School of Engineering and Technology

Programme Structure & Syllabus

MECHANICAL Engineering

2022-23

K.K. University

Bihar Sharif, Nalanda - 803115

K.K. UNIVERSITY 803115 NALANDA

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

SEMESTER-I

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**

SEMESTER-II

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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SEMESTER-III

S.No	CODE	COURSE TITLE	CREDIT	L	T	P	Hours PerWeek	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 Processes	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	9	23	210	490

SEMESTER-IV

S.No	CODE	COURSE 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	Computer Aided Design	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
8	ETME-413	Auto CAD Lab	1.5	0	0	3	3	30	70
TOTAL			**22.5**	**15**	**3**	**9**	**27**	**240**	**560**

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SEMESTER-V

S.No	CODE	COURSE TITLE	CREDIT	L	T	P	Hours PerWeek	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	Theory of Machines	3	3	0	0	3	30	70
4	CMMB-509	sonal Management andIndustrial Relation	3	3	0	0	3	30	70
5	ETSH-501	of Indian TraditionalKnowledge	0	3	0	0	3	30	70
6	ETME-511	Heat and Mass Transfer –Lab	1.5	0	0	3	3	30	70
7	ETME-512	Fluid Machinery- Lab	1.5	0	0	3	3	30	70
8	ETME-513	Theory of Machines-Lab	1.5	0	0	3	3	30	70
TOTAL			**18.5**	**15**	**2**	**9**	**26**	**240**	**560**

SEMESTER-VI

S.No	CODE	COURSE TITLE	CREDIT	L	T	P	Hours Per Week	Internal Marks	External Marks
1	ETME-601	Manufacturing Technology	4	3	1	0	4	30	70
2	ETME-602	Design of Machine Elements	4	3	1	0	4	30	70
3	****	Elective-I	3	3	0	0	3	30	70
4	****	Elective-II	3	3	0	0	3	30	70
5	****	Open Elective-I	3	3	0	0	3	30	70
6	ETME-611	Design of Machine Elements Lab	1.5	0	0	3	3	30	70
7	ETSH-601	Environmental Sciences	0	3	0	0	3	30	70
8	ETME-612	Summer Internship/ Vocational Training	1.5	2 Weeks Vocational Training after 4th Semester				30	70
TOTAL			**20**	**18**	**2**	**3**	**23**	**240**	**560**

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Elective I:	1.	ETME-621	Power plant
	2.	ETME-622	Steam Generators
	3.	ETME-623	Gas Dynamics
Elective II:	1.	ETME-624	Finite ElementMethod
	2.	ETME-625	Vibration Mechanicalsystems
	3.	ETME-626	Rapid Product DevelopmentTechnologies
Open Elective I:	1.	CMMB-621	EntrepreneurshipDevelopment & Business Incubation
	2.	CMMB-622	Total QualityManagement
	3.	CMMB-1101	Principles ofManagement

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SEMESTER-VII

S.NO	CODE	COURSE 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	****	Elective III	3	3	0	0	3	30	70
3	****	Elective-IV	3	3	0	0	3	30	70
4	ETSH-701	Biology	3	3	0	0	3	30	70
5	ETME-711	frigeration and ConditioningLab	1.5	0	0	3	3	30	70
6	ETME-712	Minor Project	3	0	0	10	10	30	70
7	ETME-713	Industrial Training	3	4 Weeks Industrial Training after 6th sem				30	70
TOTAL			**21**	**12**	**0**	**13**	**25**		

Elective III:	1.	ETME721	Energy Conversion Devices
	2.	ETME722	Automobile Engineering
	3.	ETME723	dustrial Instrumentation &Metrology
Elective IV:	1.	ETME724-A	Advanced manufacturingProcesses
	2.	ETME725-A	Automation in Manufacturing
	3.	ETME726-A	Fracture and fatigue

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SEMESTER-VIII

S.NO	CODE	COURSE TITLE	CREDIT	L	T	P	Hours Per week	Internal Marks	External Marks
1	****	Elective-V	3	3	0	0	3	30	70
2	****	Elective-VI	3	3	0	0	3	30	70
3	****	Open Elective-II	3	3	0	0	3	30	70
4	****	Open Elective-III	3	3	0	0	3	30	70
5	****	Indian Constitution	0	3	0	0	3	30	70
6	****	Major Project	8	0	0	12	12	30	70
TOTAL			**20**	**15**	**0**	**12**	**27**	**180**	**420**

Elective V:	1.	ETME-821	Optimization Techniques
	2.	ETME-822	Mechanics of CompositeMaterials
	3.	ETME-823	Robot Kinematics andDynamics
Elective VI:	1.	ETME824	Mechatronics
	2.	ETME825	IC Engine
	3.	ETME826	Work Study & Ergonomics
Open Elective-II	1.	ETME827	Industrial Pollution
	2.	ETME828	Sustainable Development
	3	ETME829	Renewable EnergyResources
Open Elective-III	1.	ETCS821	Information Security
	2.	ETCS824	Green Computing
	3.	ETCS830	Management InformationSystem

SYLLABUS

MECHANICAL ENGINEERING

(Engineering &Technology)

K.K.UNIVERSITY, NEPURA, BERAUTI, NEAR BIHARSHARIF, NALANDA,

BIHAR-803115

FIRST SEMESTER

ETSH-101 Engineering Physics

Course Objectives:-

1. To impart knowledge in basic concepts of physics relevant to engineering applications.

2. To introduce advances in technology for engineering applications.

3. Apply Biot- Savart Law and Ampere's Law to compute magnetic field due to a current distribution.

4.Calculate the field of a magnetized object.

5. To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.

Learning Outcome:-

1. To design and conduct simple experiments as well as analyze and interpret data.
2. Engineering applications Capability to understand advanced topics in engineering.
3. Identify formula and solve engineering problems.
4. Apply quantum physics to electrical phenomena.

Unit -1 ELECTROSTATICS AND ELECTROMAGNETIC Hours - 12

Electrostatics, Electric charge as point charge, charge distribution, Coulomb s law, Electric field, electric field due to point charge & charge distribution, Electrostatic Potential , Potential due to point charge, long charged wire, charged Spherical conductor & Electric dipole ,Ampere's law, application of Ampere's law, Biot- Savart law, Application of biot- savart law.

Unit -2 OPTICS & LASER Hours - 07

Reflection and refraction, Snell's law, physical significance of refractive index (simple problems), Total internal reflection, Lasers , Characteristics of Laser, Ruby laser, Working Principle of He-Ne Laser. Polarization of light, Brewster's Law, Malu's Law.

Unit- 3 QUANTUM PHYSICS Hours - 09

Planck's theory of black body radiation, Compton effect, Photo electric effect, Wave particle duality, De-Broglie waves, De-Broglie wave velocity, Wave and group velocity, Heisenberg's uncertainty principle, Application of uncertainty principle.

Unit - 4 SEMICONDUCTORS Hours - 08

Introduction of semiconductor, intrinsic & Extrinsic semiconductor, P –N junction , P-N junction with fordward bias, P-N junction with reverse bias, reverse breakdown ,light emitting diode ,Zener diode, properties of zener diode .

Unit -5 NANO-PHYSICS **Hours - 05**

Introduction and Basic definition of Nano Technology, Properties of Nano particles, Elementary ideas of Synthesis of Nano particles, Application of Nano particles.

Reference Books :

1. Modern Physics by G. Aruldhas & P. Rajagopal; Pub: Prentice Hall of India.
2. Quantum Physics by H.C. Verma Pub.: Surya Publication .
3. Lasers and Non-Linear Optics by B.B. Laud; Pub: New Age International (P) Ltd.
4. Principles of electricity by Leigh Page and Normal llsley Adams, Pub.: Eurasia Publishing House, New Delhi.
5. Engineering physics by Dr. Rakesh Dogra Pub: S.k kataria & sons.
6. Engineering physics by Dr. Abhijit Nayak Pub: S.k kataria & sons.

ETSH-111 ENGINEERING PHYSICS LABORATORY

Minimum six experiments are required to be performed in a semester : -

1. Find the acceleration due to gravity (g) with the help of bar Pendulum.
2. To determine the external diameter of solid Cylinder by the slide calipers.
3. To determined the thickness of glass plate by using Spherometer.
4. To determine the diameter of metal wire by using Micrometer (Screw Gauge).
5. Study the junction diode.
6. To find the refractive index of a material given in the form of a prism by using a Spectrometer.
7. To obtain the particle size by the laser.

ETSH-102 Engineering Mathematics-I

COURSE OBJECTIVE:

The objective of this course is to familiarize the prospective engineers with

- Techniques in matrices, differentiation and Integration.
- It aims to equip the student's todeal with advanced level of Mathematics and applications that would be essential for their disciplines.

MODULE -1: LINEAR ALGEBRA

Matrix algebra, Determinant, Inverse and rank of a matrix by elementary transformation, solution of system of linear equation, vector, Basis, L.D&L.I, Eigen value and Eigen vector of a real matrix, properties of Eigen values, cay-lay Hamilton theorem. diagonalization of matrices.

MODULE -2: DIFFERENTIAL CALCULUS

Limit, continuity and Differentiability, Successive differentiation, Leibnitz theorem, mean value theorem (Rolle's, Lagrange's Cauchy) Maxima & Minima for single variable, Taylor & Maclaurin Series.

MODULE -3: FUNCTION OF SEVERAL VARIABLES

Partial derivative, Homogeneous functions and euler's theorem Total derivative, Differentiation of implicit function of two variables, Maxima and Minima of function of variables, Lagrange's method of undetermined co-efficient.

