping in mind the needs and concern of the society they represent, safeguarding values, ethics and be instrumental in bringing about an overall technological development.

1. To deliver knowledge in Mechanical Engineering and Materials Science and Engineering with high educational standards so that the outgoing students are employable and globally competitive.
2. To produce graduate and post graduate engineers with core competency as well as relevant software skills and social responsibility.
3. To be dynamic in imparting knowledge to students depending upon the changing national and International needs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO-1: To provide the students a solid foundation in mathematical, scientific and engineering knowledge required to comprehend, analyze, design and develop innovative solutions for real time problems.

PEO-2: To impart the students a spirit of team work, effective communication and a commitment to professional ethics.

PEO-3: To imbibe the students and faculty with a desire for lifelong learning and successful career with professional excellence.

PEO-4: To create and maintain an ambience for Industry – Institute Collaborations.

PROGRAMME OUTCOMES (POs):

On successful completion of the Mechanical Engineering Degree programme, the Graduates shall exhibit the following:

PO-1: Engineering knowledge: Apply knowledge of mathematics, basic science and engineering science.

PO-2: Problem analysis: Identify, formulate and solve engineering problems.

PO-3: Design/development of solutions: Design a system or process to improve its performance, satisfying its constraints.

PO-4: Conduct investigations of complex problems: Conduct experiments & collect, analyze and interpret the data.

PO-5: Modern tool usage: Apply various tools and techniques to improve the efficiency of the system.

PO-6: The Engineer and society: Conduct themselves to uphold the professional and social obligations.

PO-7: Environment and sustainability: Design the system with environment consciousness and sustainable development.

PO-8: Ethics: Interacting industry, business and society in a professional and ethical manner.

PO-9: Individual and team work: Function in a multidisciplinary team.

PO-10: Communication: Proficiency in oral and written Communication.

PO-11: Project management and finance: Implement cost effective and improved system.

PO-12: Life-long learning Continue professional development and learning as a life-long activity.

PROGRAMME SPECIFIC OUTCOMES (PSOs): On successful completion of the Mechanical Engineering Degree programme, the Graduates shall exhibit the following:

1) Apply the knowledge gained in Mechanical Engineering for design and development and manufacture of engineering systems.
2) Apply the knowledge acquired to investigate research oriented problems in mechanical engineering with due consideration for environmental and social impacts.
3) Use the engineering analysis and data management tools for effective management of multidisciplinary projects.

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FIRST SEMESTER

S. No	CODE	TITLE	CREDIT	L	T	P	HOURS PER WEEK	Internal Marks	External Marks
1	ETSH-101	Engineering Physics	3	3	0	0	3	30	70
2	ETSH-102	Engineering Mathematics-I	3	2	1	0	3	30	70
3	ETCS-101	Introduction to Artificial Intelligence	3	3	0	0	3	30	70
4	ETSH-103	Soft Skills	3	3	0	0	3	30	70
5	ETSH-105	Engineering Chemistry	3	3	0	0	3	30	70
6	ETEA-111	Inter-disciplinary Experimental Active Learning (IDEA LAB)	2	0	0	3	3	30	70
7	ETME-111	Engineering Workshop Lab	1	0	0	2	2	30	70
8	ETSH-111	Engineering Physics Lab	1	0	0	2	2	30	70
9	ETSH-115	Engineering Chemistry Lab	1	0	0	2	2	30	70
10	ETCS-111	Introduction to Artificial Intelligence with Python Lab	1	0	0	2	2	30	70
11	ETSH-113	Soft Skill Lab	1	0	0	1	1	30	70
Total			**22**	**14**	**1**	**12**	**27**	**330**	**770**

SECOND SEMESTER

S. No	CODE	COURSE TITLE	CREDIT	L	T	P	HOURS PER WEEK	INTERNAL MARKS	EXTERNAL MARKS
1	ETSH-201	Engineering Mathematics -II	3	2	1	0	3	30	70
2	ETEE-201	Basic Electrical & Electronics Engineering	3	3	0	0	3	30	70
3	ETCS-201	C Programming	3	3	0	0	3	30	70
4	ETME-201	Fundamental of Mechanical & Civil Engineering	3	3	0	0	3	30	70
5	ETSH-202	Technical Communication & Project Management	3	2	1	0	3	30	70
6	ETME-202	Engineering Graphics & Design	3	1	0	3	4	30	70
7	ETCS-202	Basics of Internet of Things (IoT)	NC	2	0	0	2	30	70
8	ETEE-211	Basic Electrical & Electronics Engineering Lab	1	0	0	2	2	30	70
9	ETME-211	Fundamental of Mechanical & Civil Engineering Lab	1	0	0	2	2	30	70
10	ETCS-211	C Programming Lab	1	0	0	2	2	30	70
TOTAL			**21**	**16**	**2**	**09**	**27**	**300**	**700**

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THIRD SEMESTER

S.NO	CODE	COURSE TITLE	CREDIT	L	T	P	HOURS PER WEEK	Internal marks	External marks
1	ETSH-301	Engineering Mathematics-III	4	3	1	0	4	30	70
2	ETME-301	Thermodynamics	3	3	0	0	3	30	70
3	ETME-302	Strength of Materials	4	3	1	0	4	30	70
4	ETEC-304	Basic Electronics Engineering	3	3	0	0	3	30	70
5	ETME-303	Manufacturing Technology-I	3	3	0	0	3	30	70
6	ETME-312	Strength of Materials Lab	1.5	0	0	3	3	30	70
7	ETEC-314	Basic Electronics Lab	1.5	0	0	3	3	30	70
		TOTAL	**20**	**15**	**2**	**6**	**23**	210	490

FOURTH SEMESTER

S.NO	CODE	TITLE	CREDIT	L	T	P	HOURS PER WEEK	Internal marks	External marks
1	ETME-401	Applied Thermodynamics	4	3	1	0	4	30	70
2	ETME-402	Fluid Mechanics	4	3	1	0	4	30	70
3	ETME-403	Metrology Measurement andControl	4	3	1	0	4	30	70
4	ETME-404	Materials Engineering	3	3	0	0	3	30	70
5	ETEC-405	Instrumentation and Control	3	3	0	0	3	30	70
6	ETME-411	Applied Thermodynamics Lab	1.5	0	0	3	3	30	70
7	ETME-412	Fluid Mechanics Lab	1.5	0	0	3	3	30	70
		TOTAL	**21**	**15**	**3**	**6**	**24**	**210**	**490**

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FIFTH SEMESTER

S.NO	CODE	TITLE	CREDIT	L	T	P	HOURSPER WEEK	Internal marks	External marks
1	ETME-501	Heat and Mass Transfer	4	3	1	0	4	30	70
2	ETME-502	Fluid Machinery	4	3	1	0	4	30	70
3	ETME-503	Computer Aided Design	3	3	0	0	3	30	70
4	ETME-504	Theory of Machines	3	3	0	0	3	30	70
5	CMMB-509	Personal Management andIndustrial Relation	3	3	0	0	3	30	70
6	ETSH-501	Essence of Indian TraditionalKnowledge	0	3	0	0	3	30	70
7	ETME-511	Heat and Mass Transfer – Lab	1.5	0	0	3	3	30	70
8	ETME-512	Fluid Machinery- Lab	1.5	0	0	3	3	30	70
9	ETME-513	Auto CAD Lab	1.5	0	0	3	3	30	70
10	ETME-514	Theory of Machines-Lab	1.5	0	0	3	3	30	70
		TOTAL	**23**	**18**	**2**	**12**	**32**	**300**	**700**

SIXTH SEMESTER

S. NO	CODE	TITLE	CREDIT	L	T	P	HOURSPER WEEK	Internal marks	External marks
1	ETME-601	Manufacturing Technology -II	4	3	1	0	4	30	70
2	ETME-602	Design of Machine Elements	4	3	1	0	4	30	70
3	ETME621/622 /623	Elective-I	3	3	0	0	3	30	70
4	ETME624/625 /626	Elective-II	3	3	0	0	3	30	70
5	CMMB-621/622 /1101	Open Elective-I	3	3	0	0	3	30	70
6	ETME-611	Design of Machine ElementsLab	1.5	0	0	3	3	30	70
8	ETME-612	Summer Internship/ Vocational Training	1.5	6 Weeks Vocational Training after 6th Semester				30	70
9	ETME-613	Manufacturing Technology Lab	1.5	0	0	3	3	30	70

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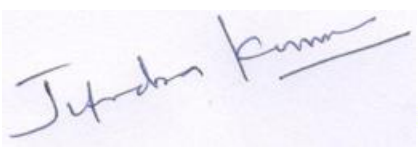
		TOTAL	**21.5**	**15**	**2**	**6**	**23**	**270**	**630**

ELECTIVE-I		**ELECTIVE-II**		**OPEN ELECTIVE-I**	
SUBJECTCODE	SUBJECT NAME	SUBJECTCODE	SUBJECTNAME	SUBJECTCODE	SUBJECT NAME
ETME-621	Power plant	ETME-624	Finite Element Method	CMMB-621	Entrepreneurship Development & Business Incubation
ETME-622	Steam Generators	ETME-625	Vibration & Mechanical systems	CMMB-622	Total Quality Management
ETME-623	Gas Dynamics	ETME-626	Rapid Product Development Technologies	CMMB-1101	Principles of Management

SEVENTH SEMESTER

S.NO	**CODE**	**TITLE**	**CREDIT**	**L**	**T**	**P**	**HOURS PER WEEK**	**Internal marks**	**External marks**
1	ETME-701	Refrigeration and Air Conditioning	3	3	0	0	3	30	70
2	ETME- 721/722/723	Elective III	3	3	0	0	3	30	70
3	ETME- 724/725/726	Elective-IV	3	3	0	0	3	30	70
4	ETBM-701	Bio-Mechanical Systems	3	3	0	0	3	30	70
5	ETME-711	Refrigeration and Air Conditioning Lab	1.5	0	0	3	3	30	70
7	ETME-712	Minor Project	3	0	0	10	10	30	70
8	ETME-713	Industrial Training	3	4 Weeks Industrial Training after 6th sem				30	70
		TOTAL	**21**	**12**	**0**	**13**	**25**	**240**	**560**



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ELECTIVE-III		**ELECTIVE-IV**	
SUBJECT CODE	SUBJECT NAME	SUBJECT CODE	SUBJECT NAME
ETME721	Energy Conversion Devices	ETME724-A	Advanced manufacturing Processes
ETME722	Automobile Engineering	ETME725-A	Automation in Manufacturing
ETME723	Industrial Instrumentation & Metrology	ETME726-A	Fracture and fatigue

EIGHTH SEMESTER

S.NO	**CODE**	**TITLE**	**CREDIT**	**L**	**T**	**P**	**HOURS PER WEEK**	**Internal marks**	**External marks**
1	ETME-821	Elective-V	3	3	0	0	3	30	70
2	ETME-822	Elective-VI	3	3	0	0	3	30	70
3	ETME827/828/829	Open Elective-II	3	3	0	0	3	30	70
4	ETCS821/824/830	Open Elective III	3	3	0	0	3	30	70
5	ETSH-801	Indian Constitution	NC	3	0	0	3	0	0
6	ETME-811	Major Project	8	0	0	12	12	30	70
		TOTAL	**20**	**15**	**0**	**12**	**27**	**150**	**350**

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ELECTIVE-V		**ELECTIVE-VI**	
SUBJECT CODE	SUBJECT NAME	SUBJECT CODE	SUBJECT NAME
ETME-821	Optimization Techniques	ETME824	Mechatronics
ETME-822	Mechanics of Composite Materials	ETME825	IC Engine
ETME-823	Robot Kinematics and Dynamics	ETME826	Work Study & Ergonomics

OPEN ELECTIVE-II		**OPEN ELECTIVE-III**	
SUBJECT CODE	SUBJECT NAME	SUBJECT CODE	SUBJECT NAME
ETME827	Industrial Pollution	ETCS821	Information Security
ETME828	Sustainable Development	ETCS824	Green Computing
ETME829	Renewable Energy Resources	ETCS830	Management Information System

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Program Structure	B. Tech (Mechanical Engineering)
Subject Code	ETCS-101
Course Name	Introduction to Artificial Intelligence
Course Credits	3 (T) + 1(P)= 4
Total Course Credit	169

Abbreviations: Lecture-L, T-Theory, P-Practical

1. Course Overview:

The primary objective of this course is to introduce the basic principles Techniques, and applications of. Artificial Intelligence, students will get a basic knowledge about Searching techniques like hill climbing, A* Algorithm, AO*.

2. Prerequisite:

To understand the basic knowledge of Reasoning, Mathematics, Psychology and Learning Techniques.

3. Objective of Syllabus:

- The primary objective of this course is to introduce the basic principles techniques, and applications of Artificial Intelligence
- In this course, students will get a basic introduction to the building blocks and components of artificial intelligence
- Learning about concepts like algorithms.

4. Course Outcome:

S. No.	Course Outcomes (Cos)
CO1	To understand Introduction to AI, Overview of AI, Problems of AI, AI technique, Searching techniques like hill climbing, A* Algorithm, AO*.
CO2	Understand the basic concept of Python, Data types, Variables, Basic input – output operations, Basic Operators, literals, Strings, Number and Conditional Statement, Loop Statements.
CO3	Ability to Define and Accessing List, tuple, Dictionary, Functions, Numpy, Matplotlib.
CO4	To understand Problem in representing knowledge, Knowledge representation using propositional and predicate logic, resolution.
CO5	Ability to understand Probabilistic reasoning, Baye's Theorem, Semantic networks, fuzzy logic, forward and backward reasoning.
CO6	Ability to understands Learning, various techniques in Learning, Introduction to Neural networks, application of Neural network, common sense and reasoning.

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5. Syllabus.

UNIT I:

Introduction to AI : History of AI, Overview of AI, Problems of AI, AI technique, Production Systems, Characteristics of production systems, Tic-Tac-Toe problems, Searching techniques like hill climbing,A* Algorithm, AO* Algorithm etc , and various types of control strategies.

UNIT II:

Introduction to Python: Python basics – Data types, Variables, Basic input –output operations, Basic operators, Python literals, Strings, Number, list, tuple, Dictionary, Functions, Conditional Statement, Loop Statements, Numpy, Matplotlib, Simple programming exercises using Python.

UNIT III:

Knowledge representation, Problem in representing knowledge, Knowledge representation using propositional and predicate logic, resolution, refutation, deducation, Theory proving, monotonic and non-monotonic reasoning.

UNIT IV:

Probabilistic reasoning, Baye's Theorem, Semantic networks, Scripts, Schema, frames, conceptual dependency, fuzzy logic, forward and backward reasoning, introduction to understanding,natural language processing.

UNIT V:

Introduction to learning, various techniques in Learning, Introduction to neural networks, application Neural network, common sense, reasoning, some example of expert systems.

TEXTBOOKS / REFERENCES

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Introduction to AI & Expert System: Dan W. Patterson, PHI.
3. Artificial Intelligence by Luger (Pearson Education)
4. Russel & Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall

INTRODUCTION TO A.I WITH PYTHON LAB SUB-CODE: ETCS-111 CREDIT: 01

LIST OF EXPERIMENTS:

Week 1: Python program to demonstrate the example for arithmetic operators
Week 2: Python program for simple interest
Week 3: Python program to find power of a number using exponential operator
Week 4: Python program Find largest of three number using nested if else.
Week 5: Python program Calculate discount based on the sale amount.
Week 6: Python program Demonstrate an example of for loop
Week 7: Python program Examples of loops (based on their control)
Week 8: Python program Find factorial of a given number

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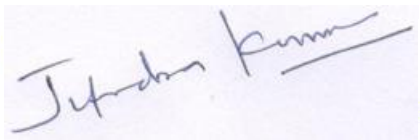
Week 9: Python Program to print Odd and Even numbers from the list of integers.
Week 10: Python Program to calculate n-th term of a Fibonacci Series
Week 11: Python Program to check whether a given Number is prime or not prime.
Week 12: Python Program to check whether a given Number is Armstrong or not.