MODULE -4: INTEGRAL CALCULUS

Integration of various functions, Definition of proper and improper integral, Convergence of improper integral, Beta and gamma functions, Differentiation under integral sign

MODULE -5: CURVE TRACING

Curve tracing of Cartesian and Polar form, Surface area and volume of Surface of revolution.

COURSE OUTCOMES:

After completing this course, students should demonstrate competency in the following skills:
1.Use both the limit definition and rules of differentiation to differentiatefunctions.
2.Apply differentiation to solve maxima and minimaproblems.
3.Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.

4.Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration byparts.

5.Determine convergence/divergence of improper integrals and evaluate convergentimproper integrals.

6.Apply various techniques in solving differentialequations.

REFERENCE BOOKS

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher's, 36 th edition, 2010.

2. Erwin Kresyszig, Advance Engineering Mathematics, John Wiley and Sons, 9 th edition,

2006.

ETCS-101 Introduction to Artificial Intelligence

COURSE OBJECTIVES:-

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.

MODULE -1:

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.

MODULE -2:

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.

MODULE -3:

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

MODULE -4:

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

MODULE -5:

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

COURSE OUTCOMES:

- Understand concepts of Artificial Intelligence and different types of intelligent agents andTheir architecture.
- Formulate problems as state space search problem & efficiently solve them.
- Understand the working of various informed and uninformed searching algorithms andDifferent heuristics
- Understand concept of knowledge representation i.e. propositional logic, first order logic.

Text Books

1. Stuart Russell and Peter Norvig – Artificial Intelligence A Modern Approach, PEARSON Education.
2. Simon Haykin -Neural Networks PHI.

Reference Books

1. N. P. Padhy – Artificial Intelligence and Intelligence Systems, OXFORD publication.
2. B. YagnaNarayana - Artificial Neural Networks, PHI

ETSH-103 Soft Skills

COURSE OBJECTIVES

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.

MODULE -1: SELFAWARENESSANDSELF-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.

MODULE -2:COMMUNICATIONSKILL

Importance of communication, Aspects of communication, communication throughwords, 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 andMinutes, Research papers and articles, Advertising and job Description, Mechanics ofManuscript preparation.

MODULE -3: INTERPERSONALRELATIONSHIP

Teamwork, Teameffectiveness, Groupdiscussion ,Decision making- Team Communication. Team, Conflict Resolution, Team Goal Setting, Team MotivationUnderstandingTeamDevelopment,TeamProblemSolving,Buildingtheteamdynamics,Multi cultural Diversity and Socializing

MODULE -4: LEADERSHIPSKILLS

Leaders: their skills, roles, and responsibilities. Vision, Empowering and delegation,motivating others, organizational skills, team building, Organizing and conductingmeetings,decisionmaking,givingsupport,Vision,Mission,Coaching,Mentoringandcounseling,Appraisalsandfeedback, conflict,PowerandPolitics, PublicSpeaking.

MODULE -5: OTHERSKILLS

Managing Time, Managing Stress,Meditation.Improvingpersonalmemory, Studyskills that include Rapid Reading, Notes Taking, Self-learning, Complex problem solvingandcreativity,listeningskillsandspeakingskills,Corporate andBusinessEtiquettes.

MODULE -6: **ETHICSINENGINEERINGPRACTICEANDRESEARCH**

Introductiontoethicalreasoningandengineerethics,Rightandresponsibilitiesregarding Intellectual property,workplace rights and responsibilities, CentralProfessionalResponsibilitiesofEngineers,Responsibilityforenvironment.

COURSE OUTCOMES:

Having successfully completed this course ,the student will be able to:

- Communicate,interactandpresenthisideastotheotherprofessionals.
- Understandandawareofimportance, roleandcontentsofsoftskillsthroughinstructions, knowledgeacquisition,demonstration andpractice.
- Haverightattitudinalandbehavioralaspects,andbuildthesamethroughactivities.
- Possessright professionalandsocialethicalvalues.

TEXTBOOKS:

1. DevelopingCommunicationSkill:KrishnaMohan,MeeraBanerji,-MacMillanIndiaLtd.
2. BNGhosh, :ManagingSoftSkillsforPersanalityDevelopment"McGrawHill
3. EthicsinEngineeringPracticeandResearch:CarolineWhitbeck,CambridgeUniversitypress
4. ACourseInCommunicationSkills:KiranmaiDutt,CambridgeUniversitypress
5. EnglishforBusinessCommunication:SimonSweeney,CambridgeUniversityPress
6. BasicsOfCommunicationInEnglish:FrancisSounderaj,MacMillanIndiaLtd.
7. GroupDiscussionsandInterviewSkills:PriyadarshiPatnaik,CambridgeUniversityPress

8. ProfessionalPresentations:MalcolmGoodale,CambridgeUniversityPress

9. An IntroductiontoProfessionalEnglishAndSoft Skills:Das,CambridgeUniversityPress

ApracticalcourseinEffectiveEnglishspeakingskills,G.K.Gangal,PHIPublication.

ETSH-105 Engineering Chemistry

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 polymerization. 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 Characterisitics of Lubricants Such and Viscosity, Viscosity Index, Oiliness, Volatility, Flash & Fire Point, and Cloud & Pour Point. Chemical Characteristics of Luricant such as Acid Value or Neutralization Number, Emulsification, Saponification Value etc.

COURSE OUTCOME:

The course will enable the student to:

1.Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.

2.Rationalise bulk properties and processes using thermodynamicconsiderations.

3.Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopictechniques.

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 andM.S.Krishnan
- Physical Chemistry, by P.W.Atkins

ETSH-115 Engineering Chemistry Lab

Course objectives:
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:-

1.Qualititive analysis of given salts having three acidic and basic radicals.
Basic radicals:- Pb^{2+},Cu^{2+},Al^{3+},Fe^{2+},Fe^{3+},Cr^{3+},Zn^{2+},Ca^{2+},Ba^{2+} etc.
Acidic radicals:- Cl^-,Br^-,I^-,,SO_4,NO_3,OH^- etc.

2. Determination the total hardnees of given water smaple.

3. To Determine the Saponifcation value of given oil sample.

4.To Determine the acid value of given oil sample.
4. Adsorption of acetic acid by charcoal.

6. Synthesis of polymer /drug.

7.To Determine the Ph of given solution by universal indicator or pH meter.

8.To Determine dissolved oxygen in water sample.

9.To determine thinner content in oil paint.

10. To determine carbon monoxide, carbon di-oxide, ontent emission from petrol vehicle.

Course Outcomes:-
- Students are able to estimate the impurities present in water.
- Ability to select lubricants for various purposes.
- Ability to prepare advanced polymer materials.
- Ability to find the Fe+2, Ca & Cl- present in unknown substances/ ores using titrimetric and instrumental methods.

ETEA-111 Inter-disciplinary Experimental Active Learning (IDEA LAB)

VISION: -

To create globally competitive electronics and communication professionals with strong values for the advancement of the nation.

MISSION:-

M1- To provide an ambiance of excellence in teaching and learning replete with innovation, collaboration and research.

M2- To instill human values, social obligations and national responsibilities.

M3- To promote a learning ecosystem for progress and development of all in the department.

List of Experiments

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

2. To study the CRO and function generator for signal analysis.

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

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

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

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

7. Identification of timbers: teak, sal, chir, shisum, siras, deodar, kail and mango. (visual identification) and with study of their properties and applications.

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

9. To learn the parts of fan, LED bulb, induction cooktop, electric iron etc

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

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

12. To study the electrical switch board and staircase wiring.

13. To learn to use the various types of pliers, wrenches & screw drivers.

14. To study the various components of Green Building (also called as Zero Energy Building).

ETME-111 Engineering Workshop Lab

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:-

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.

2. Foundry Shop

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

3. Carpentry Shop

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

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

4. Fitting Shop

(a) Toprepare a matching joint in fitting shop.

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

5. Machine Shop

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

(b) DrillingPractice

6. Welding

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

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

7. Sheet Metal Shop

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

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

TEXT BOOK:

1. Jain, R.K. Production Technology.
2. Rao, P. N. Manufacturing Technology (Vol. I &II)

ETCS-111 Introduction to Artificial Intelligence with Python Lab

PYTHON LIST OF EXPERIMENTS

1. Program to define an integer value and print it
2. Input two integers and find their addition
3. Python program to find sum of two numbers
4. Python program to demonstrate the example for arithmetic operators
5. Python program for simple interest
6. Python program for compound interest
7. Python program to check the given year is a leap year or not
8. Python program to find power of a number using exponential operator
9. Python program to extract and print digits in reverse order of a number
10. Python program Input age and check eligibility for voting.
11. Python program Find largest of three number using nested if else.
12. Python program Calculate discount based on the sale amount.
13. Python program Calculate discount based on the sale amount using Nested if else.
14. Python program Demonstrate an example of for loop
15. Python program Examples of loops (based on their control)
16. Python program Demonstrate an Example of break statement
17. Python program Demonstrate an Example of continue statement
18. Python program Demonstrate an Example of pass statement
19. Python Print all numbers between 1 to 1000 which are divisible by 7 and must not be divisible by 5.
20. Python | Find factorial of a given number
21. Python Find the factorial of a number using recursion
22. Python Program to print Odd and Even numbers from the list of integers.
23. Python Program to calculate n-th term of a Fibonacci Series
24. Python program for sum of square of first N natural numbers
25. Python program for sum of cube of first N natural numbers

ETSH-113 Soft Skill Lab

LIST OF EXPERIMENTS

- Work/Assignments
- SWOTanalysis

Personal & Career Goal setting – Short term &long termPresentation Skill

- Dining EtiquettesLetter/Application/Notice/Agenda/MinuteswritingReportwriting
- Listening skills using Language laboratory
- Group discussion
- Resume writing

SECOND SEMESTER

ETSH-201 Engineering Mathematics -II

COURSE OBJECTIVE:

- 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

UNIT 1: ORDINARY DIFFERENTIAL EQUATION

Ordinary differential equation: definitions,order and degree of differential equation, equation, 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 SeriesFourier 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).

COURSE OUTCOME:

- After successfully completing the course, the student will have a good understanding of the following topics and their applications:
- Analytic function, singularity, residues and complex integration
- Laplace and Fourier transform and its properties, application of Laplace and Fourier transform
- Finding the solution of ode and pde

REFERENCE BOOK:

B.S. Grewal, Higher Engineering Mathematics, Khanna publisher's,44thedition

Erwin Kresyszig, Advance Engineering mathematics, John Wiley and Sons,9th edition

ETEE-201 Basic Electrical & Electronics Engineering

COURSE OBJECTIVES:

- To explain the laws used in the analysis of DC and AC circuits.
- To understand and analyses 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 semi conductor devices, rectifier circuits and its applications.
- Describe the basic applications of transistor.
- Define logic gates&understand the working principles of logical circuits.
- Describe the significance of Boolean algebra in digital circuits.

MODULE-1: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 cork screw rule, Concept of M.M.F., flux, flux density, reluctance, permeability and field strength, their units and relationships, analogy of electrical and magnetic circuit, Energy stored in magnetic field.

MODULE-2: D. C. CIRCUITS AND AC FUNDAMENTALS

(A) Kirchhoff's law, ideal and practical voltage and current sources. Mesh and Nodal analysis (Super node 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, concept of cycle period, frequency, instantaneous, peak, average, r.m.s. values, peak factor , and form factor, phase difference.

MODULE-3: SINGLE PHASE TRANSFORMER AND ELECTROSTATICS

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

MODULE-4: ANALOG DEVICES

A) Semi conductor theory:- Intrinsic and Extrinsic Semiconductors - N type and P type materials – mechanism of 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.

MODULE-5: BOOLEAN ALGEBRA AND LOGIC GATES

A) Number representation: Decimal, Binary, Octal and Hexa- decimal number systems - Conversion of number 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.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- Analyze basic DC and AC electric circuits.
- Explain the working principles of transformers.
- To understand and analyses AC & DC circuits.
- Analyze Semi conductor devices and their applications.
- Explain the working principles of Rectifiers.
- To understand Number system representation and Boolean algebra& to understand Logic gates.

TEXT / REFERENCES:

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

ETCS-201 C Programming

COURSEOBJECTIVES:

- 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.

MODULE-1: 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

MODULE-2: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

MODULE-3: 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

Module-4: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.

Module-5: 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)

COURSE OUTCOMES:

- To formulate simple algorithms for arithmetic and logical problems.

- To translate the algorithms to programs (in C language)

- To test and execute the programs and correct syntax and logical errors.

- To implement conditional branching, iteration and recursion.

TEXTBOOKS /REFERENCES

1. ByronGottfried,Schaum'sOutlineofProgrammingwithC,McGraw-Hill
2. E.Balaguruswamy,ProgrammingANSIC,TataMcGraw-Hill

ETME-201 Fundamental of Mechanical & Civil Engineering

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.

MODULE-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.

MODULE-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

MODULE-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

MODULE-4:BASIC CONCEPTS OF FLUID MECHANICS

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.

MODULE-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.

COURSE OUTCOME:

Upon completion of this course, the students will be 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 locating Centroid / center of gravity of various sections
- Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To study the concepts of power plant, IC engine components refrigeration's and air conditioning.
- To study the conceptsproperties of fluids.
- To study the Civil Engineering Material, Survey and Building Components.

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

REFERENCES:

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.

ETSH-202 Technical Communication & Project Management

COURSE OBJECTIVES

- 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.

MODULE-1:

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

MODULE-2:

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

MODULE-3:

Technical paper writing: documentation style – document editing – proof reading – Organizing and formattingReading and listening comprehension of technical documentsTechnical presentations

MODULE-4:

Reading and listening comprehension of technical documents

Technical presentations

MODULE-5:

Project Writing

COURSE OBJECTIVES

- 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.

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

ETME-202 ENGINEERING GRAPHICS & DESIGN

COURSE OBJECTIVE:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products
- To expose them to existing national standards related to technical drawings.

MODULE-1:PLANE CURVES

Importance of graphics in engineering applications–Use of drafting instruments; BISconventions and specifications; Size, layout and folding ofdrawing sheets; Lettering anddimensioning; Scales; Plane Curves: - Basic Geometrical constructions; Curves used in engineering practices

Conics; Construction of ellipse, parabola and hyperbola, cycloid, involutes of square and circle; Drawing oftangents and normal to the above curves.

MODULE-2:PROJECTION

Types of projection; Orthographic projection; Orthographic projection; First and Third angle projection; Projection of points and Lines; Line inclined to one plane and both planes.

MODULE-3: PROJECTION OF PLANES AND SOLIDS

Projection of Planes: Circle, Polygons; Projection of Polyhedrons: Prisms, Pyramids; Projection of Solids: Cylinders, Cones.

MODULE-4:SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Section of right solids by normal and inclined planes; Intersection ofcylinders; Parallel line and radial - line method for right solids; Introduction of surfaces-cylinder

MODULE-5:ISOMETRIC PROJECTIONS & COMPUTER AIDED DRAFTING

Isometric Projections:Isometric scale, Isometric axes; Isometric Projection fromorthographic drawing; Computer Aided Drafting (CAD): Introduction, Benefit; Software's basic commands ofdrafting entities like line, circle, polygon, polyhedron, cylinders; transformations and editingcommands like move, rotate, mirror, array; solution of projection problems on CAD

COURSE OUTCOME:

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

- Familiarize with the fundamentals and standards of Engineeringgraphics
- Perform freehand sketching of basic geometrical constructions and multiple views ofobjects.
- Project orthographic projections of lines and planesurfaces.
- Draw projections and solids and development ofsurfaces.
- Visualize and to project isometric and perspective sections of simplesolids.

TEXT BOOK:

1. Bhatt, N.D. EngineeringDrawing.
2. Dhawan, R.K. A Textbook of Engineering Drawing.
3. Venugopal, K. Engineering Drawing andGraphics.

ETCS-202 Basics of Internet of Things (IoT)

COURSE OBJECTIVE:

- 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.

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- IoTivity 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.

COURSE OUTCOMES:

- Able to understand the application areas of IOT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics.

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 ofThings", Springer, 2011.

- David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.

- Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012. References:

- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014

- Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013

- CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1- 4493-9357-1

ETEE-211 Basic Electrical & Electronics Engineering Lab

LIST OF EXPERIMENTS:

A. BASIC ELECTRICAL ENGINEERING-

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.

4. To Verify 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. To verify Norton's theorem.

8. To measure power and power factor in a single phase A.C circuit using wattmeter.

B. BASIC ELECTRONICS ENGINEERING-

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 filter.

7. Half wave and Full wave rectifier with Filter.

8. Characteristics of Common Emitter BJT amplifier.

ETME-211 Fundamental of Mechanical & Civil Engineering Lab

LIST OF EXPERIMENT

1. To verify the parallelogram law of forces.
2. To verify the lami's theorem.
3. To determine the coefficient of Friction of an inclined Plane.
4. To study about the model of two stroke petrol engine.
5. To study about the four stroke petrol engine and diesel engine.
6. To Verify the Bernoulli's Theorem.
7. To determine the compressive strength of Brick
8. To determine the horizontal angle with prismatic and surveyor compass.

9. To determine the area by chain survey.
10. To measure horizontal and vertical angles in the field by using Theodolite.

ETCS-211 C PROGRAMMING LAB

S. No	Experiment Name
A	Theory : Variable, Data type, Keyword ,Operator, Hello world Program, Control Structure, Array, Pointer
1	Write a C program to find the sum of individual digits of a positive integer.
2	Write a C program to generate Fibonacci series.
3	Write a C program to generate all the prime numbers between 1 and n is a value supplied by the user.
4	Write a C program to find the roots of a quadratic equation.
5	Two integer operands and one operator form user, performs the operation and then prints the result.
6	Write a C program to find the factorial of a given integer by using recursive and non-recursive functions.
7	A C program to find both the largest and smallest number in list of integers
8	Write A C- Program To Determine If The Given String Is A Palindrome Or Not
9	Example of Array In C programming to find out the average of 4 integers
10	Write a program in c to Addition of two matrix in C
11	Write a C program to Implement the following searching method. i) linear search ii) Binary search
12	Write C programs that implement the following sorting methods to sort a given listof integers in ascending order by using Bubble sort.