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Programme Structure	**B. Tech (Mechanical Engineering))**
Subject Code	**ETSH-103**
Course Name	**SOFT SKILLS**
Course Credits	**3 (T) +1(P) = 4**
Total Course Credit	**169**

Abbreviations: Lecture-L, T-Theory, P-Practical

1. **Course Overview**: This course will encourage students for self awareness, self Development, and will give good communication skill, Leadership knowledge, and will also have knowledge about Ethics.

2. **Prerequisite:** students should have knowledge about Basic English and communication and also about Basic Leading knowledge **.**

3. **Objective of the Syllabus:** The objective of this course to help the students to develop as team member, leader and all round professional in the long run. This course would focus on over all personality development of the student and to improve his technical writing and documentation.

4. **Course Outcomes:**

S.No.	Course Outcomes (Cos)
CO1	Communicate, interact and present his ideas to the other professionals
CO2	Understand and aware of importance, role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice
CO3	Have right attitude in al and behavioral aspects, and build the same through activities.
CO4	Possess right professional and social ethical values.
CO5	Possess knowledge about Time Management.

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5.Syllabus:

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UNIT I: SELF AWARENESS AND SELF-DEVELOPMENT

Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting, Career Planning, Personal success factors, Handling failure, Emotional Intelligence, Lateral thinking, Depression and Habit, relating SWOT analysis &goal setting, prioritization.

UNIT II: COMMUNICATION SKILL

Importance of communication, Aspects of communication, communication through words, communicationthroughbodylanguage,communicationthroughtechnology,Oralcommunication,
Listening Skills, Group Discussion and Interview Skills, Presentations kills: preparing the presentation, performing the presentation, Written communication: Reading comprehension, précis writing, Business and technical reports, Styles, Business correspondence, Memorandum writing, Notice, Agenda and Minutes, Research papers and articles, Advertising and job Description, Mechanics of Manuscript preparation.

UNIT III: INTERPERSONAL RELATIONSHIP

Teamwork, Team effectiveness, Group discussion, Decision making- Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics, Multicultural Diversity and Socializing

UNIT IV: LEADERSHIP SKILLS

Leaders: their skills, roles, and responsibilities. Vision, Empowering and delegation, motivating others, organizational skills, team building, Organizing and conducting meetings, decision making, giving support, Vision, Mission, Coaching, Mentoring and counseling, Appraisals and feedback, conflict, Power and Politics, Public Speaking.

UNIT V: OTHER SKILLS

Managing Time, Managing Stress, Meditation. Improving personal memory, Study skills that include Rapid Reading, Note Taking, Self-learning, Complex problem solving and creativity, listening skill and speaking skills, Corporate and Business Etiquettes.

UNIT VI: ETHICS IN ENGINEERING PRACTICE AND RESEARCH Introduction to ethical reasoning and engineer ethics, Right and responsibilities regarding Intellectual property, workplace rights and responsibilities, Central Professional Responsibilities of Engineers, Responsibility for environment.

TEXTBOOKS:

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1. Developing Communication Skill: Krishna Mohan, Meera Banerji, Mac-Millan India Ltd.
2. B.N Ghosh," Managing Soft Skills for Personality Development" McGraw-Hill.
3. Ethics in Engineering Practice and Research: Caroline Whitbeck, Cambridge University press.
4. A Course In Communication Skills: Kiranmai Dutt, Cambridge University press.
5. English for Business Communication: Simon Sweeney, Cambridge University Press.
6. Basics Of Communication In English: Francis Sounderaj, MacMillan India Ltd.
7. Group Discussions and Interview Skills: Priyadarshi Patnaik, Cambridge University Press.
8. Professional Presentations: Malcolm Goodale, Cambridge University Press.
9. An IntroductiontoProfessionalEnglishAndSoft Skills: Das, Cambridge University Press.
10 A practical course in Effective English speaking skills, G.K. Gangal, PHI Publication.

SOFT SKILL LAB **SUBJECT CODE ETSH-113** **CREDIT: 01**

LIST OF EXPERIMENTS

Week 1: Work/Assignments
Week 2: SWOT analysis Personal & Career Goal setting – Short term & long term Presentation Skill
Week 3: Dining EtiquettesLetter/Application/Notice/Agenda/MinuteswritingReportwriting
Week 4: Listening skills using Language laboratory
Week 5: Group discussion
Week 6: Resume writing

Program Structure	B. Tech (Mechanical Engineering)
Subject Code	ETSH-105
Course Name	ENGINEERING CHEMISTRY
Course Credits	3 (T) + 1(P)= 4
Total Course Credit	169

Abbreviations: T-Theory, P-Practical

1. Course Overview:

A number of academic and research options are available to students in various fields such as pharmaceuticals, food products, environmental monitoring and assessments, environmental chemistry, fuel chemistry, cosmetic chemistry, biochemistry, biomaterials, nano-chemistry, materials chemistry, polymer chemistry, industrial chemistry, water chemistry, etc. in addition to physical, organic and inorganic chemistry that a student can explore for choosing a professional career.

2. Prerequisite:

Students must have Chemistry as a one subject at +2 levels.

3. Objective of Syllabus:

i. Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories.
ii. To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems.
iii. To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.

4. Course Outcome:

S. No.	Course Outcomes (Cos)
CO1	Characterize bonding between atoms, molecules, interaction and energetics (ii) hybridization and shapes of atomic, molecular orbitals, bond parameters, bond-distances and energies.
CO2	Importance of hydrogen bonding, metallic bonding
CO3	Understanding chemistry of Water and its properties
CO4	Understanding principle of UV-Vis/FTIR spectroscopy and its applications.
CO5	Understanding principles of NMR analysis and study of Flame photometry of materials/characterization of materials.

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CO6	Understanding chemistry of polymers, their structures and uses.

5. Syllabus.

UNIT- I: CHEMICAL BONDING

Introduction, Molecular Orbital Theory (MOT), Sigma (σ) and pi (π) Molecular Orbitals, Energy level Diagram for Mono and Di atomic Molecules, Linear Combination of Atomic Orbitals (LCAO) Method, Crystal Field Theory, Calculation of CFSE

UNIT- II: WATER AND ITS TREATMENT

Introduction, Soft and Hard Water, Type of Hardness, Techniques for Water Softening- Lime Soda Process, Zeolite Process, Ion Exchange Process.

UNIT- III: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Basic concept of spectroscopy. Principle and Applications of different spectroscopic techniques (UV-Visible and IR spectroscopy). Nuclear magnetic resonance and magnetic resonance imaging. Elementary Discussion of Flame photometry.

UNIT- IV: POLYMER

Introduction, types of polymerizations. Classification, mechanism of polymerization (Free radical and Ionic polymerization). Thermoplastic, and thermosetting polymers Elementary idea of Biodegradable polymers, preparation, properties and uses of the following polymers- PVC, PMMA, Teflon, Nylon-6, Polyester phenol formaldehyde, Urea- Formaldehyde, Buna-s, Vulcanization of Rubber.

UNIT- V: CORROSION AND LUBRICANT

Lubricant- Definition, Classification with examples. Functions of Lubricant, Physical Characteristics of Lubricants Such and Viscosity, Viscosity Index, Oiliness, Volatility, Flash & Fire Point, and Cloud & Pour Point. Chemical Characteristics of Lubricant such as Acid Value or Neutralization Number, Emulsification, Saponification Value etc.

TEXT BOOKS:

- University Chemistry, by B.H. Mahan.
- Chemistry Principles and Applications, by M.J. Sienko and R.A. Plane.
- Fundamentals of Molecular Spectroscopy, by C.N. Banwell.
- Engineering Chemistry (NPTEL Web-book) by B.L. Tembe, Kamaluddin and M.S. Krishnan
- Physical Chemistry, by P.W. Atkins.

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ENGINEERING CHEMISTRY LAB **ETSH-115** **CREDIT: 01**

OBJECTIVES OF THE COURSE:

This Engineering Chemistry Laboratory is common to first year branches of UG Engineering. At The end of the course the student is expected to provide the students with a solid foundation in Chemistry laboratory required to solve engineering problems. Practical implementation of fundamental concepts.

LIST OF EXPERIMENT: -

Week 1: Qualitative analysis of given salts having three acidic and basic radicals.
Basic radicals: - Pb2+, Cu2+, Al3+, Fe2+, Fe3+, Cr3+, Zn2+, Ca2+, Ba2+ etc.
Acidic radicals: - Cl,Br-,I-,,SO4,NO3,OH- etc.

Week 2: Determination the total hardness of given water sample.
Week 3: To Determine the Saponification value of given oil sample.
Week 4: To Determine the acid value of given oil sample.
Week 5: Adsorption of acetic acid by charcoal.
Week 6: Synthesis of polymer /drug.
Week 7: To Determine the Ph of given solution by universal indicator or pH meter.
Week 8: To determine dissolved oxygen in water sample.
Week 9: To determine thinner content in oil paint.
Week 10: To determine carbon monoxide, carbon di-oxide, ointment emission from petrol vehicle.

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETEA - 111**
Course Name	**Inter-disciplinary Experimental Active Learning (IDEA LAB)**
Course Credits	**0 (T) + 2 (P) = 2**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

1. **Syllabus:**

Course Objective:

The objective of an Idea Lab course is to foster creativity, innovation, and problem-solving skills among participants. Through a combination of theoretical learning, practical exercises, and hands-on projects, Idea Lab courses aim to:

Cultivate creative thinking: Encourage participants to think outside the box, explore unconventional solutions, and challenge traditional approaches to problem-solving.

Develop ideation skills: Equip participants with techniques and methods for generating, refining, and evaluating ideas effectively.

Promote collaboration: Foster a collaborative environment where participants can exchange ideas, provide feedback to each other, and collaborate on projects.

Encourage experimentation: Encourage participants to experiment with different ideas, prototypes, and solutions, embracing failure as a natural part of the creative process.

Course Outcomes:

The outcomes of an Idea Lab course go beyond the acquisition of knowledge to encompass the development of a creative and entrepreneurial mindset, equipping participants with the skills and confidence to thrive in a rapidly changing world.

LIST OF EXPERIMENTS: -

Week 1 To study various active & passive devices like R, L & C, battery etc.

Week 1 To study the CRO and function generator for signal analysis.

Week 2 To study the basics of mechatronics and various parts of a robot.

Week 3 To study the refrigeration and Air-conditioning system with future perspectives.

Week 4 Identification of various types fabrics like cotton, woolen, linen, silk etc.

Week 4 Identification of different types of stones and aggregates (visual identification) with study of their properties and applications.

Week 5 Identification of timbers: teak, Sal, chir, shisum, siras, deodar, kail and mango. (Visual identification) and with study of their properties and applications.

Week 6 Identification of hard drive, RAM, mother board and other important parts in a desktop computer

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Week 7 To study the types of soil, water and renewable energy with present scenario and future challenges for sustainable development.

Week 8 To learn the parts of fan, LED bulb, induction cook top, electric iron etc.

Week 9 To study the working principle and various parts of a Hybrid Electric Vehicle (HEV)

Week 10 To study the various components of Green Building (also called as Zero Energy Building)

Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 111**
Course Name	**Engineering Workshop Lab**
Course Credits	**0(L)+0 (T) + 1 (P) = 1**
Total Course Credit	**169**

Abbreviations: Lecture-L, T-Theory, P-Practical

1. Course Objective:

Providing basic knowledge of workshop tools, equipment, machineries and various workshop activities related to carpentry, smithy, foundry etc. with hands-on practices.

2. Course Outcomes:

On successful completion of this course, the student will be able to

- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Illustrate on operations of smithy, Carpentry, foundry and fittings

LIST OF EXPERIMENTS: -

Week 1 Smithy Shop

(a) To prepare a ring a mild steel rod in black smithy shop.

(b) To prepare an eye-nail of M.S rod of 125 mm long & 8 mm thickness.

Week 2 Foundry Shop

(a) To prepare a V block casting using pit furnace.

Week 3 Carpentry Shop

(a) To prepare a dovetail joint in carpentry shop.

(b) To prepare a cross lap joint in carpentry shop.

Week 4 Fitting Shop

(a) To prepare a matching joint in fitting shop.

(b) To prepare a square by chipping & filling.

Week 5 Machine Shop

(a) To prepare a cylindrical job of dia. 25 mm to 22.5 mm on lathe using turning operation.

(b) Drilling Practice

Week 6 Welding

(a) To prepare a T-joint by arc welding.

(b) To prepare an L-shape corner joint by Arc welding.

Week 7 Sheet Metal Shop

(a) To prepare a conical funnel with soldering in sheet metal shop.

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TEXT BOOK:

1. Jain, R.K. Production Technology.

2. Rao, P. N. Manufacturing Technology (Vol. I &II)

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II[nd] SEMESTER

Program Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETSH-201**
Course Name	**ENGINEERING MATHEMATICS –II**
Course Credits	**3 (T)**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

1. Course Overview:

This course will introduce the core concepts of differential equations, Laplace and Fourier transform, Fourier series and advanced level of mathematics and applications.

2. Prerequisite:

Basic knowledge of differential equation.

3. Objective of Syllabus:

- The objective of this course is to familiarize the prospective engineers with techniques in ordinary and partially differential equations, Laplace and Fourier transform, Fourier series, complex variables
- It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their discipline

4. Course Outcome:

S. No.	Course Outcomes (Cos)
CO1	After successfully completing the course, the student will have a good understanding of the following topics and their applications:
CO2	Analytic function, singularity, residues and complex integration
CO3	Laplace and Fourier transform and its properties, application of Laplace and Fourier transform
CO4	Laplace and Fourier transform and its properties, application of Laplace and Fourier transform.
CO5	Finding the solution of ode and pde

5. Syllabus.

UNIT 1: ORDINARY DIFFERENTIAL EQUATION

Ordinary differential equation: definitions, order and degree of differential equation, equation,

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exact differential equations, equations solvable for x, y and p, Clairaut's form, second order linear differential equation with constant coefficient, Cauchy -Euler's equation, Method of variation of parameter.

UNIT 2: PARTIAL DIFFERENTIAL EQUATION

Partial differential equations: Definition and formulation, partial differential equation of the first order, Non-linear Partial differential equations, Legendre's and Charpit's method, Homogeneous linear partial differential equation with constant co-efficient, Methods for finding C.F. and P.I. of Linear Homogeneous Partial Differential Equations.

UNIT 3: LAPLACE TRANSFORM

Laplace Transform: Definition and properties of Laplace transform, shifting theorem, Transform of derivative and integrals, Multiplication by t^n, Division by t. Inverse Laplace transform, convolution theorem (without proof) and its application.

UNIT 4: FOURIER SERIES AND FOURIER TRANSFORM

Fourier series: Periodic Function, Function of arbitrary period, Even and odd functions, half range Series Fourier Transform: definition and properties of Fourier transform, convolution, Parseval's identity for Fourier transforms, Relation between Fourier transform and Laplace transform.

UNIT 5: COMPLEX ANALYSIS

Complex Analysis: definitions, Cauchy- Riemann Equations, Harmonic functions, Elementary Analytic function and their properties, Cauchy Integral formula (without proof), Taylor's Series, Singularities, Residues, Cauchy Residue Theorem (without proof).