THIRD SEMESTER

ETSH-301	ENGINEERING MATHEMATICS-III	L	T	P	C	HOURS PER WEEK
		3	1	0	4	4

Course Objective:

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

MODULE I: BASIC PROBABILITY 9

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

MODULE II: CONTINUOUS PROBABILITY DISTRIBUTIONS AND BIVARIATE DISTRIBUTIONS

Continuous random variables and their properties, distribution functions and densities, normal, bivariate distributions and their properties, distribution of sums and quotients, conditional densities,Bayes' rule

MODULE III: BASIC STATISTICS MEASURES OF CENTRAL TENDENCY 9

Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

MODULE IV: APPLIED STATISTICS 9

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

MODULE V: SMALL SAMPLES 9

Test for single mean, difference of means and correlation coefficients, test for ratio of variances -Chi-square test for goodness of fit and independence of attributes

Course Outcomes:

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

Basic Probability,
Applied Statistics
Continuous Probability Distributions And Bivariate Distributions

REFERENCE BOOKS:

1. **B. S. Grewal,** Higher Engineering Mathematics, Khanna Publisher's, 36th edition, 2010.
2. **Erwin Kresyszig,** Advance Engineering Mathematics, John Wiley and Sons, 9th edition, 2006.

ETEC-305	BASICS ELECTRONICS ENGINEERING	L	T	P	C	HOURSPER WEEK
		3	0	0	3	4

Course objectives:

To be exposed to the characteristics of basic electronic devices.

MODULE I:INTRODUCTION TO SEMICONDUCTOR PHYSICS 9

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 ofresistors

MODULE II: GENERATION AND RECOMBINATION OF CARRIERS 9

Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-Vcharacteristics, Rectifier, Clipper,Clamper and small signal switching models;

Avalanche breakdown, Zener diode, Schottky diode

MODULE III: TRANSISTOR 9

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: INTEGRATED CIRCUIT FABRICATION PROCESS 9

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

MODULE V: PHOTODIODES 9

Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, light Emitting materials Tunnel Diode

Course Outcomes:

At the end of this course students will demonstrate the ability to

Understand the principles of semiconductor Physics

Understand and utilize the mathematical models of semiconductor junctions and

MOS transistors for circuit's and systems.

TEXT /REFERENCE BOOKS:

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-HillEducation
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 ScientificPublishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, "Operation and Modelingof the MOS Transistor,"Oxford Univ.Press,2011.

ETEC-314	SICS ELECTRONICS ENGINEERINGLAB	L	T	P	C	HOURSPER WEEK
		0	0	3	1.5	4

Course objectives:

To be exposed to the characteristics of basic electronic devices.

LIST OF EXPERIMENT:-

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

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

2. To perform and plot the forward and reverse V-I characteristics of a PN junction diode.
3. To perform and plot the characteristics of Zener diode.
4. To perform and plot the wave shape of half wave rectifier.
5. To perform and plot the wave shape of full wave rectifier.
6. To perform and study the input and output characteristics of common base transistor.
7. To perform and study the input and output characteristics of common emitter transistor.
8. To perform and study transfer and drain characteristics of FET.
9. Measurement of H-Parameter of CB Configuration.
10. Drain and Transfer Characteristics of JFET.
11. To perform and plot the characteristics of Photo diode.
12. To perform and plot the characteristics of lightemitting diode.

Learn the characteristics of basic electronic devices.

ETME-301	THERMODYNAMICS	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objective:

• To familiarize the students to understand the fundamentals of thermodynamics and to performthermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart andPsychrometric Chart permitted)

MODULE I: BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9

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.

MODULE II: SECOND LAW OF THERMODYNAMICS AND AVAILABILITY ANALYSIS 9

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.

MODULE III: PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9

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.

MODULE IV: IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced 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.

MODULE V: GAS MIXTURES AND PSYCHROMETRY 9

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

Course Outcomes:

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

- Apply the first law of thermodynamics for simple open and closed systems under steady andunsteady conditions.
- Apply second law of thermodynamics to open and closed systems and calculate entropy andavailability.
- Apply Rankine cycle to steam power plant and compare few cycle improvement methods
- Derive simple thermodynamic relations of ideal and real gases
- Calculate the properties of gas mixtures and moist air and its use in psychometric processes

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.

REFERENCES:

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.

4. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition.

5. Nag.P.K., "Engineering Thermodynamics", 5th Edition, Tata McGraw-Hill, New Delhi, 2013.

ETME-302	STRENGTH OF MATERAILS	L	T	P	C	HOURS PERWEEK
		3	1	0	4	4

Course Objectives:

- 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 totorsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

MODULE I:STRESS, STRAIN AND DEFORMATIONOF SOLIDS 9

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 9

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 9

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 9

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 9

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

Course Outcomes:

After completing this course, the students should be able to recognize various types loads applied onmachine components of simple geometry and understand the nature of internal stresses that will develop within the components

The students will be able to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading

TEXT BOOKS:

Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi,2001.

R. Subramanian, Strength of Materials, Oxford University Press,2007.

Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005.

ETME-312	STRENGTH OF MATERIALS LAB	L	T	P	C	HOURSPER WEEK
		0	0	3	1.5	3

Course Objectives:

- To study the mechanical properties of materials when subjected todifferent types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

LIST OF EXPERIMENT

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

Course Outcomes:

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

B.TECH ME42	ETME-303	MANUFACTURING PROCESS	L	T	P	C	HOURS PER WEEK
			3	1	0	4	4

Course Objectives:

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

MODULE 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

MODULE 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

MODULE 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.

MODULE IV: POWDER METALLURGY

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

MODULE 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 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

Course Outcomes:

- Explain different metal casting processes, associated defects, merits and demerits
- Compare different metal joining processes.
- Summarize various hot working and cold working methods of metals.
- Explain various sheet metal making processes.
- Distinguish various methods of manufacturing plastic components.

REFERENCES:

1. Rao P.N, Manufacturing Technology: Foundry, Forming and Welding, 3rd Edition, Tata McGraw-Hill PublishingLimited.
2. Kalpakjian S and Schmid S.R, Manufacturing Engineering and Technology Pearson Education.
3. Ghosh A and Mallik A.K, Manufacturing Science, 2nd edition, AffiliatedEast West Press, New Delhi.

FOURTH SEMESTER

ETME-401	APPLIED THERMODYNAMICS	L	T	P	C	HOURS PERWEEK
		3	1	0	4	4

Course Objectives:

- To learn about of I law for reacting systems and heating value of fuels
- To learn about gas and vapor cycles and their first law and second law efficiencies
- To understand about the properties of dry and wet air and the principles of psychrometry
- To learn about gas dynamics of air flow and steam through nozzles
- To learn the about reciprocating compressors with and without intercooling
- To analyze the performance of steam turbines

MODULEI: FUELS AND COMBUSTRION 9

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.

MODULEII: THERMODYNAMICS CYCLES AND ITS APPLICATIONS 9

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.

MODULEIII: AIR CONDITIONING AND PSYCHOMETRIC PROCESS 9

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

MODULEIV: COMPRESSIBLE FLOW 9

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.

MODULEV:RECIPROCATING COMPRESSORS AND ANALYSIS OF STEAMTURBINES 9

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

Course Outcomes:

- After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
- They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.
- They will be able to understand phenomena occurring in high speed compressible flows.

TEXT BOOKS:

- Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of
- Thermodynamics, John Wiley andSons.
- Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall ofIndia
- Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics,John Wiley and Sons.
- Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co.Ltd.

ETME-411	APPLIED THERMODYNAMICS LAB	L	T	P	C	HOURS PERWEEK
		3	1	0	4	4

Course Objective:

- To learn about of I law for reacting systems and heating value of fuels

LIST OF EXPERIMENT

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

Course Outcome:

They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.

ETME-402	FLUID MECHANICS	L	T	P	C	HOURS PER WEEK
		3	1	0	4	4

Course Objectives:

- To learn about the application of mass and momentum conservation laws for fluid flows
- To understand the importance of dimensional analysis
- To obtain the velocity and pressure variations in various types of simple flows
- To analyze the flow in water pumps and turbines.

MODULE I:BASIC CONCEPTS AND PROPERTIES OF FLUID 9

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

MODULE II:FLUID STATICS AND BUOYANCY 9

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

MODULE III:FLIUD KINEMATICS AND FLUID DYNAMICS 9

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

MODULE IV:DIMENSIONALANALYSIS 9

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

MODULE V:INCOMPRESSIBLE FLUID FLOW AND BOUNDARY LAYERSEPARATION **9**

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.

Course Outcomes:

- Upon completion of this course, students will be able to mathematically analyze simple flowsituations.
- They will be able to evaluate the performance of pumps and turbines.

TEXT BOOK:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

REFERENCES:

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.

ETME-412	FLUID MECHANICS LAB	L	T	P	C	HOURS PERWEEK
		0	0	3	1.5	3

Course Objective:

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

LIST OF EXPERIMENT:

1. To determine the Metacentric Height of a ship model.
2. Verification of Bernoulli's Theorem.
3. To find the coefficient "k" for given Venturimeter.
4. To determine the hydraulic coefficients Cv, Cc and Cd for Orifice and Mouthpiece apparatus.
5. To find the value of Critical Velocity in pipes by Reynolds's Experiment.
6. To study flow over a Notch and find the coefficient of discharge.
7. To determine the coefficient of friction for pipes of different sizes.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating thevelocity profile.
9. To study the variation of friction factor 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundarylayer thickness.

Course Outcome:

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

- Use the measurement equipments for flowmeasurement.
- Perform test on different fluidmachinery.

ETME-403	COMPUTER AIDED DESIGN	L	T	P	C	HOURSPER WEEK
		3	1	0	4	4

Course Objectives:

To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

MODULE I: INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 9

Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotation) windowing - view ports - clipping transformation.

MODULE II: CURVES AND SURFACES MODELING 9

Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations. Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface- surface manipulations.

MODULE III: NURBS AND SOLID MODELING 9

NURBS- Basics- curves, lines, arcs, circle, and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations – constructive solid Geometry - comparison of representations - user interface for solid modeling.

MODULE IV: VISUAL REALISM 9

Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages

MODULE V: ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE 9

Assembly modeling - interferences of positions and orientation - tolerances analysis – mass property calculations - mechanism simulation. Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc– Communication standards.

Course Outcomes: At the end of the course, student will be able to

- It helps the students to get familiarized with the computer graphics application in design.
- This understanding reinforces the knowledge being learned and shortens the

overall learningcurve which is necessary to solve CAE problems that arise in engineering.

REFERENCES:

1. Nighat Yasmin, Introduction to AutoCAD 2014 for Civil Engineering Applications. SchroffDevelopmentCorp.
2. Sham Tickoo, Anurag, AUTOCAD 2013 FOR ENGINEERS AND DESIGNERS.Dreamtech

ETME-413	AUTO CAD LAB	L	T	P	C	HOURS PER WEEK
		0	0	3	1.5	3

Laboratory Experiments **(Any six experiments are to be carried out)**
Experiment No. 1: Using First Angle Projection, draw view from front, top and left/right of given solid (Nut) using the software AutoCAD.
Experiment No. 2: Sketching and Modeling a given machine component (Piston) using the CREO software.
Experiment No. 3: To write the Bresenham's Mid-Point Line Algorithm with a positive slope. Develop a computer program of the same and validate it.
Experiment No. 4: To write the Bresenham's Mid-Point Circle Algorithm for a given radius r and screen center position (xc, yc). Develop a computer program for the same and validate it.
Experiment No. 5: To write a computer program for individual 2D/3D Geometric Transformation such as translation/ rotation/scaling and validate it on MATLAB
Experiment No. 6: To write a computer program for 2D/3D Combined Geometric Transformations and validate it on MATLAB.
Experiment No. 7: To write and validate the computer program for generating
Experiment No. 8: To write and validate the computer program for generating space curves.

ETME-404	MATERIALS ENGINEERING	L	T	P	C	HOURS PERWEEK
		3	1	0	4	4

Course Objectives:

• 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.

MODULE I: ALLOYS AND PHASE DIAGRAMS 9

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

MODULE II: HEAT TREATMENT 9

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

MODULE III: FERROUS AND NON-FERROUS METALS 9

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.

MODULE IV: NON-METALLIC MATERIALS 9

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.

MODULE V: MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

9

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 Izod and charpy, fatigue and creep failure mechanisms.

Course Outcomes:

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

- Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
- Explain isothermal transformation, continuous cooling diagrams and different heat treatmentprocesses.
- Clarify the effect of alloying elements on ferrous and non-ferrous metals
- Summarize the properties and applications of non metallic materials.
- Explain the testing of mechanical properties. .

TEXT BOOKS:

1. W. D. Callister, 2006, "MaterialsScience and Engineering-An Introduction", 6th Edition,WileyIndia.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall ofIndia Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited,1999.
4. U. C. Jindal, "Engineering Materials and Metallurgy",Pearson, 2011.

ETEC-405	INSTRUMENTATION AND CONTROL	L	T	P	C	HOURS PERWEEK
		3	1	0	4	4

Course Objectives:

- To understand the concept of measurement system.
- To analyze the different error occur in measurement system
- To understand mechanical measurement device
- To design different types of controller

MODULE I: BASIC PRINCIPLESOF MEASUREMENT 9

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 9

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 9

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 8

System models, transfer function and system response, frequency response; Nyquist diagrams and their use

Course Outcome:

- Upon completion of this course, the students will be able to understand the measurement of various quantities using instruments, their accuracy & range, and the techniques for controlling devices automatically.

TEXT/REFERENCE BOOKS:

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

FIFTH SEMESTER

ETME-501	HEAT AND MASS TRANSFER	L	T	P	C	HOURS PER WEEK
		3	1	0	4	4

Course Objectives:

- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines,and Refrigeration & Air ConditioningSystems.
- To understand the concept of utilising residual heat in thermalsystems.

Use of approved heat and mass transfer data books and steam tables are permitted

MODULE I: CONDUCTION 9

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.

MODULE II: CONVECTION 9

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.

MODULE III:PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

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

MODULE IV: RADIATION 9

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

MODULE V: MASS TRANSFER 9

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.\

Course Outcomes:

At the end of the course students should be able to

- Demonstrate the mechanism of steady and unsteady heat transfers and extendedsurfaces.
- Analyse internal flow and external flow and natural convection mode of heat transferand apply the principles in various applications.
- Evaluate the boiling and condensation phase change heat transfer and sizing of heatexchangers.
- Compute radiative heat transfer in black body and grey body with effect of shape factorin real time applications
- Appraise the basic concepts of mass transfer

TEXT BOOKS:

1. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer"New AgeInternational, New Delhi, 4th Edition 2012 (MODULE I, II, III, IV, V).
2. Yunus A.Cengel and Afshin J. Ghajar "Heat and Mass Transfer-Fundamentals&Applications", McGraw-Hill Education, 5th Edition,2015 (MODULE I, II, III,IV,V).

REFERENCES:

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)
2. Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., New Delhi, 3th Edition1994(MODULE I, II, III,IV).
3. Nag P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 7th Edition 2012(MODULEI, II,III,IV).
4. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, New Delhi, 9th Edition 2012(MODULE I, II, III,IV, V).
5. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Academic Science, New Delhi, 5th Edition, 2016(MODULE I, II, III,IV,V).

ETME-511	Heat and Mass Transfer Lab	L	T	P	C	HOURS PERWEEK
		0	0	3	1.5	3

Course Objectives:

- To study the heat transfer phenomena predict the relevant coefficient using implementation

LIST OF EXPERIMENT

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

Course Outcomes:

- Conduct tests on heat conduction apparatus and evaluate thermal conductivity of Materials.
- Conduct tests on natural and forced convective heat transfer apparatus andevaluate Heat transfer coefficient.
- Conduct tests on Radiative heat transfer apparatus and evaluate StefanBoltzmann Constant and emissivity.
- Conduct tests to evaluate the performance of parallel/counter flow heatexchanger Apparatus and reciprocating air compressor

ETME-502	FLUID MACHINERY	L	T	P	C	HOURS PER WEEK
		3	1	0	4	4

Course Objectives:

- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.

MODULE I:IMPULSE OF JET 9

Introduction: Impulse of Jet: Classification of Fluid Machines & Devices, Application of momentum and moment of momentum equation to flow through hydraulic machinery, Euler's fundamental equation. Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve)

MODULE II:IMPULSE TURBINES 8

Impulse Turbines: Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel.

MODULE III:REACTION TURBINES 10

Reaction Turbines: Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitations in turbines, Principles of similarity, MODULEand specific speed, Performance characteristics, Selection of water turbines.

MODULE IV:CENTRIFUGAL PUMPS 8

Centrifugal Pumps: Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Cavitations & separation, Performance characteristics.

MODULE V:RECIPROCATING PUMP 9

Positive Displacement and other Pumps: Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels, Comparison of centrifugal and reciprocating pumps, Performance characteristics. Hydraulic ram, Jet pumps, Air lift pumps.

Course Outcomes:

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

- Apply mathematical knowledge to predict the properties and characteristics of a fluid
- Analyse and calculate major and minor losses associated with pipe flow in piping networks
- Mathematically predict the nature of physical quantities
- Critically analyse the performance of pumps
- Critically analyse the performance of turbines

REFERENCES:

1. Lal Jagdish, Hydraulic Machines, Metropolitan book co. Pvt. Ltd.
2. Subramanya K, Hydraulic Machines, Tata McGrawHill.
3. Ojha C.S.P, Berndtsson .R, Chandramouli P.N, Fluid Mechanics and Machinery,Oxford UniversityPress.
4. Kumar D S, Fluid Mechanics and Fluid Power Engineering, S K Kataria&Sons.
5. Das,Fluid Mechanics and Turbo machines,PHI.
6. Esposito,Fluid Power with Applications,Pearson.
7. Modi& Seth,Fluid Mechanics and hydraulic machines, Standard BookHouse.
8. Venkanna B.K.,Fundamentals of Turbo machinery,PHI.

ETME-512	FLUID MACHINERY LAB	L	T	P	C	HOURS PER WEEK
		0	0	3	1.5	4

Course Objectives:

- The applications of the conservation laws to flow through pipes arestudied.
- To understand the performance Characteristics of Centrifugal pump Test Rig.
- To understand the importance of various types of flow inturbines.

LIST OF EXPERIMENT

1. To determine operation characteristics of Pelton wheel turbine.
2. To draw the performance Characteristics of Centrifugal pump Test Rig.
3. To Draw the Performance Characteristics of Single Stage Reciprocating Pump Test Rig.
4. To determine different types of efficiencies of hydraulic ram Test Rig.
5. Study of Francis turbine.
6. Study on the impact of jet.
7. Study of Kaplan turbine.
8. Study of hydraulic brake.
9. Study of hydraulic Jack/press.
10. Study through visit of any water pumping station/plant.

Course Outcomes:

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

To understand the concept of Pelton wheel turbine, Characteristics of Centrifugal pump TestRig, efficiencies of hydraulic ram Test Rig.

ETME-503	THEORY OF MACHINES	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objectives:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of amechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified outputmotions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machinecomponents.

MODULE I: VELOCITY ANALYSIS AND ACCELERATION ANALYSIS 12

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

MODULE II: GEARS AND GEAR TRAINS 8

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 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.