REFERENCE BOOK:

B.S. Grewal, Higher Engineering Mathematics, Khanna publisher's, 44thedition
Erwin Kresyszig, Advance Engineering mathematics, John Wiley and Sons, 9th edition

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Program Structure	**B. Tech (Mechanical Engineering))**
Subject Code	**ETEE201**
Course Name	**Basic Electrical & Electronics Engineering**
Course Credits	**3 (T) + 1 (P) = 4**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

1. **Course Overview:**

The course provides a thorough understanding of fundamental electrical concepts, beginning with potential difference, current, resistance, and Ohm's law, progressing to advanced topics such as electromagnetism, magnetic circuits, and energy stored in magnetic fields. Students learn analysis techniques for DC circuits and AC fundamentals, including Kirchhoff's laws and sinusoidal voltage/current characteristics. Single-phase transformers and electrostatics are explored, covering construction, working principles, and capacitance. Semiconductor theory, diodes, rectifiers, and transistor configurations and applications are also studied. The course concludes with an introduction to Boolean algebra, logic gates, and simplification techniques, equipping students with a comprehensive skill set for electrical engineering and related disciplines.

2. **Prerequisite:** The prerequisite for the course encompasses a solid understanding of fundamental electrical concepts, including potential difference, current, resistance, and Ohm's law. Additionally, familiarity with electromagnetism, magnetic circuits, and basic analysis techniques for DC circuits and AC fundamentals is required. Students should also possess knowledge of single-phase transformers, electrostatics, semiconductor theory, and Boolean algebra.

3. **Objective of the Syllabus:**

- To explain the laws used in the analysis of DC and AC circuits.
- To understand and analyze AC & DC circuits.
- To provide students with a fundamental knowledge of Single-phase transformer construction and working.
- To provide students with a fundamental knowledge of AC Fundamentals.
- To provide students with a fundamental knowledge of Electrostatics.
- Familiarize with semiconductor devices, rectifier circuits, and their applications.
- Describe the basic applications of transistors.
- Define logic gates & understand the working principles of logical circuits.
- Describe the significance of Boolean algebra in digital circuits.

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4. Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	Students will comprehend fundamental electrical principles and electromagnetism, enabling them to analyze circuits and understand magnetic effects.
CO2	Learners will master DC and AC circuit analysis techniques, including Kirchhoff's laws and sinusoidal characteristics, enhancing their ability to analyze and design electrical circuits.
CO3	By the end of this module, students will be proficient in understanding the operation of single-phase transformers and electrostatic phenomena, enabling them to evaluate transformer efficiency and capacitor behavior.
CO4	Participants will gain expertise in semiconductor theory, diode, and transistor operation, facilitating their capability to design and analyze electronic circuits.
CO5	Students will develop skills in Boolean algebra and logic gates, allowing them to simplify logical expressions and design digital systems effectively.

5. Syllabus:

Unit I ELEMENTARY CONCEPTS

(A) Prerequisite: Concept of Potential difference. Current and resistance. Ohm's law, resistance Temperature coefficient, insulation resistance, SI units of work Power and Energy (B) Electromagnetism: Magnetic effect of an electric current, cross and dot conventions, right-hand thumb rule and corkscrew rule, Concept of M.M.F., flux, flux density, reluctance, permeability and Field strength, their units and relationships, the analogy of electrical and magnetic circuit, Energy stored In a magnetic field.

Unit II D. C. CIRCUITS AND AC FUNDAMENTALS

(A) Kirchhoff's law, ideal and practical voltage and current sources. Mesh and Nodal analysis (Supernode And super mesh excluded). Source transformation. Star delta transformation. Superposition Theorem, Thevevnins's theorem Norton's theorem, maximum power transfer theorem (Source Transformation not allowed for superposition theorem, Mesh and Nodal analysis. (B) Sinusoidal voltage and currents, their mathematical and graphical representation, the concept of Cycle period, frequency, instantaneous, peak, average, R.M.S. values, peak factor, and form factor, Phase difference.

Unit III SINGLE PHASE TRANSFORMER AND ELECTROSTATICS

A) Single phase transformers: Construction, principle of working, e.m.f. equations, voltage, and current ratios, losses, the definition of regulation and efficiency, determination of these by direct

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loading method. B) Electrostatics: electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity, and capacitance, composite dielectric capacitors, capacitors in series and parallel, energy stored in capacitors.

Unit IV ANALOG DEVICES

A) Semiconductor theory:- Intrinsic and Extrinsic Semiconductors - N type and P type materials – mechanism of the hole and free electrons- majority and minority carriers, drift and diffusion current - Semi conductor diode - V -I characteristics of PN Junction diode, B) Rectifiers: Working and Waveforms of Half wave - Full wave - Bridge rectifiers (without filters) – Differences. C) Transistor: Working Principle of NPN and PNP transistor - Transistor as a switch - Transistor working as an amplifier- common base - common collector- common emitter configuration - input and output characteristics.

Unit V BOOLEAN ALGEBRA AND LOGIC GATES

A) Number representation: Decimal, Binary, Octal, and Hexa- decimal number systems - Conversion of numbers from one number system to another without decimal points - BCD Codes and limitations – Conversion of BCD to decimal and vice versa. B) Logic gates: Definition, truth table, symbol, and logical equations of logic gates: AND – OR - NOT- NAND – NOR-EXOR - EXNOR (Only 2-inputs) – Universal gates. C) Logic Simplification: Rules and laws of Boolean algebra – Demorgan's Theorem and proof - Simplification of logic functions using Boolean.

TEXT / REFERENCES BOOKS:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011
4. E. Hughes, "Electrical and Electronics Technology, Pearson, 2010
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India 1989

Basic Electrical & Electronics Engineering Lab **SUB-CODE: ETEE-211** **CREDIT: 02**

A. BASIC ELECTRICAL ENGINEERING-
WEEK 1-5

1. Verification of Ohm's Law.
2. Verification of KVL (Kirchhoff's Voltage Law) and KCL (Kirchhoff's Current Law).
3. Verification of Superposition theorem.

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4. To Verify the Maximum Power Transfer theorem.
5. Measurement of power and power factor of single phase AC circuit using three voltmeter methods.
6. Verification of The venin's theorem.
7. 7. To verify Norton's theorem.
8. To measure power and power factor in a single-phase A.C. circuit using a wattmeter.

B. BASIC ELECTRONICS ENGINEERING-

WEEK 6-11

1. CRO – Applications.
2. V- I characteristics of Silicon & Germanium PN junction diodes.
3. V-I characteristics of Zener diode.
4. Characteristics of BJT in Common Emitter Configuration.
5. Characteristics of JFET in common source configuration.
6. Half and Full wave rectifier without a filter.
7. Half wave and Full wave rectifier with Filter.
8. Characteristics of Common Emitter BJT amplifier.

REFERENCE BOOKS:

- E. Hughes, "Electrical and Electronics Technology, Pearson, 2010
- V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

Program Structure	B. Tech (Mechanical Engineering)
Subject Code	ETCS201
Course Name	C Programming
Course Credits	3 (T) + 1(P)= 4
Total Course Credit	169

Abbreviations: T-Theory, P-Practical

1. Course Overview:

Understand the basic concept of C Programming, and its different modules that include Conditional and looping expressions, Arrays, Functions, Pointers, Structures and files.

2. Prerequisite:

To understand the basic knowledge of computer, Keyboard and operating system.

3. Objective of Syllabus:

- Understand the basic concept of C Programming, and its different modules that include conditional and looping expressions, Arrays, Strings, Functions, Pointers, and Structures.
- Acquire knowledge about the basic concept of writing a program.
- Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language
- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.

4. Course Outcome:

S. No.	Course Outcomes (Cos)
CO1	Understand the basic concept of C Programming, Constants, variables & data types Operators and expressions managing input and output operators, and Branching Decision Making and Looping.
CO2	Understanding One–dimensionalArrays and their declaration and Initialisations, Two-dimensional Arrays and their initialisations, Multidimensional Arrays, Dynamic Arrays, String Variables, Reading and Writing Strings, Arithmetic Operations on characters, Putting Strings together, Comparison of Two Strings.
CO3	Understand the concept of Functions, Declaration, Definition and Calling of functions, Nesting function and Recursion, Passing array and string to functions, Storage classes: automatic, external and static variables.
CO4	Ability to Defining Structure, Declaring Structure Variable and Accessing Structure Members, Initialisation of Structure, Comparing Structure Variables, Operation on Individual Members, Arrays of Structures, Structures within structures, Structures and Functions, Unions, Size of Structures

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CO5	Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor
CO6	Understanding Pointers and Arrays, Pointers and Character Strings, Arrays of Pointers, Pointers and Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures, Union, File Management in C.

5. Syllabus.

UNIT I: INTRODUCTION TO PROGRAMMING

Introduction to components of a computer system (disks, memory, processor, where a Program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo Code with examples. From algorithms to programs; source code, variables (with data types)

Variables and memory locations, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence.

UNIT II: CONDITIONAL BRANCHING AND LOOPS & ARRAYS

Writing and evaluation of conditionals and consequent branching, Iteration and loops Arrays

(1-D, 2- D), Character arrays and Strings

UNIT III: **BASIC ALGORITHMS & FUNCTIONS**

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required) Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

UNIT IV: RECURSION

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort**.**

UNIT V: STRUCTURE & POINTERS

Structures, Defining structures and Array of Structures Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

TEXTBOOKS / REFERENCES

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguru swamy, Programming ANSIC, Tata McGraw-Hill

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3. C in Depth by S.K. Srivastava/ Deepali Srivastava
4. C Programming Language (Prentice Hall)
5. https://www.tutorialspoint.com/cprogramming/index.htm
6. https://www.geeksforgeeks.org/c-programming-language/
7. https://www.javatpoint.com/c-programming-language-tutorial

C PROGRAMMING LAB SUB-CODE: ETCS-211 CREDIT: 01

A Theory: Variable, Data type, Keyword, Operator, Hello world Program, Control Structure, Array, Pointer

Week 1: Write a C program to find the sum of individual digits of a positive integer.

Week 2: Write a C program to generate Fibonacci series.

Week 3: Write a C program to generate all the prime numbers between 1 and n is a Value supplied by the user.

Week 4: Write a C program to find the roots of a quadratic equation.

Week 5: Two integer operands and one operator form user, performs the operation and then prints the result.

Week 6: Write a C program to find the factorial of a given integer by using recursive and non-recursive functions.

Week 7: A C program to find both the largest and smallest number in list of integers

Week 8: Write A C- Program to Determine If The Given String Is A Palindrome Or Not

Week 9: Example of Array In C programming to find out the average of 4 integers

Week 10: Write a program in c to Addition of two matrix in C

Week 11: Write a C program to implement the following searching method.

i) Linear search ii) Binary search

Week 12: Write C programs that implement the following sorting methods to sort a given list of integers in ascending order by using Bubble sort.

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME – 201**
Course Name	**Fundamental of Mechanical and Civil Engineering**
Course Credits	**3 (L)+0 (T) + 1 (P) = 4**
Total Course Credit	**169**

Abbreviations: Lecture-L, T-Theory, P-Practical

1. **Course Overview:**

A course on "Fundamental of Mechanical and Civil Engineering" is foundational for understanding the physical principles that govern the behavior of solids and fluids. This part of the course covers topics such as force systems, moments, equilibrium conditions, free-body diagrams, and analysis of trusses, frames, and beams. Students learn how to calculate reactions, internal forces, and stresses in static systems. Fluid mechanics deals with the behavior of fluids (liquids and gases) at rest and in motion. Topics include fluid properties, fluid statics, fluid dynamics, continuity equation, Bernoulli's equation, momentum equation, flow in pipes, and boundary layer theory. Students learn about the principles governing fluid flow and their applications in engineering systems. Overall, a course on Fundamental of Mechanical & Civil Engineering provides students with a strong foundation in the principles of mechanics, enabling them to analyze and design mechanical and structural systems with confidence and precision.

2. **Prerequisite:**

Throughout the course, students are exposed to a variety of engineering problems and applications that require the application of mechanics principles. This could include analyzing structures, designing mechanical components, and solving real-world engineering challenges.

3. **Objective of the Syllabus:**

The main learning objective of this course is to prepare the students for:

- Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
- Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
- To understand the concepts of Centroid and centre of gravity.
- To study the concepts of power plant, IC engine components refrigeration’s and air conditioning.
- To study the concepts of properties of fluids.
- To study the civil engineering materials and building components.

4. **Course Outcomes:**

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

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S.No.	Course Outcomes (Cos)
CO1	Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
CO2	Apply the concepts of locating Centroid / center of gravity of various sections
CO3	To study the concepts of power plant, IC engine components refrigeration's and air conditioning.
CO4	To study the concepts of properties of fluids.
CO5	To study the Civil Engineering Material, Survey and Building Components.

5. Syllabus:

UNIT 1 FORCE SYSTEMS AND FRICTION

Introduction –Laws of Mechanics – Lami's theorem,Triangle, Parallelogram and polygon law of forces –Force system and its classifications –Equivalent systems of forces, free body diagram.

Beam and types of beam – Support and types of support, Shear force and bending moment diagram– for cantilever and simply supported beam with concentrated, distributed load and couple.

Friction-its types, Laws of friction, Co-efficient of friction, Angle of friction, Angle of repose and its relation.

UNIT 2 CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA

Center of gravity and Moment of inertia; Centroid and center of gravity, Moment Inertia of area and mass, Radius of Gyration

UNIT 3 THERMAL ENGINEERING

Introduction, Classification of power plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear power plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles - Principle of vapour compression system – Layout of typical domestic refrigerator – Window and split type room Air conditioner

UNIT 4 BASIC CONCEPTS OF FLUID MECHANICS

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Fluid – definition, - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension,Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.Bernoulli's equation and its applications.

UNIT 5 CIVIL ENGINEERING MATERIAL, SURVEY AND BUILDING COMPONENTS

Civil Engineering Material:Brick, Stone, Cement, Concrete and its properties.
Surveying:Principles, Measurements of distances, Determination of angles, area, and leveling
Building components: Foundation and its types, bearing capacity,Requirement of goodfoundation
Superstructure: Brick masonry, Stone Masonry, beams, columns, Lintels, roofing, flooring, plastering.

BOOKS AND REFERENCES

Text Books

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education. 11thEdition, 2017
2. Vela Murali, “Engineering Mechanics-Statics and Dynamics”, Oxford University Press, 2018.
3. Nag. P.K. “Power Plant Engineering” Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008
4. B. C. Punamia- Surveying part-1
5. N.S. Basak – Surveying
6. Building Material – S. K. Duggal
7. R. K. Bansal Fluid Mechanics and Machinery

Reference Books

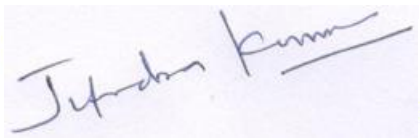
1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., and Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.

Fundamental of Mechanical and Civil Engineering SUB-CODE: ETME-211 **CREDIT: 01**

Course Objective:

The main learning objective of this course is to prepare the students for:

- Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
- Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
- To understand the concepts of Centroid and centre of gravity.



- To study the concepts of power plant, IC engine components refrigeration's and air conditioning.
- To study the concepts of properties of fluids.
- To study the civil engineering materials and building components.

Course Outcomes:

At the end of the course the students are able to:

- Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To study the concepts of IC engine components.

Syllabus:

Week 1 To verify the parallelogram law of forces.
Week 2 To verify the lami's theorem.
Week 3 To determine the coefficient of Friction of an inclined Plane.
Week 4 To study about the model of two stroke petrol engine.
Week 5 To study about the four stroke petrol engine and diesel engine.
Week 6 To Verify the Bernoulli's Theorem.
Week 7 To determine the compressive strength of Brick
Week 8 To determine the horizontal angle with prismatic and surveyor compass.
Week 9 To determine the area by chain survey.
Week 10 To measure horizontal and vertical angles in the field by using Theodolite.

BOOKS AND REFERENCES

Text Books

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education. 11thEdition, 2017
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.
3. Nag. P.K. "Power Plant Engineering" Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008
4. B. C. Punamia- Surveying part-1
5. N.S. Basak – Surveying
6. Building Material – S. K. Duggal
7. R. K. Bansal Fluid Mechanics and Machinery

Reference Books

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1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., and Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013

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Programme Structure	**B. Tech (Mechanical Engineering))**
Subject Code	**ETSH-202**
Course Name	**TECHNICAL COMMUNICATION & PROJECT MANAGEMENT**
Course Credits	**3 (T)**
Total Course Credit	**169**

Abbreviations: T-Theory

1. **Course Overview**:
   In this course student will learn about letter writing and technical presentation skills.

2. **Prerequisite:**
   Basic knowledge of grammar, letter & application.

3. **Objective of the Syllabus**
   - To introduce the students to the fundamentals of mechanics of writing.
   - To facilitate them with the style of documentation and specific formal written communication.
   - To initiate in them the art of critical thinking and analysis.
   - To help them develop techniques of scanning for specific information, comprehension and organization of ideas.
   - To enhance their technical presentation skills.

4. **Course Outcomes:**

S.No.	Course Outcomes (Cos)
CO1	Students will heighten their awareness of correct usage of English grammar in writing and speaking
CO2	Acquisition of technical communication's generic aspects like Reading Technical Material, Technical Writing, Listening
CO3	Learning the skill of proofreading and copy editing, paraphrasing and spinning using technical tools
CO4	Learning the technical phrases and writing styles like descriptive, argumentative etc for developing good technical documents for presentations or disseminating technical documents

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CO5	Accessing the reading material and developing the writing technical material with the use of technical concepts and tools

5. Syllabus:

UNIT I:
Mechanics of Writing: Grammar rules -Articles, Tenses, Part of Speech. General Reading and Listening comprehension – rearrangement & organization of sentences.

UNIT II:
Different kinds of written documents: Definitions- descriptions- instructions-recommendations- user manuals – reports – proposals. Formal Correspondence: Writing formal Letters. Reading & Listening Comprehension.

UNIT III:
Technical paper writing: documentation style – document editing – proof reading – Organizing and formatting Reading and listening comprehension of technical documents Technical presentations

UNIT IV:
Reading and listening comprehension of technical documents Technical presentations

UNIT V:
Project Writing

TEXT BOOKS:

- Essential Communication Strategies for Scientists, Engineers and Technology Professionals. II Edition. New York: IEEE press, 2002
- Technical Communication: A Reader-Centred Approach. V Edition. Harcourt Brace College Publication, 2003
- Technical Report Writing Today. VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.
- Practical English Usage, Oxford University Press, 2000

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Programme Structure	**B. Tech (**Mechanical ENGINEERING**)**
Subject Code	**ETCS202**
Course Name	**Basics of Internet of Things (IoT)**
Course Credits	**0(L) + 0(P)= 0**
Total Course Credit	**169**

Abbreviations: L-Lecture, P-Practical

ETCS-202 BASICS OF INTERNET OF THINGS (IOT)

OBJECTIVES OF THE COURSE:

- The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time.
- It's becoming the Internet of Things (IoT).
- The course enables student to understand the basics of Internet of things and protocols.
- It introduces some of the application areas where Internet of Things can be applied.
- Students will learn about the middleware for Internet of Things.

1. Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural Models
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
CO3	Appraise the role of IoT protocols for efficient network communication.
CO4	Elaborate the need for data analytics and security in IoT.
CO5	Illustrate different sensor technologies for sensing real world entities.

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MODULE - 1 INTRODUCTION

Introduction, Definition and Characteristics of IoT, Some basic terminologies related to IoT, The technology behind IoT, Design principles of IoT: Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Advantage & Disadvantage of IoT. Applications of IoT.

MODULE-2 IOT& M2M

IoT& M2M ,M2M Communication, Key features of M2M, M2M Applications, Difference between IoT and M2M, Sensing, Actuation, Basic of Networking. M2M ecosystem.

MODULE-3 IOT ARCHITECTURE

IOT ARCHITECTURE - IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoT acivity stack architecture- Resource model and Abstraction.

MODULE-4 IOT AND ITS COMPONENT

IoT and its component –Introduction, RFID, Applications of RFID, Wireless Sensor network (WSN & VSN),Participatory Sensing Technology, Embedded platform for IoT. Interfacing a gas sensor to Arduino.

MODULE- 5 IOT APPLICATION DEVELOPMENT AND DESIGN CHALLENGES

IoT Design methodology, Requirement and process model of IoT, Process specification, Information model for IoT application. IoT applications- smart city street lights-control and monitoring, Home automation, E-health, Smart farming.

TEXT BOOKS /REFERENCES:

• Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press,2012.
• Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
• David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.
• Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012. References:
• Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”,1st Edition, VPT,

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2014
• Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
• CunoP fister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1- 4493-9357-1

Abbreviations: L-Lecture, T- Tutorial, P-Practical

1) **Course Overview:** This course of Graphics explains the concepts of engineering drawing of objects in order to develop the skill of designing the new and existing engineering products.

2) **Prerequisite:** There are no specific prerequisites for this course, although a basic understanding of Geometry and Menstruation is recommended.

3) **Objectives of the Syllabus:** To develop graphic skills for communication of concepts, ideas and design of engineering products among the students. To expose them to existing national standards related to technical drawings.

4) Course Outcomes: On successful completion of this course, the student will be able to

SL No.	Course Outcomes(Cos)
CO1	Familiarize with the fundamentals and standards of Engineering graphics
CO2	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
CO3	Project orthographic projections of lines and plane surfaces.
CO4	Draw projections and solids and development of surfaces.
CO5	Visualize and to project isometric and perspective sections of simple solids.

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Programme Structure	**B. Tech (MECHANICAL ENGINEERING)**
Semester	**2nd**
Subject Code	ETME-202
Course Name	Engineering Graphics & Design
Course Credits	**1 (L) +0(T)+3(P)=4**
Total Course Credit	**169**

5) Syllabus:

CONCEPTS AND CONVENTIONS

Importance of graphics in engineering applications–Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning, Scales

MODULE I: PLANE CURVES

Plane Curves: - Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of in volutes of square and circle – Drawing of tangents and normal to the above curves.

MODULE II: PROJECTION

Projection: - Types of projection, Orthographic projection, First and Third angle projection, Projection of points and lines, Line inclined to one plane, Inclined with both the plane.

MODULE III: PROJECTION OF PLANES AND SOLIDS

Projection of Planes and Solids: - Projection of Planes likes circle and polygons in different positions; Projection of polyhedrons like prisms, pyramids and solids of revolutions like cylinder, cones in different positions.

MODULE IV: SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Section of Solids: - Section of right solids by normal and inclined planes; Intersection of cylinders.

Development of Surfaces: - Parallel line and radial - line method for right solids, Introduction of surfaces-cylinder.

MODULE V: ISOMETRIC PROJECTIONS & COMPUTER AIDED DRAFTING

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Isometric Projections:-Isometric scale, Isometric axes, Isometric Projection from orthographic drawing.

Computer Aided Drafting (CAD): Introduction, benefit, software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders; transformations and editing commands like move, rotate, mirror, array; solution of projection problems on CAD.

ENGINEERING GRAPHICS & DESIGN LAB **Sub code:** ETME111

Syllabus:

Week-1: Introduction to the sheet layout
Week-2: Dimensioning & Lettering
Week-3: Conic sections
Week-4: projection of points
Week-5: projection of lines
Week-6: projection of planes
Week-7: Section of solids and development of surfaces

BOOKS AND REFERENCES:

1) Bhatt, N.D.,Panchal V M and Pramod R. Ingle, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2) Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015
3) Agrawal, B. and Agrawal C.M., "Engineering Drawing", Tata McGraw, N. Delhi, 2008.
4) Gopalakrishna, K. R., "Engineering Drawing",Subhas Stores, Bangalore, 2007.
5) Natarajan, K. V., "A text book of Engineering Graphics", 28thEd.,Dhanalakshmi Publishers, Chennai, 2015
6) Shah, M. B., and Rana, B. C., "Engineering Drawing", Pearson, 2nd Ed., 2009.
7) Venugopal, K. and Prabhu Raja, V., "Engineering Graphics", New Age, 2008.

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Programme Structure	**B. Tech (MECHANICAL ENGINEERING)**
Semester	**3rd**
Subject Code	**ETEC301**
Course Name	**Electronic Devices & Circuit**
Course Credits	**4 (L) + 1(P)= 5**
Total Course Credit	**169**

Abbreviations: L-Lecture, P-Practical

6) Course Overview:

This course serves as an introduction to the fundamental principles and applications of electronic devices and circuits. It provides students with a solid foundation in the theory, analysis, and design of electronic circuits, preparing them for advanced study or careers in electrical engineering, electronics, and related fields**.**

7) **Prerequisite:** To understand the fundamental principles of electronic devices and circuits & Analyze and design basic electronic circuits using passive components.

8) Objective of the Syllabus:

This course Electronic Devices & Circuit is an essential part of any Electronics engineering education. These objectives aim to provide students with a comprehensive understanding of electronic devices and circuits, preparing them for further study or careers in fields such as electrical engineering, electronics, telecommunications, and computer hardware.

Learn the fundamentals of principles of electronic devices and circuits & Analyze and design basic electronic circuits using passive components such as resistors, capacitors, and inductors and also explore semiconductor physics.

9) Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	Understand fundamentals of Introduction to Semiconductor Physics.
CO2	Apply in PN Junction Diode, P-N junction characteristics, I-V characteristics, Rectifier, Clipper &Clamper.

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CO3	Understand the basic concepts of BJT & MOSFET.
CO4	Understand the basic concepts of CMOS Fabrication & Special Types of Diodes.
CO5	Understand fundamentals of Operational Amplifier & its Characteristics of an ideal op-amp.

10) Syllabus:

Module I: **Introduction to Semiconductor Physics**

Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors

Module II: **PN Junction Diode**

Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-V characteristics, Rectifier, Clipper &Clamper and small signal switching models; Avalanche breakdown, Zener diode, Scotty diode

Module III: BJT & MOSFET

Bipolar Junction Transistor, I-V characteristics, early effect, Ebers-Moll Model, MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor.

Module IV: **CMOS Fabrication & Special Types Of Diodes**

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process. Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, and light emitting materials. Tunnel Diode

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Module V: Operational Amplifier

Characteristics of an ideal op-amp, Introduction- Summing, Scaling and averaging amplifier, Subs tractor or difference amplifier, Voltage to current converter, Current to voltage converter, Controlled sources, O pamp integrator and differentiator.

BOOKS AND REFERENCES:

1. G. Streetman, and S. K. Banerjee, " Solid State Electronic Devices," 7th edition, Pearson,2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, " Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons,2006.
4. C.T. Sah, " Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, " Operation and Modeling of the MOS Transistor," Oxford Univ.Press,2011.

ELECTRONIC DEVICES AND CIRCUITS LABORATORY

SUB-CODE: ETEC311 **CREDIT: 01**

Course Objective:

- To be exposed to the characteristics of basic electronic devices.
- Investigate the characteristics and applications of various types of diodes including rectifiers, Zener diodes, and light-emitting diodes (LEDs).
- Gain hands-on experience through laboratory experiments, circuit simulations, and design projects to reinforce theoretical concepts and develop practical skills.

Course Outcomes:

At the end of the course the students are able to:

- Ability to implement the characteristics and applications of various types of diodes including rectifiers.
- Ability to design and develop practical skills.

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- Ability to simulate and implement Gain hands-on experience through laboratory experiments, circuit simulations, and design projects.

Syllabus:

Week 1: To perform and get familiar with working knowledge of following instruments:-

(a) Function generator (b) CRO (cathode ray oscilloscope)

Week 2: . To perform and plot the forward and reverse V-I characteristics of a PN junction diode.

Week 3: . To perform and plot the characteristics of Zener diode.

Week 4: To perform and plot the wave shape of half wave rectifier.

Week 5: To perform and plot the wave shape of full wave rectifier.

Week 6: To perform and study the input and output characteristics of common base transistor

Week 7: To perform and study the input and output characteristics of common emitter transistor.

Week 8: To perform and study transfer and drain characteristics of FET.

Week 9: Drain and Transfer Characteristics of JFET.

Week 10: To perform and plot the characteristics of Photo diode.

Week 11: To perform and plot the characteristics of light emitting diode.

REFERENCE BOOKS:

1. Fundamentals of Electric Circuits | 7th Edition. Charles K. Alexander.

2. Op-Amps and Linear Integrated Circuits | Fourth Edition | By Pearson. Ramakant A. Gayakwad.

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME-303**
Course Name	**Manufacturing Processes**
Course Credits	**3(L)+0 (T) + 0 (P) = 3**
Total Course Credit	**169**

Abbreviations: L-Lecture, T-Theory, P-Practical

1) Course Overview:

"Manufacturing Processes" typically covers a broad range of topics related to the processes, methods, and systems involved in manufacturing various products. This part of the course delves into various manufacturing processes such as machining, casting, forming, welding, additive manufacturing (3D printing), and rapid prototyping. Each process is studied in detail, including its principles, equipment, applications, advantages, and limitations.

2) **Prerequisite:** To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joins, metal forming and manufacture of plastic components.

3) Objective of the Syllabus:

- To illustrate the working principles of various metal casting processes.
- To learn and apply the working principles of various metal joining processes.
- To analyse the working principles of bulk deformation of metals.
- To learn the working principles of sheet metal forming process.
- To study and practice the working principles of plastics molding.

4) Course Outcomes:

Sl.No.	Course Outcomes (Cos)
CO1	Explain the principle of different metal casting processes.
CO2	Describe the various metal joining processes.
CO3	Illustrate the different bulk deformation processes.
CO4	Apply the various sheet metals forming process.
CO5	Apply suitable molding technique for manufacturing of plastics components.

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5) Syllabus:

UNIT I: CASTING PROCESSES

Casting Processes: Principles of pattern making, allowances in patterns and core boxes, sand mould casting, constituents and properties of moulding sand and their tests, types of sand moulds, method and principles of gating, rise ring, use of cores and chills, cleaning of casting, defects in casting and their remedies, sand mould machines, melting and casting practices relating to cast iron, steel, aluminium and its alloys. Cupola, crucible and electric furnaces, metal mould casting, gravity casting, die casting, centrifugal casting, non-metallic mould casting-shell mould casting. Investment casting, plaster of paris mould casting

UNIT II: MANUFACTURING OF PLASTIC COMPONENTS

Manufacturing of Plastic Components: Types and characteristics of plastics, Future of plastic and its application. Working principles and typical applications of - Injection moulding, compression moulding and extrusion moulding, welding of plastics

UNIT III: BULK DEFORMATION PROCESSES

Bulk Deformation Processes: Hot working and cold working of metals, their comparison and limitation, Hot working process, forging, roll forging, rolling piercing, extrusion, cold working processes – rolling, spinning, roll forming, cold heating, swaging, thread rolling, tube and wire drawing, coining, embossing, tube rolling.

UNIT IV: POWDER METALLURGY

Powder Metallurgy: Principles, method of producing power, pressing, sintering and finishing operation – applications.