MODULE III:FORCE ANALYSIS AND TURNING MOMENT 11

Force Analysis: Static force analysis of mechanisms, D'Alembert's Principle, dynamics of rigid linkin 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.

MODULE IV:BALANCING AND GYROSCOPE 9

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.

MODULE V:GOVERNORS 5

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 controlled governors.

Course Outcome:

- After completing this course, the students can design various types of linkage mechanisms forobtaining specific motion and analyse them for optimal functioning
- Calculate static and dynamic forces of mechanisms.
- Calculate the balancing masses and their locations of reciprocating and rotating masses.
- Calculate the speed and lift of the governor and estimate the gyroscopic effect on Automobiles, ships and airplanes

TEXT BOOK:

- Khurmi R S,Theory ofMachines.
- Rattan S S, Theory of Machines, McGrawHill

ETME-513	THEORY OF MACHINES LAB	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives:

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

LIST OF EXPERIMENT:

1. To study of the links, Kinematic pairs and chain.
2. To find the displacement and jump speed of the cam follower.
3. To determine the force and spring stiffness in Hartnell Governor.
4. To study the characteristic of the porter Governor.
5. To determine the centrifugal force of the watt Governor.
6. To balance unbalance masses using static and dynamic balancing method.
7. To determine the natural frequency of a spring mass system.
8. To determine the critical or whirling speed of a shaft.
9. To determine the gyroscopic couple.
10. Determination of transmissibility ratio-vibrating table.

Course Outcome:

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

CMMB-509	SONAL MANAGEMENT ANDINDUSTRIAL RELATION	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objective:

- To understand the basic concepts of Importance of Personnel Management, Manpower Planning.

MODULE I: FUNCTION, & IMPORTANCE OF PERSONNEL MANAGEMENT 9

Meaning, concept, function, & importance of personnel management, role of a personnel manager, personnel policies - Need of a personnel policies, organization of personnel Department (functional basis, service basis and chentile basis)

MODULE II: MANPOWER PLANNING 9

Manpower planning : Meaning & concept, need for manpower planning, types of manpower planning, meaning and concept of job analysis, job description & job specification, uses of job analysis information, Recruitment, selection – meaning and steps of selection process, meaning of induction

MODULE III:TRAINING AND DEVELOP 9

Training and develop: Meaning, need & importance for training, method of training, development - meaning of development, method of development.

MODULE IV:PERFORMANCE APPRAISED 9

Performance appraised: Meaning, Objective, method of performance appraisal .Transfer: meaning objective, types. Promotion:Meaning, policies, basis of promotion. Separation: Resignation, Discharge & Dismissal, Suspension & Retrenchment, Layoff.

MODULE V: WAGES AND SALARY ADMINISTRATION 9

Wages and salary administration: Meaning purpose & principle of wage & salary administration, factors influencing wage & salary administration. Meaning of wage &salary, minimum wage , fair wage& living , wage. Meaning of money and real wage' Methods of wage payment - time rate & piece rate, Incentive- Financial Incentive& non financial Incentive, method of wage payment based on result'Health, safety and welfare facilities' social security, Industrial Relation: meaning & concept, changing concept of industrial relation, role played by the employer, trade union & government, current I. R. position in India, I.R. policies of government of India. Trade Union:

Meaning and concept, objective, functions, type, method of trade union.

COURSE OUTCOME:

Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

- Explain various Manpower Planning

TEXT BOOKS:

1. Personal management by C.B.Memoria & G.V. Gankar- himalaya
2. Personal management & industrial relation by P.C.Tripathi-S.chand

REFERENCE BOOK:

1. Industrial relation, Trade Union & Labour Relation by G.P.Sinha & PRN Sinha, Pearson.

ETSH-501	ENCE OF INDIAN TRADITIONALKNOWLEDGE	L	T	P	C	HOURS PER WEEK
		3	0	0	0	3

Course Objectives:

To facilitate the students with the concepts of Indian traditionalKnowledge and to make them understand the Importance of roots of knowledge system

MODULE I: INTRODUCTION TO TRADITIONAL KNOWLEDGE 9

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

MODULE II: PROTECTION OF TRADITIONAL KNOWLEDGE 5

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

MODULE III: LEGAL FRAME WORK AND TK 7

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);

B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

MODULE IV: TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY 8

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

MODULE V: TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS 9

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

Course Outcomes:

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

- Upon completion of the course, the students are expected to:
- Understand the concept of Traditional knowledge and its importance
- Know the need and importance of protecting traditional knowledge.
- Know the various enactments related to the protection of traditional knowledge.
- Understand the concepts of Intellectual property to protect the traditional knowledge.

REFERENCE BOOKS:

1. Traditional Knowledge System in India, by AmitJha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar MohantaAnd Vipin Kumar Singh, PratibhaPrakashan 2012.
3. Traditional Knowledge System in India by AmitJha Atlantic publishers, 2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2

E-RESOURCES:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

SIXTH SEMESTER

ETME-601	MANUFACTURING TECHNOLOGY	L	T	P	C	HOURS PERWEEK
		3	1	0	4	4

Course Objectives:

- To understand the concept and basic mechanics of metal cutting, workingof 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

MODULE I:TOOLING FOR CONVENTIONAL & NON-CONVENTIONAL MACHINING PROCESSES 9

Tooling for conventional and non-conventional machining processes: Mould and die design, Press tools, Cutting tools; Holding tools: Jigs and fixtures, principles, applications and design; press tools – configuration, design of die and punch; principles of forging die design.

MODULE II:METROLOGY 9

Metrology: Dimensions, forms and surface measurements, Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; Metrology in tool wear and part quality including surface integrity, alignment and testing methods; tolerance analysis in manufacturing and assembly. Process metrology for emerging machining processes such as micro-scale machining, Inspection and work piece quality,

MODULE III:ASSEMBLY PRACTICES 9

Assembly practices: Manufacturing and assembly, process planning, selective assembly, Material handling and devices.

MODULE IV:LINEAR PROGRAMMING 9

Linear programming, objective function and constraints, graphical method, Simplex and duplex algorithms, transportation assignment, Traveling Salesman problem; Network models: shortest route, minimal spanning tree, maximum flow model- Project networks

MODULE V:CPM AND PERT 9

CPM and PERT, critical path scheduling; Production planning& control: Forecasting models, aggregate production planning, materials requirement planning. Inventory Models: Economic Order Quantity, quantity discount models, stochastic inventory models, practical inventory control models, JIT Simple queuing theory models

Course Objective:

- Explain different metal casting processes, associated defects, merits and demerits
- Compare different metal joining processes.
- Summarize various hot working and cold working methods of metals.
- Explain various sheet metal making processes.
- Distinguish various methods of manufacturing plastic components.

TEXT BOOKS:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition) -Pearson India, 2014.
2. Taha H. A., Operations Research, 6th Edition, Prentice Hall of India, 2003
3. Shenoy G.V. and Shrivastava U.K., Operations Research for Management, Wiley Eastern, 1994

ETME-602	DESIGN OF MACHINE ELEMENTS	L	T	P	C	HOURS PERWEEK
		3	1	0	4	4

Course Objectives:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensionsof 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 Book is permitted)

MODULE I: STEADY STRESSES AND VARIABLE STRESSES IN MACHINEMEMBERS 9

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 – stressconcentration – Design for variable loading.

MODULE II:SHAFTS AND COUPLINGS 9

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 9

Threaded fastners - 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 9

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 9

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

Course Outcomes:

- Explain the influence of steady and variable stresses in machine component design.
- Apply the concepts of design to shafts, keys and couplings.
- Apply the concepts of design to temporary and permanent joints.
- Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
- Apply the concepts of design to bearings.

TEXT BOOKS:

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

ETME-611	DESIGN OF MACHINE ELEMENTS LAB	L	T	P	C	HOURSPER WEEK
		0	0	3	1.5	3

Course Objective:

- To familiarize the various steps involved in the Design Process
- To understand the drawing of Cotter joint , boiler riveted joint, helical spring,

LIST OF EXPERIMENT:

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

Course Outcome:

To understand about the how to draw the drawing for the various components

ELECTIVE-I

ETME-621	POWER PLANT ENGINEERING	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives:

Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I: COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II: DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III: NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV: POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V: ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

Course Outcome:

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

- Explain the layout, construction and working of the components inside a thermal power plant.
- Explain the layout, construction and working of the components inside a Diesel, Gas

andCombined cycle power plants.

- Explain the layout, construction and working of the components inside nuclear power plants.

- Explain the layout, construction and working of the components inside Renewable energypower plants.
- Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT/REFERENCE BOOKS:

1. Rajmohan Gupta, “Steam Turbine”, Oxford & IBH Publishing Co. Pvt. Ltd.
2. P. K. Nag, “Power Plant Engineering”, Tata McGraw Hill Publications.
3. R. Yadav, “Steaurbine”, Khanna Publishers.
4. “Modern Power Station Practice” Volume C, British Electricity International Ltd., Central Electricity Generating Board, Pergamon Press, Oxford, 1991.
5. “Steam Turbine and its Auxiliaries”, Manufacturer’s Power Plant Manual.
6. Power Plant Familiarisation – Vol. III, NPTI Publication.
7. M. M. Vakil, “Power Plant Technology”

ETME-622	STEAM GENERATORS	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives:

To apply the thermodynamic concepts for Steam Generators

MODULE I:DESCRIPTION OF MAIN BOILER 9

Classification and Types of Steam Generators, Fundamentals of Boilers design. Constructional details including steam water circuit of high pressure and high capacity water tube boilers, Economizers, Superheaters, De-Superheater, Re-heaters.