UNIT V: WELDING PROCESSES

Welding: Classification of welding processes, Gas welding, oxy-acetylene welding, electric arc welding, TIG and MIG welding, submerged arc welding, resistance welding and atomic - hydrogen welding. New welding techniques - Plasma arc welding, ultrasonic welding, electro-slag welding, electron beam welding, laser beam welding, plastic welding, friction welding, Thermit welding, welding of cast iron, aluminium and its alloys, copper and its

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alloys. Weld defects. Testing of weld destructive & non-destructive tests, Flange cutting. Brazing and Soldering: Soldering process. Brazing process, Comparison of the processes and their application

BOOKS AND REFERENCES

Text Books

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,4th Edition, 2013
2. P.N.Rao Manufacturing Technology Volume 1 Mc Grawhill Education 5th edition,2018.

Reference Books

1. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2. S. Gowri P. Hariharan, A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.
3. Paul Degarma E, Black J.T and Ronald A. Kosher, Eligth Edition, Materials and Processes, in Manufacturing, Eight Edition, Prentice – Hall of India, 1997.
4. Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997
5. Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME – 301**
Course Name	**Thermodynamics**
Course Credits	**3 (T) + 0 (P) = 3**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

1) Course Overview:

A course in thermodynamics typically covers the fundamental the behavior of energy and its principles governing transformations within systems. This subject throw light on system, surrounding, energy conversion by help of entropy principal.

2) **Prerequisite:**

Before diving into a thermodynamics course, it's beneficial to have a solid foundation in several key areas of science and mathematics. Some common prerequisites that students have to know that physics, chemistry, Algebra and simple mathematics etc.

3) Objective of the Syllabus:

The objective of a thermodynamics syllabus is to provide students with a comprehensive understanding of the principles governing the behavior of energy and its transformations within systems. By the end of the course, students Understand Fundamental Concepts, Apply Thermodynamic Principles, Study Thermodynamic Cycles, Examine Equilibrium and Stability, Prepare for Further Study or Professional Practice et Overall, the objective is to provide students with a strong theoretical and practical understanding of thermodynamics, preparing them for both further academic pursuits and practical applications in various fields.

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4) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Acknowledge the different thermodynamics terminology, basic concept and application of First law of thermodynamics for open or closed system and for steady or unsteady processes
CO2	Application of second law of thermodynamics for any process and any system and concept of entropy
CO3	Understanding of various properties diagram and application of Rankine cycle to steam power plant
CO4	To be aware on thermodynamic relations of ideal and real gas.
CO5	Understand the properties of gas mixture and moist air and application of it in psychrometry

5) Syllabus:

UNIT I: BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach.Path and point functions.Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT II: SECOND LAW OF THERMODYNAMICS AND AVAILABILITY

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases different processes, principle of increase in entropy. Applications of II Law. High and

low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT III: PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles..

UNIT IV: IDEAL AND REAL GASES, THERMODYNAMICS RELATIONS

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gasesReduced properties.Compressibility factor-.Principle of Corresponding states. – Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT V: GAS MIXTURES AND PSYCHROMETRY

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gasconstant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometricproperties, Psychrometric charts. Property calculations of air vapour mixtures by using chart andexpressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

BOOKS AND REFERENCES

Text Books

1. R.K.Rajput, "A Text Book Of Engineering Thermodynamics ",Fifth Edition,2017.
2. Yunus a. Cengel &michael a. Boles, "Thermodynamics", 8th edition 2015.

Reference Books

1 Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Borgnakke & Sonnatag, "Fundamental of Thermodynamics", 8th Edition , 2016.
3. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2016.

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 401**
Course Name	**Applied Thermodynamics**
Course Credits	**3 (T) + 1 (P) = 4**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

6) Course Overview:

An applied thermodynamics course focuses on the practical application of thermodynamic principles to engineering systems and processes. Throughout the course, students will engage in theoretical studies, problem-solving exercises, and possibly laboratory experiments to reinforce theoretical concepts and develop practical skills in applied thermodynamics. The course aims to provide students with the knowledge and tools necessary to analyze, design, and optimize thermodynamic systems in engineering practice.

Prerequisite:

To learn engineering applied thermodynamics, it's important to have a strong foundation in mathematics, physics, and chemistry. Specifically, a good understanding of calculus, differential equations, mechanics, and heat transfer will be beneficial. Additionally, knowledge of basic engineering principles and concepts such as energy, work, and the laws of thermodynamics will be helpful very helpful.

7) Objective of the Syllabus:

The objective of an applied thermodynamics course is to provide students with the knowledge, skills, and analytical tools necessary to analyze, design, and optimize thermodynamic systems commonly encountered in engineering practice. Analysis of practical devices/applications using first and second law, applications such as steam andgas turbine power plants, vapor compression refrigeration devices, spark ignition and compression ignition IC engines, psychrometry, combustion of fuels and compressible flow through nozzle. By the end of the course, students should be equipped with the knowledge, skills, and practical experience necessary to apply thermodynamic principles to solve real-

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world engineering challenges and contribute effectively to the development of innovative and sustainable engineering solutions.

8) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
CO2	They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.
CO3	They will be able to understand phenomena occurring in high speed compressible flows.
CO4	They understand about the properties of dry and wet air and the principles of psychrometry.
CO5	Students will able to learn the about reciprocating compressors with and without intercooling.

9) Syllabus:

UNIT I: FUELS AND COMBUSTRION

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations are using free energy.

UNIT II: THERMODYNAMICS CYCLES AND ITS APPLICATIONS

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, energy analysis. Super-critical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and

intercooling Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.

UNIT III: AIR CONDITIONING AND PSYCHOMETRIC PROCESS

Properties of dry and wet air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

UNIT IV: COMPRESSIBLE FLOW

Basics of compressible flow, Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation- compressible flow in diffusers, efficiency of nozzle and diffuser.

UNIT V: RECIPROCATING COMPRESSORS AND ANALYSIS OF STEAM TURBINES

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors, Analysis of steam turbines, velocity and pressure compounding of steam turbines.

BOOKS AND REFERENCES

Text Books

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6 th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India.
3. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co.Ltd.

Reference Books

1 Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

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Applied Thermodynamics LAB **SUB-CODE:ETME - 411**

CREDIT: 1.5

Course Objective:

- Understanding of application of Law of thermodynamics
- To find the calorific value of various fuels.
- Application of First law of thermodynamics to reacting system.

Course Outcomes:

At the end of the course the students are able to:
They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.

Syllabus:

Week 1: To find out dryness fraction of steam by combined separating and throttling calorimeter.
Week 2: To Study Low pressure boilers and their mounting and accessories
Week 3: To Study high pressure boilers and their mounting and accessories.
Week 4: To Study the working of impulse and reaction steam turbines.
Week 5: To find power output and efficiency of a steam turbine.
Week 6: To Study cooling tower and find its efficiency.
Week 7: To Study the construction and working of steam turbine.
Week 8: To Study and find volumetric efficiency of a reciprocating air compressor.
Week 9: To Study the working of impulse and reaction steam turbines.
Week 10: To prepare heat balance sheet for given boiler.

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 402**
Course Name	**Fluid Mechanics**
Course Credits	**3 (T) + 1 (P) = 4**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

10) **Course Overview:**

Fluid mechanics is the branch of physics and engineering that deals with the behavior of fluids (liquids and gases) at rest and in motion. It provides students with a comprehensive understanding of the behavior of fluids (liquids and gases) and their applications in engineering and science. This subject provide brief knowledge of fluid statics, kinematics and Dynamics behavior of the fluid.

11) **Prerequisite:**

The prerequisites for a fluid mechanics course typically include a foundation in several key areas of mathematics, physics, and engineering.

12) Objective of the Syllabus:

The objectives of a fluid mechanics course typically aim to provide students with a thorough understanding of the fundamental principles and applications of fluid mechanics. In this course students are able to learn about the application of mass and momentum conservation laws for fluid flows, Fluid Behavior Analysis, Fluid Forces and Pressure Distribution, Flow Measurement and Instrumentation, learn the obtain the velocity and pressure variations in various types of simple flows, understand the importance of dimensional analysis, analyze the flow in water pumps and turbines, applications in Engineering etc.Overall, the objective of a fluid mechanics course is to equip students with the knowledge, skills, and analytical tools necessary to understand, analyze, and solve engineering problems related to the behavior of fluids in various applications.

13) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Understand the fundamental principles of fluid mechanics, including fluid properties, fluid statics, and fluid dynamics
CO2	Apply mathematical techniques to solve problems related to fluid flow, including differential equations, vector calculus, and numerical methods
CO3	Conduct laboratory experiments to measure fluid flow parameters, such as velocity, pressure, and flow rate, using appropriate instrumentation and techniques.
CO4	Predict fluid behavior under different flow conditions, including steady and unsteady flow, compressible and incompressible flow, and viscous and inviscid flow.
CO5	Demonstrate ethical behavior and professional responsibility in the practice of fluid mechanics, including honesty, integrity, and respect for diversity and environmental sustainability

14) Syllabus:

UNIT I: BASIC CONCEPTS AND PROPERTIES OF FLUID

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension.

UNIT II: FLUID STATICS AND BUOYANCY

Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges. Hydrostatic force on vertical, horizontal inclined and curved surface. Study of Buoyancy Force, centre of buoyancy, stability analysis of floating body, determination of metacentric height.

UNIT III: FLIUD KINEMATICS AND FLUID DYNAMICS

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline -stream function - velocity potential function - circulation - flow

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net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter,Orifice meter, Pitot tube.

UNIT IV: DIMENSIONALANALYSIS

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT V: :INCOMPRESSIBLE FLUID FLOW AND BOUNDARY LAYERSEPARATION

Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy weisback's equation – pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

BOOKS AND REFERENCES

Text Books

Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.2.

Reference Books

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint,2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016.
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, “Fluid Mechanics and Machinery”,2011
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co.2010.

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FLUID MECHANICS LAB SUB-CODE:ETME - 412 CREDIT: 1.5

Course Objective:

To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

Course Outcomes:

At the end of the course the students are able to understand the laboratory component and focous on practical skills, experimental techniques, and data analysis related to fluid mechanic. They are equip with the knowledge of measurement of equipments for flow measurement also they are able to Perform test on different fluid machinery.

Syllabus:

Week 1: To determine the Metacentric Height of a ship model.

Week 2: Verification of Bernoulli's Theorem.

Week 3: To To find the coefficient "k" for given Venturimeter.

Week 4: To determine the hydraulic coefficients Cv, Cc and Cd for Orifice and Mouthpiece apparatus.

Week 5: To find the value of Critical Velocity in pipes by Reynolds's Experiment.

Week 6: To determine the coefficient of friction for pipes of different sizes.

Week 7: To Study the construction and working of steam turbine.

Week 8: To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile..

Week 9: To study the variation of friction factor 'f' for turbulent flow in commercial pipes.

Week 10: To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.

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Subject Code	**ETME-403**
Course Name	**STRENGTH OF MATERIALS** (SOM)
Course Credits	**3 (L) +1(T)+1(P)=5**
Total Course Credit	**169**

Abbreviations: L-Lecture, T- Tutorial, P-Practical

1. Course Overview:

This course explains about the mechanics of the deformable bodies and determines their strength under various types of loadings.

2. Prerequisite: There are no specific prerequisites for this course, although a basic understanding of Mechanics is recommended.

3. Objective of the Syllabus:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

4. Course Outcomes: after the successful completion of this course students will be eligible to

Sl.No.	Course Outcomes(Cos)
CO1	1. Apply the principle concepts behind stress, strain and deformation of solids for various engineering applications.
CO2	2. Analyze the transverse loading on beams and stresses in beam for various engineering applications.
CO3	3. Analyze the torsion principles on shafts and springs for various engineering applications.
CO4	4. Analyze the deflection of beams for various engineering applications.
CO5	Analyze the thin and thick shells and principal stresses in beam for various engineering applications.

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5. Syllabus:

MODULE I: STRESS, STRAIN AND DEFORMATIONOF SOLIDS

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle

MODULE II: TRANSVERSE LOADING ON BEAMS AND STRESSESIN BEAM

Beams and type's transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

MODULE III: DEFLECTIONOF BEAMS

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems

MODULE IV: TORSION

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at ends, stresses and deflection of helical springs.

MODULE V: THIN CYLINDERS, SPHERES ANDTHICK CYLINDERS

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure

BOOKS AND REFERENCES:

1) Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2007
2) Jindal U.C., Strength of Materials, Asian Books Pvt. Ltd., New Delhi, 2007
3) Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi,2001.
4) R. Subramanian, Strength of Materials, Oxford University Press,2007.
5) Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005.

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STRENGTH OF MATERIALS LAB **SUB-CODE: ETME413**

Course Objectives:

- To study the mechanical properties of materials when subjected to different types of loading with the help of experiments in lab.
- To verify the principles studied in STRENGTH OF MATERIAL theory by performing experiments in lab.

Syllabus:

Week-1. To study the Brinell Hardness testing machine and perform the Brinell hardness test.
Week-2. To study the Rockwell Hardness Testing machine and perform the Rockwell hardness test.
Week-3. To study the torsion testing machine and perform the torsion test
Week-4. To study the impact testing machine and perform the impact test (Izod and Charpy test).
Week-5. To determine the fatigue strength under reversed bending stresses using S-N curve.
Week-6. To determine the torsion properties of Mild Steel
Week-7. To determine the tensile strength by Universal Testing machine UTM.
Week-8. To determine the compressive strength by Universal testing machine UTM.
Week-9. To determine bending strength by Universal testing machine UTM.
Week-10. To determine shearing strength by Universal testing machine UTM.

Course Outcomes:

Upon completion of this course, the students will be able to:
1. Apply the principle concepts behind stress, strain and deformation of solids for various Engineering applications.
2. Analyze the transverse loading on beams and stresses in beam for various engineering Applications.
3. Analyze the torsion principles on shafts and springs for various engineering applications.
4. Analyze the deflection of beams for various engineering applications.

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5. Analyze the thin and thick shells and principal stresses in beam for various engineering applications.

BOOKS AND REFERENCES:

1) Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2007
2) Jindal U.C., Strength of Materials, Asian Books Pvt. Ltd., New Delhi, 2007
3) Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
4) R. Subramanian, Strength of Materials, Oxford University Press, 2007.
5) Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005.

Programme Structure	B. Tech (Mechanical Engineering)
Subject Code	ETME - 404
Course Name	Materials Engineering
Course Credits	3 (T) + 0 (P) = 3
Total Course Credit	169

Abbreviations: T-Theory, P-Practical

15) Course Overview:

A course overview of materials engineering typically covers a wide range of topics related to the properties, processing, and applications of materials. This section provides an overview of the field, including the classification of materials, historical developments, and the role of materials in engineering applications.

16) **Prerequisite:**

To introduce the concepts of the mechanical behavior of materials under different loading conditions. Topics include stress and strain, elastic and plastic deformation, fracture mechanics, hardness, toughness, and fatigue.

17) Objective of the Syllabus:

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

18) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
CO2	Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
CO3	Clarify the effect of alloying elements on ferrous and non-ferrous metals
CO4	Summarize the properties and applications of non metallic materials.
CO5	Explain the testing of mechanical properties.

19) Syllabus:

UNIT I: ALLOYS AND PHASE DIAGRAMS

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application

UNIT II: HEAT TREATMENT

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams –

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cooling curves superimposed onI.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

UNIT III: FERROUS AND NON-FERROUS METALS

Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys– Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV: NON-METALLIC MATERIALS

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON –Composites- Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V: MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test lzod and charpy, fatigue and creep failure mechanisms.

BOOKS AND REFERENCES

Text Books

1. Balasubramaniam, R. “Callister's Materials Science and Engineering”. Wiley India Pvt. Ltd.,2014.
2. Raghavan, V. “Physical Metallurgy: Principles and Practice”. PHI Learning, 2015.
3. Raghavan, V. “Materials Science and Engineering: A First course”. PHI Learning, 2015.

Reference Books

1. Askeland, D. “Materials Science and Engineering”. Brooks/Cole, 2010.

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2. Smith, W.F., Hashemi, J. & Prakash, R. “Materials Science and Engineering”. Tata McGraw Hill Education Pvt. Ltd., 2014.
3. Wahab, M.A. “Solid State Physics: Structure and Properties of Materials”. Narosa Publishing House, 2009.

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Programme Structure	**B.Tech. (MECHANICAL ENGINEERING)**
Subject Code	**ETEC-405**
Course Name	**Instrumentation and Control**
Course Credits	**3 (L) = 3**
Total Course Credit	**182**

Abbreviations: L-**lectures per week**

11) Course Overview:

The Instrumentation and Control course provides students with a comprehensive understanding of the principles, techniques, and applications of instrumentation and control systems in various engineering fields. Through theoretical lectures, practical laboratory sessions, and hands-on projects, students develop the necessary skills to design, analyze, and troubleshoot instrumentation and control systems in real-world scenarios.

12) **Prerequisite:** Basic knowledge of physics, mathematics (calculus, differential equations), and electrical circuits is recommended. Familiarity with programming languages such as MATLAB, Python, or C/C++ is beneficial but not mandatory.

13) Objective of the Syllabus:

To introduce fundamental concepts of instrumentation and control systems & familiarize students with various sensors, actuators, and signal conditioning techniques.

14) Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	Understand fundamentals of Introduction to Basic principles of measurement.
CO2	Apply in Theory and construction of various transducers to measure displacement.
CO3	Understand the basic concepts of Various types of stress and strain measurements.
CO4	Understand the basic concepts of ELEMENTS OF CONTROL SYSTEMS.

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CO5	Understand fundamentals of System models, transfer function and system response, frequency response.

15) Syllabus:

MODULE I: BASIC PRINCIPLESOF MEASUREMENT Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error

MODULE II: MEASUREMENT OF DISPLACEMENT Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures

MODULE III: STRESS STRAIN MEASUREMENTS Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes

MODULE IV: ELEMENTS OF CONTROL SYSTEMS 5

Introduction, Importance – Classification – Open and closed systems Servomechanisms– Examples with block diagrams–Temperature, speed & position control systems.

MODULE V: SYSTEM MODULE AND TRANSFER FUNCTION System models, transfer function and system response, frequency response; Nyquist diagrams and their use

REFERENCES

1. Measurement Systems: Applications & design by D.S Kumar.
2. Mechanical Measurements / BeckWith, Marangoni,Linehard, PHI / PE

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Programme Structure	B. Tech (Mechanical Engineering)
Subject Code	ETME - 501
Course Name	Heat and Mass Transfer
Course Credits	3 (T) + 1 (P)
Total Course Credit	168

Abbreviations: T-Theory, P-Practical

20) **Course Overview:**

A course in heat and mass transfer typically covers the principles, mechanisms, and applications of heat transfer (thermal energy transport) and mass transfer (mass transport) in engineering system. Course in heat and mass transfer aims to provide students with a comprehensive understanding of the principles, mechanisms, and applications of heat and mass transfer, preparing them for careers in engineering, research, and technology development across various industries.

21) **Prerequisite:**

The prerequisites for a subject in heat and mass transfer typically include foundational knowledge in mathematics, physics, and engineering. It's essential for students to review the course requirements and consult with instructors or academic advisors to ensure they have the necessary background knowledge and skills before enrolling in a heat and mass transfer subject.

22) **Objective of the Syllabus:**

The objectives of a heat transfer subject typically encompass understanding the fundamental principles of heat transfer and their application to engineering problems. Some major points are Develop a fundamental understanding of the mechanisms and modes of heat transfer, including conduction, convection, and radiation, Understand the principles of thermal equilibrium, temperature gradients, and heat flux, Comprehend the mechanisms of heat conduction in solids and the mathematical formulation of Fourier's Law, nalyze steady-state and transient heat conduction problems in one-dimensional and multi-dimensional geometries, Understand the principles of convection heat transfer in fluids, including forced and natural convection, Grasp the basics of thermal radiation, including blackbody radiation, emissivity, and the Stefan-Boltzmann

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Law, Learn the design principles of heat exchangers and analyze their performance in various applications etc.

By achieving these objectives, students can develop a solid foundation in heat transfer principles and their practical applications, preparing them for careers in various engineering fields where heat transfer plays a crucial role.

23) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Demonstrate a comprehensive understanding of the fundamental principles and modes of heat transfer, including conduction, convection, and radiation.
CO2	Apply mathematical techniques to solve heat transfer problems, including differential equations, Fourier's law, Newton's law of cooling, and Stefan-Boltzmann law
CO3	Analyze steady-state and transient heat conduction problems in one-dimensional and multi-dimensional geometries, including composite materials and transient heat conduction.
CO4	Calculate convective heat transfer coefficients and analyze forced and natural convection heat transfer problems in various engineering applications.
CO5	Apply radiation heat transfer principles to analyze heat transfer between surfaces, including blackbody radiation, emissivity, and view factors.

24) Syllabus:

UNIT I: CONDUCTION

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation– Fourier Law of Conduction - General Differential equation of Heat Conduction–Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems –Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces –Unsteady Heat Conduction – Lumped Analysis – Use of Heisler Chart.

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UNIT II: CONVECTION

Basic Concepts –Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection –Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow –Combined Laminar and Turbulent –Flow over Bank of tubes – Free Convection –Dimensional Analysis – Flow over Vertical Plate,Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III: PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

Introduction-boiling regimes and types of boiling-pool boiling flow boiling, correlations in boiling –Nusselt's theory of condensation – types of condensation-film wise and drop wise condensation.Types of Heat Exchangers – Heat Exchanger Analysis – LMTD method andEffectiveness- NTU method – Overall Heat Transfer Coefficient – Fouling Factors.

UNIT IV: RADIATION

Basic Concepts - Laws of Radiation – Stefan-Boltzmann Law, Kirchoff‟s Law –Black BodyRadiation –Gray body radiation -Shape Factor Algebra – Electrical Analogy – Radiation Shields Introduction to Gas Radiation.

UNIT V: MASS TRANSFER

Basic Concepts – Diffusion Mass Transfer – Fick‟s Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations.

5. BOOKS AND REFERENCES

Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.2.

6. Text Books

Kothandaraman C.P “Fundamentals of Heat and Mass Transfer”New AgeInternational, New Delhi, 4th Edition 2012 (MODULE I, II, III, IV)

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Yunus A.Cengel and Afshin J. Ghajar "Heat and Mass TransferFundamentals&Applications", McGraw-Hill Education, 5th Edition,2015 (MODULE I, II, III,
IV,V).

Referneces

1. Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer",
   John Wiley & Sons, New Jersey,6th Edition 2006 (MODULE I,II, III, IV, V)

Heat Transfer LAB SUB-CODE:ETME - 511 CREDIT: 1.5

Course Objective:

Course objectives for a heat transfer laboratory typically focus on practical skills, experimental techniques, and data analysis related to heat transfer phenomena. It also study the heat transfer phenomena predict the relevant coefficient using Implementation

- **Course Outcomes:**

  Course outcomes for a heat transfer laboratory focus on practical skills, experimental techniques, and data analysis related to heat transfer phenomena. These includes Students will demonstrate proficiency in setting up experimental apparatuses commonly used in heat transfer experiments, Students will develop skills in conducting a variety of heat transfer experiments, including conduction, convection, and radiation heat transfer, Students will collect experimental data accurately and reliably using appropriate measurement techniques and instruments. By achieving these course outcomes, students will develop practical skills, experimental techniques, and data analysis capabilities essential for applying heat transfer principles in engineering practice and research.

Syllabus:

Week 1: Determination of Heat transfer coefficient in a free convection on a vertical tube.

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Week 2: Determination of LMTD and effectiveness in a parallel flow and counter flow.
Week 3: Determination of Heat transfer coefficient Heat transfer coefficient in a forced convection.
Week 4: Heat transfer through composite wall apparatus.
Week 5: Heat pipe demonstrator.
Week 6: Critical heat flux (pool boiling).
Week 7: Study of heat transfer from a pin-fin.
Week 8: Study of transient conduction heat transfer.
Week 9: Study of emissivity of a surface.
Week 10: Study of Stefan- Boltzmann's law.

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Programme Structure	**B. Tech (MECHANICAL ENGINEERING)**
Semester	**5th**
Subject Code	**ETME-503**
Course Name	**Computer aided design** (CAD)
Course Credits	**3 (L) +1(T)+1(P)=5**
Total Course Credit	**169**

Abbreviations: L-Lecture, T- Tutorial, P-Practical

1. **Course Overview:** This course focuses on the development of modeling/drafting skill of any component.
2. **Prerequisite:** There are no specific prerequisites for this course, although a basic understanding of Geometry and Menstruation is recommended.
3. **Objectives of the Syllabus:**

The main learning objective of this course is to prepare the students for:

1. Applying the fundamental concepts of computer graphics and its tools in a generic framework.
2. Creating and manipulating geometric models using curves, surfaces and solids.
3. Applying concept of CAD systems for 3D modeling and visual realism.
4. Creating and adding geometric tolerances in assembly modeling.
5. Applying CAD standard practices in engineering design

4. **Course Outcomes:** after the successful completion of this course students will be eligible to

Sl.No.	Course Outcomes(Cos)
CO1	Apply the fundamental concepts of computer graphics and its tools in a generic framework.
CO2	Create and manipulating geometric models using curves, surfaces and solids.
CO3	Apply concept of CAD systems for 3D modeling and visual realism.
CO4	Create and adding geometric tolerances in assembly modeling.
CO5	Apply standard CAD practices in engineering design.

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5. Syllabus:

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS

Product cycle- Design process - Computer Aided Design – Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - graphic primitives (point, line, circle drawing algorithms) - Clipping- viewing transformation.

UNIT II GEOMETRIC MODELING

Representation of curves - Hermite cubic spline curve, Bezier curve, B-spline curves, Surface Modeling – Surface Entities, Representation of Surface, Bezier Surface, B-Spline Surface and Coons Surface. Solid Modeling - Solid Entities, Solid Representation, Boundary Representation (BRep), Sweeps Representation, Constructive Solid Geometry (CSG).

UNIT III VISUAL REALISM

Need for hidden surface removal, The Depth - Buffer Algorithm, Properties that help in reducing efforts, Scan Line coherence algorithm, Span - Coherence algorithm, Area-Coherence Algorithms, Warnock's Algorithm, Priority Algorithms– shading – coloring – computer animation.

UNIT IV PART ASSEMBLY

Mass properties - Assembly modeling – Inference of position and orientation – Geometric Dimensioning and Tolerancing – Functional importance of various types of fits, Geometrical dimensioning and Tolerancing, Tolerance stacking – types and remedies.

UNIT V CAD STANDARDS

Standards for computer graphics- Graphical Kernel System (GKS) - Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, ACIS and DXF - communication standards.

COMPUTER AIDED DESIGN (CAD) **LAB** **SUB-CODE: ETME-513**

Syllabus:

Week-1: Introduction to Auto-Cad:

Week-2: Study of Entity Drawing Commands:

Week-3: Hatching Commands:

Week-4: Creating Texts and Defining Block Attributes

Week-5: Isometric Drawing:

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Week-6: Modeling of screw and nut:
Week-7: Algorithm for Breshanham Line in MATLAB
Week-8: Algorithm for Breshanham Circle in MATLAB

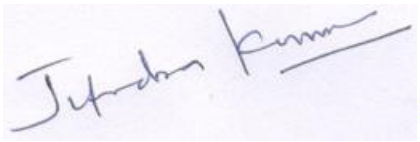
Course Outcomes:
Upon completion of this course, the students will be able to:

1. Apply the fundamental concepts of computer graphics and its tools in a generic framework.
2. Create and manipulating geometric models using curves, surfaces and solids.
3. Apply concept of CAD systems for 3D modeling and visual realism.
4. Create and adding geometric tolerances in assembly modeling.
5. Apply standard CAD practices in engineering design.

BOOKS AND REFERENCES:

1. Groover, M. P., CAD/CAM: Computer-Aided Design and Manufacturing, Pearson Education, 2008.
2. Chris McMahon and Jimmie Browne “CAD/CAM Principles, practice and manufacturing management “Pearson education Asia, 2001.
3. Donald Hearn and M. Pauline Baker “Computer Graphics”’. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes – “Computer graphics principles & practice”, Pearson Education -2003.
5. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.
6. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007.

P. N. Rao, CAD/CAM: Principles and Applications, Tata



Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME-504**
Course Name	**Theory Of Machines**
Course Credits	**3 (T) + 1.5 (P) = 4.5**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

25) Course Overview:

A course on "Theory of Machines" typically delves into the principles governing the behavior and functionality of mechanical systems.

Introduction to Theory of Machines: This section introduces the fundamental concepts of kinematics and dynamics of machines. It covers topics such as types of motion, degrees of freedom, and basic principles of machine design. Kinematics of Machines: Kinematics deals with the study of motion without considering the forces causing it. This part of the course focuses on understanding the various types of motion, mechanisms, and linkages. Mechanisms and Machines: This section explores different types of mechanisms such as four-bar linkage, slider-crank mechanism, gears, cams, and followers. Students learn how these mechanisms are used in machines to convert motion and transmit power. Dynamics of Machines: Dynamics involves the study of forces and their effects on motion. In this part of the course, students learn about the analysis of forces, balancing of rotating masses, and dynamic analysis of mechanisms.

26) **Prerequisite:** To introduce the concepts of basic fundamental concepts of kinematics and dynamics of machines.

27) Objective of the Syllabus:

- To understand the basic components and layout of linkages in the assembly of a system machine.

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- 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.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- 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.
- 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.
- To understand the principles in mechanisms used for speed control and stability control.

28) Course Outcomes:

After completing this course, the students can design various types of linkage mechanisms for obtaining specific motion and analyse them for optimal functioning

S.No.	Course Outcomes(Cos)
CO1	To understand the basic components and layout of linkages in the assembly of a system machine.
CO2	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.

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CO3	Calculate static and dynamic forces of mechanisms.
CO4	Calculate the balancing masses and their locations of reciprocating and rotating masses and estimate the gyroscopic effect on Automobiles, ships and airplanes
CO5	Calculate the speed and lift of the governor

29) Syllabus:

UNIT I: VELOCITY ANALYSIS AND ACCELERATION ANALYSI

Introduction: Mechanisms and machines, kinematics and kinetics, types of links, kinematic pairs and their classification, types of constraint, degrees of freedom of planar mechanism, Grubler's equation, mechanisms, inversion of four bar chain, slider crank chain and double slider crank chain. Velocity analysis: Introduction, velocity of point in mechanism, relative velocity method, velocities in four bar mechanism, slider crank mechanism and quick return motion mechanism, rubbing velocity at a pin joint, instantaneous center method, types and locations of instantaneous center, Kennedy's theorem, velocities in four bar mechanism and slider crank mechanism. Acceleration Analysis: Introduction, acceleration of a point on a link, acceleration diagram, Corioli's component of acceleration, crank and slotted lever mechanism, Klein's construction for slider crank mechanism and four bar mechanism

UNIT II: GEARS AND GEAR TRAINS

Gears and Gear Trains: Introduction, classification of gears, law of gearing, tooth forms and their comparisons, systems of gear teeth, length of path of contact, contact ratio, interference

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and undercutting in involute gear teeth, minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and planetary gear trains, sun and planet gear train.