MODULE II:BOILER CIRCULATION THEORY 9

Boiler Drum & its Internals, Boiler Mountings, Feed water treatment.

MODULE III:AIR PRE-HEATER 9

Types and functions, Constructional details, SCAPH, Soot Blower, Draft System: Theory ofNatural, Induced, Forced and Balance Draft, Constructional details /Lubricating Oil System for PA Fan, FD Fan, ID Fan, Layout etc.

MODULE IV:ELECTROSTATIC PRECIPITATOR 7

Basic working principle and constructional details of Electrostatic Precipitator, Corona effect, rapping Mechanism.

MODULE V:ASH HANDLING SYSTEM 8

Bottom ash, Fly ash, System Layout, equipment description, Ash disposal and utilization.

Course Outcome:

Explain the functioning and features of different types of Steam Generators and auxiliaries and Calculate performance parameters

TEXT/REFERENCE BOOKS:

1. P. K. Nag, “Power Plant Engineering”, Tata McGraw Hill Publication
2. “Modern Power Station Practice”, Volume B, British Electricity International Ltd., Central Electricity Generating Board, Pergamon Press, Oxford, 1991.

3. "Steam Generator and its Auxiliaries", Manufacturer's Power Plant Manual.

4. Power Plant Familiarisation – Vol. II, NPTI Publication.

ETME-623	GAS DYNAMICS	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objectives:

- To understand the basic difference between incompressible and compressibleflow.
- To understand the phenomenon of shock waves and its effect on flow. Togain some basic knowledge about Unsteady wave motion

MODULE I:INTRODUCTION 9

Governing equations of compressible flow. 1 D Flow: Introduction - Normal Shock Relations - Hugoniot Equations.

MODULE II:OBLIQUE SHOCKS 9

Supersonic flow over wedges and cones - Interaction of shocks of opposite families - Intersection of shocks of same family.

MODULE III:3D SHOCK WAVES 9

Prandtl-Meyer Expansion waves - Shock expansion theory - Crocco's Theorem.

MODULE IV:LINEARIZED FLOW 9

Linearized velocity potential equation - Linearized pressure coefficient - Linearized Subsonic flow - Improved compressibility corrections - Linearized supersonic flow - Critical Mach Number.

MODULE V:UNSTEADY WAVE MOTION 9

Moving normal shock wave - Reflected shock waves - Incident and reflected expansion waves - Shock tube relations - Finite compression waves.

Course Outcome:

- Apply the concept of compressible flows in variable area ducts.
- Apply the concept of compressible flows in constant area ducts.
- Examine the effect of compression and expansion waves in compressible flow.

TEXT/REFERENCE BOOKS:

1. H. W. Liepmann and A. Roshko, Elements of Gas Dynamics

2. John D. Anderson, Jr., Modern Compressible Flow: With Historical Perspective, Third Edition,

ELECTIVE-II

ETME-624	FINITE ELEMENT METHOD	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives:

- To introduce the concepts of Mathematical Modeling of EngineeringProblems
- To appreciate the use of FEM to a range of EngineeringProblems

MODULE I: INTRODUCTION 9

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

MODULE II: ONE-DIMENSIONAL PROBLEMS 9

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation – Transverse deflections and Natural frequencies of beams.

MODULE III: TWO DIMENSIONAL SCALARVARIABLEPROBLEMS 9

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors, Application to Field Problems - Thermal problems – Torsion of Non circular shafts – Quadrilateral elements – Higher Order Elements

MODULE IV: TWO DIMENSIONAL VECTORVARIABLE PROBLEMS 9

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements

MODULE V: ISOPARAMETRICFORMULATION 9

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

Course Outcomes:

- Summarize the basics of finite element formulation.
- Apply finite element formulations to solve one dimensional Problem.
- Apply finite element formulations to solve two dimensional scalar Problems.
- Apply finite element method to solve two dimensional Vector problems.
- Apply finite element method to solve problems on iso parametric element and dynamicProblems.

TEXT BOOKS:

1. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill,2005

2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi,2007.

REFERENCES:

1. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley &Sons, 2005 (Indian Reprint 2013)

2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition,Prentice Hall College Div, 1990

3. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002

4. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2004

5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.

ETME-625	VIBRATION & MECHANICAL SYSTEM	L	T	P	C	HOURSPER WEEK
		3	0	0	3	3

Course Objectives:

- The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of thecomponents.

MODULE I: FUNDAMENTAL ASPECTS OF VIBRATIONS 9

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 9

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 9

One degree of freedom- forced harmonic vibration; vector representation of forces; excitation dueto 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 9

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 9

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.

Course Outcome:

- Summarize the Basics of Vibration
- Summarize the Basics of Noise
- Explain the Sources of Automotive Noise
- Discuss the Control techniques for vibration
- Describe the sources and control of Noise

REFERENCES:

1. Ambekar A.G.,' Mechanical Vibrations and Noise Engineering; PHI
2. Meirovitch Leonard; Element of Vibration Analysis; TMH
3. Dukikipati RV Srinivas J Text book of Mechanical Vibrations; PHI
4. Kelly SG and kudari SK; Mechanical Vibrations; Schaum Series;TMH
5. Thomson , W.T., Theory of Vibration with Applications , C.B.S Pub & distributors .
6. Singiresu Rao, 'Mechanical Vibrations, Pearson Education .
7. G.K. Grover, 'Mechanical Vibration , Nem chand and Bross , Roorkee

ETME-626	RAPID PRODUCT DEVELOPMENTTECHNOLOGIES	L	T	P	C	HOURSPER WEEK
		3	0	0	3	3

Course Objectives:

- The student will be able to understand the Rapid Prototyping Techniques

MODULE I:OVERVIEW OF RAPID PRODUCT DEVELOPMENT 9

Product Developing Cycle, Components of RPD, Classification of manufacturing processes. Preprocessing: Solid Modeling, Data exchange formats, STL file format, RP Preprocessing.

MODULEII:RAPID PROTOTYPING (RP) 9

Introduction to RP, Need of RP; Basic Principles of RP, Steps in RP, Process chain in RP in integrated CAD-CAM environment, Advantages of RP, Classifications of different RP techniques, Selection of RP processes, Issues in RP, Emerging trends.

MODULE III:RP TECHNIQUES 9

Solid RP, liquid RP techniques and Powder RP Techniques - Process Technology and Comparative study of Selective laser sintering, Selective powder binding, etc. Rapid Too
technologies, welding based technologies, direct pattern making, emerging trends in RT.

MODULE IV:REVERSE ENGINEERING 5

Geometric data acquisition, 3D reconstruction

MODULE V:APPLICATIONS AND CASE STUDIES 10

Engineering applications, Medical application Special Topic on Preprogramming in RP, Modeling, Slicing, Internal Hatching, Surface Skin Fills, and Support Structure. Overview of the algorithms for RP&T and Reverse Engineering

Course Outcome:

Discuss the techniques for Rapid Product Development.

TEXT/REFERENCE BOOKS:

1. Chua, C.K., Leong, K.F., Rapid Prototyping: Principles and Applications in Manufacturing, JohnWiley and Sons Inc., 2000.
2. Pham, D.T., Demov, S.S., Rapid Manufacturing: The Technologies and Applications of Rapid

Prototyping and Rapid Tooling, Springer-Verlag London Limited, 2001.

3. Hopkinson, N., Hague, R.J.M. and Dickens, P.M., Rapid Manufacturing and Industrial Revolution for the Digital Age, John Wiley and Sons Ltd, Chichester, 2005.

4. Noorani, R., Rapid Prototyping: Principles and Applications, John Wiley & Sons, Inc., NewJersey, 2006.

5. Zeid, I., Mastering CAD/CAM, Tata McGraw Hill, 2006

OPEN ELECTIVE-I

CMMB-621	EPRENEURSHIP DEVELOPMENT &BUSINESS INCUBATION	L	T	P	C	HOURS PER WEE
		3	0	0	3	3

Course Objectives:

To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively

MODULE I: ENTREPRENEURSHIP 9

Entrepreneur –Types of Entrepreneurs–Difference between Entrepreneur and Entre preneurEntrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth

MODULE II: MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

MODULE III: BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

MODULE IV: FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, and Management of working Capital, Costing, Break Even Analysis, and Taxation – Income Tax, Excise Duty – SalesTax.

MODULE V: SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

Course Outcome:

- Upon completion of the course, students will be able to gain knowledge and skills needed

to run abusiness successfully.

TEXT BOOKS:

1. Donald F Kuratko, “Entrepreneurship – Theory, Process and Practice”, 9Learning, 2014.Edition, Cengage

2. Khanka. S.S., “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

REFERENCES:

1. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

2. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013. . Math

Edition Dream tech, 2005. nd

4. Rajeev Roy, "Entrepreneurship" 2 Edition, Oxford University Press, 2011.

CMMB-622	TOTAL QUALITY MANAGEMENT	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives:

To facilitate the understanding of total quality management principles and processes

MODULE I:INTRODUCTION 9

Introduction, need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby, Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention; costs to quality.

MODULE II:TQMPRINCIPLES 9

TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement; PDCE cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.

MODULE III:TQM TOOLS AND TECHNIQUES 9

The seven traditional tools of quality; New management tools; Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; FMEA-stages,types.

MODULE IV: TQM TOOLS AND TECHNIQUES 9

TQM tools and techniques, control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function; TPM- concepts, improvement needs, performancemeasures.