UNIT III: FORCE ANALYSIS AND TURNING MOMENT

Force Analysis: Static force analysis of mechanisms, D'Alembert's Principle, dynamics of rigid link in plane motion, dynamic force analysis of planar mechanisms, piston force and crank effort. Turning moment on crankshaft due to force on piston, Turning moment diagrams for single cylinder double acting steam engine, four stroke IC engine and multi-cylinder engines, Fluctuation of speed, Flywheel.

UNIT IV: BALANCING AND GYROSCOPE

Balancing: Introduction, static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of reciprocating masses, balancing of single cylinder engine, balancing of multi cylinder inline engines

Gyroscope: Space motion of rigid bodies, angular momentum, gyroscopic couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

NIT V: GOVERNOR

Governors: Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors. Effort and Power of governor, Controlling force diagrams for Porter governor and spring

BOOKS AND REFERENCES

Text Books

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1. F.B. Sayyad, “Kinematics of Machinery”, MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011

2. Rattan, S.S, “Theory of Machines”, 4 Edition, Tata McGraw-Hill, 2014.

3. Utihcker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms Edition, Oxford University Press, 2014.

Reference Books

1. Allen S. Hall Jr., “Kinematics and Linkage Design”, Prentice Hall, 1961

2. Cleghorn. W. L, “Mechanisms of Machines”, Oxford University Press, 2014

3. Ghosh. A and Mallick, A.K., “Theory of Mechanisms and Machines", 3rd Edition Affiliated East West Pvt. Ltd., New Delhi, 2006.

4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.

5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

THEORY OF MACHINES LAB SUB-CODE: ETME-513 CREDIT: 02

Course Objective:

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

Course Outcomes:

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

- Explain gear parameters, kinematics of mechanisms, gyroscopic effect and working of lab Equipments.
- Determine mass moment of inertia of mechanical element, governor effort and range sensitivity, natural frequency and damping coefficient, torsional frequency, and critical speeds of Shafts, balancing mass of rotating and reciprocating masses, and transmissibility ratio

Syllabus:

Week 1 To study of the different types of mechanism system.
Week 1 To study of the mechanisms of transmission system.
Week 2 To determine the critical or whirling speed of a shaft.
Week 3 To determine the characteristics curves of the porter governor.
Week 4 To determine the controlling force and spring stiffness of a Hartnell governor.
Week 5 To determine the gyroscopic couple for the various loads and speeds.
Week 6 To determine the jump speed and to draw the profile of the various cams
Week 7 To determine the natural frequency and spring stiffness of the spring mass system
Week 7 To determine moment of inertia and natural frequency by using simple pendulum.
Week 8 To determine the radius of Gyration of given bar by using Bi-Flier Suspension.
Week 9 To find the natural frequency of transverse vibration of the cantilever beam.
Week 9 To find the natural frequency of transverse vibration of the fixed beam.
Week 10 To determine the balancing mass and angle during the static and dynamic balancing.

REFERENCE BOOKS:

1 Allen S. Hall Jr., “Kinematics and Linkage Design”, Prentice Hall, 1961
2. Cleghorn. W. L, “Mechanisms of Machines”, Oxford University Press, 2014
3. Ghosh. A and Mallick, A.K., “Theory of Mechanisms and Machines", 3rd Edition Affiliated East West Pvt. Ltd., New Delhi, 2006.

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4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME-601**
Course Name	**Manufacturing Technology**
Course Credits	**4 (T) + 0 (P) = 4**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

30) Course Overview:

"Manufacturing Processes" typically covers a broad range of topics related to the processes, methods, and systems involved in manufacturing various products. This part of the course delves into various manufacturing processes such as machining. This section provides an overview of manufacturing processes, the importance of manufacturing in the economy, and the role of manufacturing technology in producing goods.

31) **Prerequisite:** To introduce the concepts of basic manufacturing processes and fabrication techniques, such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.

32) Objective of the Syllabus:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

33) Course Outcomes:

S.No.	Course Outcomes (Cos)
CO1	Explain the mechanism of material removal processes.
CO2	Describe the constructional and operational features of centre lathe and other special Purpose lathes.

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CO3	Describe the constructional and operational features of shaper, planner, milling, drilling, Sawing and broaching machines.
CO4	Explain the types of grinding and other super finishing processes apart from gear Manufacturing processes.
CO5	Summarize numerical control of machine tools and write a part program.

34) Syllabus:

UNIT I THEORY OF METAL CUTTING

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle: Swiss type, automatic screw type – multi spindle:

UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES

Shaper - Types of operations. Drilling, reaming, boring, and Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling ,hobbing and gear shaping processes –finishing of gears.

UNIT IV ABRASIVE PROCESS AND BROACHING

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding and internal grinding-Typical applications concepts of surface integrity, broaching machines: broach construction – push, pull surface and continuous broaching machines

UNIT V CNC MACHINING

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Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, and part programming fundamentals CNC – manual part programming – micromachining – wafer machining.

BOOKS AND REFERENCES

Text Books:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2014
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013.

References:

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998
2. Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 1984
3. HMT, "Production Technology", Tata McGraw Hill, 1998.
4. Roy. A.Lindberg, "Process and Materials of Manufacture," Fourth Edition, PHI/Pearson Education 2006.
4. Roy. A.Lindberg, "Process and Materials of Manufacture," Fourth Edition, PHI/Pearson Education 2006.

Programme Structure	**B. Tech (MECHANICAL ENGINEERING)**
Semester	**6th**
Subject Code	**ETME-602**
Course Name	Design of Machine Elements
Course Credits	**3 (L) +1(T)+1(P)=5**
Total Course Credit	**169**

Abbreviations: L-Lecture, T- Tutorial, P-Practical

1. Course Overview:

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This course explains about the determination of dimensions by following the standard design steps for any mechanical components such as bearings, shafts and coupling, internal combustion engine parts, joints and springs etc.

2. Prerequisite: There are no specific prerequisites for this course, although a basic understanding of Mechanics and engineering drawing is recommended.

3. Objective of the Syllabus:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
- (Use of P S G Design Data hand Book is permitted)

4. Course Outcomes: after the successful completion of this course students will be eligible to

SL. No.	Course Outcomes(Cos)
CO1	Explain the influence of steady and variable stresses in machine component design.
CO2	Apply the concepts of design to shafts, keys and couplings.
CO3	Apply the concepts of design to temporary and permanent joints.
CO4	Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
CO5	Apply the concepts of design to bearings.

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5. Syllabus:

MODULE I: STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

MODULE II: SHAFTS AND COUPLINGS

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

MODULE III: TEMPORARY AND PERMANENT JOINTS

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

MODULE IV: ENERGY STORING ELEMENTS AND ENGINE COMPONENTS Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

MODULE V: BEARINGS

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings

DESIGN OF MACHINE ELEMENTS LAB **SUB-CODE:ETME611**

Course Objectives:

- To familiarize with the detailing and failure of any mechanical component.
- To understand the various steps involved in the Design Process of a mechanical component.

Syllabus:

Week-1. Design & drawing of Cotter joint.

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Week-2. Design & drawing of Knuckle joint.
Week-3. Design of machine components subjected to combined steady and variable loads.
Week-4. Design of eccentrically loaded riveted joint.
Week-5. Design of boiler riveted joint.
Week-6. Design of shaft for combined constant twisting and bending loads.
Week-7. Design of shaft subjected to fluctuating loads.
Week-8. Design and drawing of flanged type rigid coupling.
Week-9. Design and drawing of flexible coupling.
Week-10. Design and drawing of helical spring

Course Outcomes:

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

1. Design machine members subjected to static and variable loads.
2. Design shafts and couplings for various applications.
3. Analyze bolted and welded joints for various kinds of loads.
4. Design helical, leaf springs and flywheels for various applications.
5. Design and select sliding and rolling contact bearings.

BOOKS AND REFERENCES:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co,2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical
3. Design Data Hand Book", PSG College of Technology, Coimbatore, 2013.
4. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",6th Edition, Wiley, 2017.
5. Sundararajamoorthy T. V. and Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
6. Design Data Hand Book", PSG College of Technology, Coimbatore, 2013.

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 621**
Course Name	**Power Plant Engineering**
Course Credits	**3 (T) + 1 (P) = 4**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

35) Course Overview:

This Course provides a simple understanding of the power plant engineering. The course contains the details of steam and gas thermal power plants, hydro power plants, nuclear power plants, along with solar, wind and geothermal energy power systems in addition to the direct energy conversion. The economics of power generation and the environmental aspect of power generation are also being addressed in this course. The main purpose of implementing this course in curriculum is to learn about how the power is generated in a power plant and its applications.

Prerequisite:

Before taking a course in power plant engineering, students typically need to have a strong foundation in several key areas of science and engineering. Here are some common prerequisites are Thermodynamics, Fluid Mechanics, Thermal engineering, Heat transfer etc.

36) Objective of the Syllabus:

The objective of a power plant engineering syllabus is to provide students with a comprehensive understanding of the design, operation, and optimization of power generation systems. Here's an overview of the objectives typically covered in such a syllabus are Introduction to Power Plants, Thermodynamic Analysis of Power Cycles, Components of Power Plants (Boiler, Condenser, Generator, Turbine, pump), Plant Layout and Design Considerations, Environmental and Safety Considerations.

By the end of the course, students should be equipped with the knowledge, skills, and practical experience necessary to design, operate, and manage power generation systems

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effectively and efficiently, considering technical, economic, environmental, and societal aspects.

37) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Upon completion of this course, students will be able to explain the layout, construction and working of the components inside a thermal power plant.
CO2	They will able to explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.
CO3	Students are able to explain the layout, construction and working of the components inside nuclear power plants.
CO4	They understand the importance of dimensional analysis
CO5	Students will able to obtain the velocity and pressure variations in various types of simple flows

38) Syllabus:

UNIT I: BASIC BASIC CONCEPTS AND PROPERTIES OF FLUID

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids -density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility,vapour pressure, capillary and surface tension

UNIT II: FLUID STATICS AND BUOYANCY

Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges. Hydrostatic force on vertical, horizontal inclined and curved surface. Study of Buoyancy Force,centre of buoyancy,stability analysis of floating body,determination of metacentric height.

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UNIT III: FLIUD KINEMATICS AND FLUID DYNAMICS

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration- continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube.

UNIT IV: :DIMENSIONALANALYSIS

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT V: :INCOMPRESSIBLE FLUID FLOW AND BOUNDARY LAYER SEPARATION

Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy weisback's equation – pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

.

BOOKS AND REFERENCES

Text Books

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.
2. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co.2010.

Reference Books

1 Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint,2011.
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p Ltd., Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, “Fluid Mechanics and Machinery”,2011.

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Programme Structure	**B. Tech (MECHANICAL ENGINEERING)**
Semester	**6th**
Subject Code	ETME-625
Course Name	Vibration & Mechanical systems (VMS)
Course Credits	**3 (L) +0(T)+0(P)=3**
Total Course Credit	**169**

Abbreviations: L-Lecture, T- Tutorial, P-Practical

1. Course Overview: This course is about the oscillation and vibration phenomena occur in any system and the techniques used to reduce it to protect it from failure.

2. Prerequisite: There are no specific prerequisites for this course, although a basic understanding of engineering mechanics is recommended.

3. Objectives of the Syllabus:

1. Apply the fundamental concepts of vibration.
2. Apply the fundamentals of noise.
3. Describe the various sources of noise for automotive applications.
4. Determine the natural frequencies and mode shapes of the two degree freedom systems.
5. Describe the different types of noise and its control measures.

4. Course Outcomes: after the successful completion of this course students will be eligible to

Sl.No.	Course Outcomes(Cos)
CO1	Apply the fundamental concepts of vibration.
CO2	Apply the fundamentals of noise.
CO3	Describe the various sources of noise for automotive applications.

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CO4	Determine the natural frequencies and mode shapes of the two degree freedom systems.

5. Syllabus:

MODULE I: FUNDAMENTAL ASPECTS OF VIBRATIONS

Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non- harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series; elements of vibratory system; lumped and distributed parameter systems. Undamped Free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: the compound pendulum.

MODULE II: DAMPED FREE VIBRATIONS

Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

MODULE III: HARMONICALLY EXCITED VIBRATION

One degree of freedom- forced harmonic vibration; vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility; absolute and relative motion of mass (Seismic Instruments). Whirling Motion and Critical Speed: Whirling motion and Critical speed: Definitions and significance. Critical speed of a vertical, light flexible shaft with single rotor: with and without damping. Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed

MODULE IV: SYSTEMS WITH TWO DEGREES OF FREEDOM

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Un-damped free vibration of 2 degree of freedom and Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation ; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

MODULE V: NOISE ENGINEERING SUBJECTIVE RESPONSE OF SOUND

Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging, sound spectra and Octave band analysis; loudness; weighting networks; equivalent sound level, auditory effects of noise; hazardous noise, exposure due to machines and equipments; hearing conservation and damage risk criteria, daily noise doze.

TEXT BOOKS:

1. Ambekar. A. G., Mechanical Vibrations and Noise Engineering", Prentice Hall of India Pvt. Ltd., 2006
2. Singiresu S. Rao, "Mechanical Vibrations", Pearson Education Incorporated, 2017

REFERENCES:

1. Benson H. Tongue, "Principles of Vibrations", Oxford University, 2007.
2. David A. Bies and Colin H. Hansen, "Engineering Noise Control – Theory and Practice", Spon Press, 2009.
3. Grover. G.K., edited by Nigam. S. P., "Mechanical Vibrations", Nem Chand and Bros., 2014.
4. Julian Happian-Smith - "An Introduction to Modern Vehicle Design", ButterworthHeinemann, 2001.
5. William T. Thomson, "Theory of Vibration with Applications", Taylor & Francis, 2003.

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 701**
Course Name	**Refrigeration and Air-conditioning**
Course Credits	**3 (T) + 1 (P) = 4**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

Course Overview:

A course in refrigeration and air conditioning typically covers the principles, techniques, and applications of refrigeration and air conditioning systems. This subject helps in to understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components. It also provide the knowledge on design aspects of Refrigeration & Air conditioning systems.

Prerequisite:

The prerequisites for a course in refrigeration and air conditioning can vary depending on the level and depth of the course, but typically include a foundation in several key areas such as Thermodynamics, Heat transfer, Fluid mechanics, physics, mathematics etc.

39) Objective of the Syllabus:

The objectives of a syllabus for a course in refrigeration and air conditioning typically aim to provide students with a comprehensive understanding of the principles, technologies, and applications of refrigeration and air conditioning systems. Here's a general outline of the objectives which students are able to be learned after the study of this subject. These includes Fundamental concept of refrigeration and conditioning, Various refrigeration cycle, Different types of refrigerents use in refrigerator and heat pump, study about condenser, evaporator and various refrigerator equipments. Overall, the objective of a refrigeration and air conditioning syllabus is to equip students with the knowledge, skills, and tools necessary to design, install, operate, and maintain efficient and reliable refrigeration and air conditioning systems in various applications and industries

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40) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Explain the basic concepts of Refrigeration
CO2	Explain the Vapor compression Refrigeration systems and to solve problems
CO3	They learn about the various types of Refrigeration systems
CO4	They understand the claculation of the Psychrometric properties and its use in psychrometric processes
CO5	Explain the concepts of Air conditioning and to solve problems

41) Syllabus:

UNIT I: INTRODUCTION

Introduction to Refrigeration - MODULE of Refrigeration and C.O.P.– Ideal cyclesRefrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

UNIT II: VAPOUR COMPRESSION REFRIGERATION SYSTEM

Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle – subcoolingand super heating- effects of condenser and evaporator pressure on COPmultipressure system - low temperature refrigeration - Cascade systems – problems.

Equipments: Type of Compressors,Condensers, Expansion devices, Evaporators

UNIT III: OTHER REFRIGERATION SYSTEMS

Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic- Vortex and Pulse tube refrigeration systems.

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UNIT IV: PSYCHROMETRIC PROPERTIES AND PROCESSES

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of airconditioning processes, mixing of air streams.

UNIT V: AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls

BOOKS AND REFERENCES

Text Books

1. Arora, C.P., "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010.

Reference Books

1 ASHRAE Hand book, Fundamentals, 2010.
2. Jones W.P., "Air conditioning engineering", 5th edition, Elsevier Butterworth, Heinemann, 2007.
3. Roy J. Dossat, "Principles of Refrigeration", 4th edition, Pearson Education Asia, 2009.
4. Stoecker, W.F. and Jones J. W., "Refrigeration and Air Conditioning", McGraw Hill, New Delhi, 1986.

Refrigeration and Air-conditioning Lab SUB-CODE:ETME - 712 CREDIT: 1.5

Course Objective:

To study the performance of refrigeration cycle and air-conditioning

Course Outcomes:

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- Conduct tests to evaluate the performance of refrigeration and airconditioning test rigs..

Syllabus:

Week 1: To Study of Simple Vapour Compression Refrigeration cycle on Refrigeration Test Rig

Week 2: To Study Simple Vapor Compression Refrigeration cycle on Refrigeration Test Rig (Fin Arrangement)

Week 3: Study of Window air –conditioning System on Test Rig (simple).

Week 4: Study of vapour absorption refrigeration system

Week 5: To study different Psychrometric processes on Psychrometric chart.

Week 6: To Study the analysis of simple vapour compression cycle and explain the types of vapour compression cycle with T-S and P-H diagram.

Week 7: To determine sensible heat factor of air on re-circulated air-conditioning set up.

Week 8: To study works principle of steam jet refrigeration system.

Week 9: Study of various elements of mechanical refrigerator system through actual apparatus

Week 10: To study the chilling plant and its working cycle.

Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 722**
Course Name	**Automobile Engineering**
Course Credits	**3 (T) + 0 (P) = 3**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

42) Course Overview:

Automobile engineering, also known as automotive engineering, is a branch of engineering that deals with the design, development, manufacturing, and maintenance of vehicles, primarily cars, trucks, motorcycles, and other motorized vehicles. It encompasses various disciplines such as mechanical, electrical, electronic, software, and safety engineering. Overall, automobile engineering is a multidisciplinary field that plays a crucial role in shaping the transportation industry, driving innovation, and improving the efficiency, safety, and sustainability of vehicles.

43) **Prerequisite:**

Becoming an automobile engineer typically requires a strong foundation in various areas of science, mathematics, and engineering. The course objectives of automobile engineering aim to equip students with the knowledge, skills, and abilities necessary to understand, design, develop, and maintain automotive systems.

44) Objective of the Syllabus:

To understand the construction and working principle of various parts of an automobile.
To have the practice for assembling and dismantling of engine parts and transmission system

45) Course Outcomes:

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

S.No.	Course Outcomes (Cos)

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CO1	Recognize the various parts of the automobile and their functions and materials.
CO2	Discuss the engine auxiliary systems and engine emission control.
CO3	Distinguish the working of different types of transmission systems.
CO4	Explain the Steering, Brakes and Suspension Systems.
CO5	Predict possible alternate sources of energy for IC Engines.

46) Syllabus:

UNIT I: VEHICLE STRUCTURE AND ENGINES

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines – components-functions and materials, variable valve timing (VVT).

UNIT II: ENGINE AUXILIARY SYSTEMS

Electronically controlled gasoline injection system for SI engines, electronically controlled diesel injection system (injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS)

UNIT III: TRANSMISSION SYSTEMS

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV: STEERING, BRAKES AND SUSPENSION SYSTEMS

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Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control

UNIT V: ALTERNATIVE ENERGY SOURCES

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required – Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

BOOKS AND REFERENCES

Text Books

1. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014..

Reference Books

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.
3. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart - Will Cox Company Inc, USA ,1978.

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Programme Structure	B. Tech (Mechanical Engineering)
Subject Code	ETME-724
Course Name	Advanced Manufacturing Processes
Course Credits	3 (T) + 0 (P) = 3
Total Course Credit	169

Abbreviations: T-Theory, P-Practical

47) Course Overview:

Advanced Manufacturing Processes, also known as non-traditional machining processes, are a group of methods used to remove material from a workpiece using techniques other than traditional cutting tools. These processes are often utilized when traditional machining methods are impractical or ineffective due to factors like hardness, brittleness, or complex shapes of the workpiece material.

48) **Prerequisite:**

Advanced Manufacturing Processes, it's beneficial to have a foundational understanding of engineering principles and basic manufacturing techniques

49) Objective of the Syllabus:

To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

50) Course Outcomes:

S.No.	Course Outcomes (Cos)
CO1	Explain the need for unconventional machining processes and its classification
CO2	Compare various thermal energy and electrical energy based unconventional machining processes.
CO3	Summarize various chemical and electro-chemical energy based unconventional machining processes.

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CO4	Explain various nano abrasives based unconventional machining processes.
CO5	Distinguish various recent trends based unconventional machining processes.

51) Syllabus:

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES

Unconventional machining Process – Need – classification – merits, demerits and applications. Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES

Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing –– Applications. Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

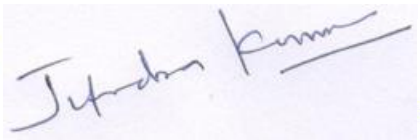
UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES

Chemical machining and Electro-Chemical machining (CHM and ECM)- Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications.

UNIT IV ADVANCED NANO FINISHING PROCESSES

Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES



Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

BOOKS AND REFERENCES

Text Books

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2007.

Reference Books

1. Benedict. G.F. "Nontraditional Manufacturing Processes", Marcel Dekker Inc., New York, 1987.
2. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.
3. Paul De Garmo, J.T.Black, and Ronald. A.Kohser, "Material and Processes in Manufacturing" Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

Programme Structure	B. Tech (Mechanical Engineering)
Subject Code	ETME-827
Course Name	Industrial Pollution
Course Credits	3 (T) + 0 (P) = 3
Total Course Credit	169

Abbreviations: T-Theory, P-Practical

52) Course Overview:

An overview of industrial pollution covers the various types, sources, impacts, and mitigation strategies related to pollution generated by industrial activities.

53) **Prerequisite:**

Industrial pollution requires a multi-faceted approach involving government regulations, industry initiatives, technological innovation, and public engagement to protect the environment and safeguard human health.

54) Objective of the Syllabus:

The objectives of industrial pollution revolve around mitigating its adverse effects on the environment, human health, and socio-economic aspects. Here are some common objectives:

Environmental Protection: Minimizing the release of pollutants into air, water, and soil to safeguard ecosystems, biodiversity, and natural resources.

Public Health: Reducing exposure to harmful substances emitted by industries to prevent health issues such as respiratory diseases, cancer, and neurological disorders among populations living near industrial areas.

55) Course Outcomes:

The outcomes of studying industrial pollution vary depending on the specific course and its objectives. Here are some potential course outcomes:

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S.No.	Course Outcomes (Cos)
CO1	Students gain insight into various industrial processes and the types of pollutants they produce, including air emissions, wastewater discharges, and solid waste generation.
CO2	Students learn about the environmental impacts of industrial pollution on air quality, water bodies, soil health, biodiversity, and ecosystems, as well as its implications for human health and well-being.
CO3	Students learn about the environmental Emissions from industrial processes, combustion of fossil fuels, and release of particulate matter, sulfur dioxide, nitrogen oxides, volatile organic compounds (VOCs), and other pollutants contribute to air pollution.

56) Syllabus:

Course Objectives:

The course has been designed to improve the understanding of the students about different pollution control strategies and the skills of application of remediation techniques to combat pollution in three environmental compartments i.e. air, water and soil.

UNIT I: INTRODUCTION

Introduction: Environments and Human activities, Environments and Ecology, Consequences of population growth. Energy problem, Population of Air, water and land, Fossil fuel related pollutants in the environment

UNIT II: ENVIRONMENTAL IMPACTS

Environmental Impacts of Hydro-electric, Nuclear energy and chemicals forward a solution. Air Pollution, definitions and scales of concentration, classification and properties of air pollutants, emission sources and their classification

UNIT III: AIR POLLUTION

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Air pollution laws and standards, Inversion Ambient air sampling, stack sampling, sampling system, analysis of air pollutants, Air pollution emission control, selection of a particulate: collector, control of gaseous emission, combustion

UNIT IV: WATER POLLUTION

Water Pollution : Hydrologic cycle and water quality , origin of waste water and its composition, Type of water pollutants and their effects, water pollution laws: and standards, waste water sampling and analysis water quality standard, waste water treatment , Biological systems(Aerobic and Facultative ponds), Recovery of material from process effluents. Noise pollution: Different noise environments and their sources, measurement of noise and the equipments Noise pollution lows an, Vibration isolation and noise control in industries.

UNIT V: SOLID WASTE MANAGEMENT

Solid waste management: Sources and classification, Public health aspect, effluent treatment processes and solid waste management: sources and classification, Public health aspect, effluent treatment process and solid waste management, “Solid-Solid separation technique for recovery and reuse. Case study, Modern environmental assessment method, pollution control in steel plants and coal industries

TEXT BOOK:

1. **Managing Industrial Pollution by SC Bhatia**
2. **Enviromental pollution by HM Dix**
3. **Chemistry for environmental engineering by SAWYER**

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Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 824**
Course Name	**Mechatronics System**
Course Credits	**3 (T) + 0 (P) = 3**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

57) Course Overview:

A mechatronics course typically integrates elements of mechanical engineering, electronics, computer science, and control engineering to design and create intelligent systems and products. It involves Mechanical Systems, Electronics and Electrical Systems, Control Systems, Programming and Software Development and Sensors and Actuators etc. Overall, a mechatronics course provides a multidisciplinary approach to engineering, combining principles from mechanical, electrical, and computer engineering to create innovative solutions to complex problems. Hands-on projects and laboratory exercises are often integral components of such courses, allowing students to apply theoretical concepts to practical scenarios

Prerequisite:

The prerequisites for a mechatronics subject typically encompass a combination of knowledge and skills from multiple engineering disciplines.. However, here students might be expected to have Mathematics, Physics, Computer science, Control theory, Digital electronics, Machine learning and Artificial intelligence (AI) etc.

58) Objective of the Syllabus:

To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation. The objective of a mechatronics subject typically revolves around providing students with a comprehensive understanding of the integration of mechanical systems with electronics and computer control in order to design and create intelligent products and processes. Some common objectives of a mechatronics course may include Understanding the fundamental

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principles of mechanical engineering, electronics, and computer science, Learning how to design, model, and analyze electromechanical systems, Developing proficiency in sensor and actuator technologies, Acquiring skills in programming microcontrollers and embedded systems, Exploring control theory and its application in mechatronic systems.

Overall, the objective is to equip students with the knowledge, skills, and mindset necessary to design, build, and optimize complex systems that seamlessly integrate mechanical, electronic, and computational components

59) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.
CO2	Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressin Modes of Microprocessor and Microcontroller.
CO3	Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various device interfacing
CO4	Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering.
CO5	Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

60) Syllabus:

UNIT I: INTRODUCTION

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for

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Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. ensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors.

UNIT II: MICROPROCESSORANDMICROCONTROLLER

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes – Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram.

UNIT III: PROGRAMMABLE PERIPHERALINTERFACE

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Controlinterface.

UNIT IV: PROGRAMMABLE LOGIC CONTROLLER

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

UNIT V: ACTUATORS AND MECHATRONIC SYSTEM DESIGN

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TEXT BOOKS:

1. Bolton, “Mechatronics”, Prentice Hall,2008

2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition, Prentice Hall,2008.

REFERENCES:

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1. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and H all,1993.
2. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print,2013
3. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company,2007.
4. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.
5. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, McGraw Hill International edition,2007.

Programme Structure	**B. Tech (Mechanical Engineering)**
Subject Code	**ETME - 823**
Course Name	**Robot Kinematics and Dynamics**
Course Credits	**3 (T) + 0 (P) = 3**
Total Course Credit	**169**

Abbreviations: T-Theory, P-Practical

61) Course Overview:

A robotics course typically covers a wide range of topics related to the design, construction, programming, and control of robotic systems. Here are some an overview of what the subject Robotics includes are Robot Kinematics and Dynamics, Robot Programming, Motion Planning and Navigation, Robotics Applications, Hands-on Projects etc. A robotics course aims to provide students with a solid foundation in the theory and practice of robotics, preparing them for careers in robotics research, development, and engineering across various industries.

Prerequisite:

The prerequisites for a robotics subject can vary depending on the level and depth of the course. However, here are some common prerequisites that students might be expected to have Mathematics,
Physics, Computer science, Control theory, Digital electronics, Machine learning and Artificial intelligence (AI) etc.

62) Objective of the Syllabus:

The objectives of a robotics subject typically aim to provide students with a comprehensive understanding of the principles, techniques, and applications of robotics. These includes fundamental Understanding of the basic components of a Robot, Design and Construction, use of various types of End of Effectors and Sensors, Programming and Control impart knowledge in Robot Kinematics and Programming learn Robot safety issues and economics, Problem Solving and Optimization, Sensing and Perception, Applications and Case Studies and Innovation and Creativity.

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Overall, the objective of a robotics subject is to prepare students for careers in robotics research, development, and engineering, equipping them with the knowledge, skills, and mindset necessary to contribute to advancements in the field and address complex challenges in society

63) Course Outcomes:

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

S.No.	Course Outcomes (Cos)
CO1	Explain the concepts of industrial robots, classification, specifications and coordinate systems.
CO2	To learn about the kinetics and dynamics behavior of robot
CO3	Also summarize the need and application of robots in different sectors.
CO4	Able the understand the Lagrengian Mechanics of the robot.
CO5	Able to calssify and application of different types of robot.

64) Syllabus:

UNIT I: INTRODUCTION

Introduction to robotics, history of robotics, current research in robotics around the world, Classification of Robotics, Coordinate Frames, Mapping and Transforms.

UNIT II: CO-ORDINATE OF ROBOTS

Coordinate frames, description of objects in space, transformation of vectors, fundamental rotation matrices, composition of rotations, the axis-angle representation, homogeneous Transformations. Direct Kinematic Model

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UNIT III: KINEMATICS MECHANISAM

Forward kinematics, Denavit-Hartenberg Notation, examples of forward kinematics. The Inverse Kinematics Inverse kinematics, workspace, solvability, closed form solutions, algebraic vs. geometric solution, solution by a systematic approach. Manipulator Differential Motion and Statics

UNIT IV: MOTION OF ROBOT

Linear and angular velocity of a rigid body, relationship between transformation matrix and angular velocity, manipulator Jacobian, Jacobian inverse, Jacobian singularities, redundancy 6. Dynamic Modeling

UNIT V: LARGRANGIAN MECHANICS

Largrangian mechanics, two degree of freedom manipulator, dynamic model, Lagrange-Euler formulation, Newton-Euler formulation, inverse dynamics.

Text Books

1. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2012.
2. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering – An Integrated Approach”,Prentice Hall,2003.

References

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education,2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co.,2013.
3. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill,1995.
4. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co.,1992.