MODULE V: QUALITY MANAGEMENT SYSTEM 9

Quality systems, need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation, Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits; TQM implementation in manufacturing and service sectors

Course Outcomes:

Upon completion of this course, the students will be able to use the tools and techniques of TQM inmanufacturing and service sectors.

TEXT BOOKS:

1. Besterfield D.H. et al., Total qualityManagement, 3rd ed., Pearson Education Asia,

2006.

2. Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indianedition, Cengage Learning, 2012.

3. Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.
4. Suganthi L. and Samuel A., Total Quality Management, Prentice HallIndia, 2006

CMMB-1101	PRINCIPLES OF MANAGEMENT	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives:

To understand the principles of management and their application to the functioning of an organization

MODULE I:INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of management, science or art, manager vs entrepreneur; Types of managers-managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public andprivate enterprises; Organization culture and environment; Current trends and issues in management.

MODULE II:PLANNING 9

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes

MODULE III:ORGANISING 9

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

MODULE IV:DIRECTING 9

Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

MODULE V:CONTROLLING 9

Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Course Outcomes:

Upon completion of this course

The students will get a clear understanding of management functions in an organization

TEXT BOOKS:

Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009

Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999

ETSH-601	ENVIRONMENTAL SCIENCES	L	T	P	C	HOURS PERWEEK
		3	0	0	0	3

Course Objective:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic andpolitical solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

MODULE I: ENVIRONMENT & BIODIVERSITY 9

Definition, scope and introduction –Planet earth (atmosphere, lithosphere & hydrosphere) of environment, Introduction to biodiversity definition: genetic, species and ecosystem diversity– Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values–Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

MODULE II: AIR & NOISE POLLUTION 9

Air pollution - Atmospheric chemistry - Chemical composition of the atmosphere-Definition- causes, effects and control measures. Control of particulate and gaseous emission - Electrostatic precipitator – Automobile emission - Catalytic convertor - Acid rain- Green house effect - Global warming- -Air (Prevention & control of pollution act) - Noise pollution– Definition, effects & control of noise pollution.

MODULE III: WATER & SOIL POLLUTION 9

Water and their environment significance-Water quality parameters-Physical, chemical and biological parameters-Dissolved Oxygen-Biological Oxygen demand – Chemical Oxygen Demand (Definition only) - Water pollution- causes, effect & control measures-Sewage water treatment – Water (prevention & control of pollution act) - Soil pollution-Definition, causes, effects of soil pollution

MODULE IV: CONVENTIONAL & NON CONVENTIONAL ENERGY RESOURCES 9

Conventional – Coal – Gross net calorific value (Definition only) – Coke – Manufacture of coke – Otto Hoffmann method – Petroleum- Fractional distillation - Natural gas - LPG and CNG-Need for alternative energy resources –Nuclear energy- Fission and fusion reactions- Light water nuclear reactor for power generation (block diagram only) – Solar energy – Wind energy-H2O2 fuel cell. Role of an individual in conservation of energy resources

MODULE V: GREEN CHEMISTRY & ENVIRONMENTAL MANAGEMENT 9

Green chemistry- Principles of green chemistry – Water conservation – Rain water harvesting - Solid waste management: causes, effects and control measures of municipal solid wastes. Disaster management – Floods, Earthquake – Population growth – Population explosion and its consequences - Role of information technology in environment and human health

Course Outcome:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at in fan stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmentaldisasters

TEXT BOOKS:

1. Dr.A.Ravikrishnan, “Environmental Science & Engineering”Sri Krishna Hitech Pub.Co.Pvt.Ltd.2013 (MODULE I, II, III, IV, V)

2. Benny Joseph, “Environmental Science & Engineering” Tate McGraw-Hill Pub.Co.Ltd, New Delhi.2009. (MODULE I, II, III, IV, V)

REFERENCES:

1. G.Tyler Miller, “Environmental Science” Cengage Learning India Pvt. Ltd.New Delhi.2011 (MODULE I, II, III)

2. Dr. Debang Solanki, “Principles of EnvironmentalChemistry” Prateeksha Pub. Jaipur.2011. (MODULE I)

3. Gilbert M. Masters and Wendell. P.Ela, “Introduction to Environmental Engineering and Science” PHI Learning Pvt. Ltd. New Delhi.2010 (MODULE II, III, V)

4. Deeksha Dave and S.S. Katewa, “Environmental Science & Engineering” Learning India Pvt. Ltd.New Delhi.2011 (MODULE I, II, IV, V)

5. Benny Joseph “Environmental Science & Engineering” Tata McGraw-Hill Pub.Co.Ltd, New Delhi. 2009 (MODULE I, II, IV, V).

ETME-612	**MER INTERNSHIP/VOCATIONALTRAINING**	**C** **1.5**	**Weeks Vocational Trainingafter 4th semester**

The curricula for all B.Tech, would include compulsory industrial training for 2 weeks carrying 1.5 credits to be carried out in the summer vacation at end of the sixth semester

The two-week industrial training undergone by the student in the summer vacation would be assessed. The students are required to submit a report on the training received and give a seminar onthe basis of which a grade would be awarded. The students are also required to submit to Head of department a completion certificate in the prescribed form the competent authority of the organization where the training was received without which he/she would not be assessed.

SEVENTH SEMESTER

ETME-701	REFRIGERATION AND AIR CONDITIONING	L	T	P	C	HOURSPER WEEK
		3	0	0	4	3

Course Objectives:

- To understand the underlying principles of operations in different Refrigeration & Airconditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems

MODULE I: INTRODUCTION 9

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

MODULE II: VAPOUR COMPRESSION REFRIGERATION SYSTEM 9

Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle – subcoolingand super heating- effects of condenser and evaporator pressure on COP- multipressure system - low temperature refrigeration - Cascade systems – problems. Equipments: Type of Compressors,Condensers, Expansion devices, Evaporators

MODULE III: OTHER REFRIGERATION SYSTEMS 9

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

MODULE IV: PSYCHROMETRIC PROPERTIES AND PROCESSES 9

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 air- conditioning processes, mixing of air streams.

MODULE V: AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION 9

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.

Course Outcomes:

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

- Explain the basic concepts of Refrigeration
- Explain the Vapor compression Refrigeration systems and to solve problems
- Discuss the various types of Refrigeration systems
- Calculate the Psychrometric properties and its use in psychrometric processes
- Explain the concepts of Air conditioning and to solve problems

TEXT BOOK:

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

REFERENCES:

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.

ETME-712	REFRIGERATION AND AIRCONDITIONING LAB	L	T	P	C	HOURS PER WEEK
		0	0	3	1.5	3

Course Objective:

To study the performance of refrigeration cycle and air-conditioning.

LIST OF EXPERIMENT

1. To Study of Simple Vapour Compression Refrigeration cycle on Refrigeration Test Rig
2. To Study Simple Vapor Compression Refrigeration cycle on Refrigeration Test Rig (FinArrangement)
3. Study of Window air –conditioning System on Test Rig (simple)
4. Study of vaopour absorption refrigeration system
5. To study different Psychrometric processes on Psychrometric chart
6. To Study the analysis of simple vapour compression cycle and explain the types of vapourcompression cycle with T-S and P-H diagram
7. To determine sensible heat factor of air on re-circulated air-conditioning set up
8. To study works principle of steam jet refrigeration system
9. Study of various elements of mechanical refrigerator system through actual apparatus
10. To study the chilling plant and its working cycle

Course Outcomes:

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

ETSH-701	BIOLOGY	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objective:

- To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.
- To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
- To convey that "Genetics is to biology what Newton‟s laws are to Physical Sciences". Mendel‟s laws, Concept of segregation and independent assortment.
- To convey that all forms of life has the same building blocks and yet the manifestations areas diver e as one can imagine, Molecules of life.
- To convey that without catalysis life would not have existed on earth.
- The molecular basis of coding and decoding genetic information is universal..

MODULE I: INTRODUCTION & CLASSIFICATION 9

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor, These examples will highlight the fundamental importance of observations in any scientific inquiry.Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) Energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitataacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E. coli, S. cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M musculus

MODULE II: GENETICS 9

Concept of allele, Gene mapping, Gene interaction, Epistasis, Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring, Concepts of recessiveness and dominance.
Concept of mapping of phenotype to genes, Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

MODULE III: BIOMOLECULES & ENZYMES 9

In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins, Nucleotides and DNA/RNA, Two carbon units and lipids Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification, Mechanism of enzyme action, Discuss at least two examples. Enzyme

kinetics and kinetic parameters, Why should we know these parameters to understand biology?RNA catalysis

MODULE IV: INFORMATION TRANSFER 9

Molecular basis of information transfer, DNA as a genetic material, Hierarchy of DNA structure from single stranded to double helix to nucleosomes, Concept of genetic code, Universality and degeneracy of genetic code, Define gene in terms of complementation and recombination **MODULE V: MICROBIOLOGY** **9**

Concept of single celled organisms, Concept of species and strains, Identification and classificationof microorganisms Microscopy, Ecological aspects of single celled organisms, Sterilization and media compositions, Growth kinetics

Course Outcomes:

After studying the course, the student will be able to:

- Describe how biological observations of 18th Century that lead to major discoveries.
- Convey that classification *per se* is not what biology is all about but highlight the underlyingcriteria, such as morphological, biochemical and ecological
- Highlight the concepts of recessiveness and dominance during the passage of genetic materialfrom parent to offspring
- Classify enzymes and distinguish between different mechanisms of enzyme action.
- Identify DNA as a genetic material in the molecular basis of information transfer.
- Analyse biological processes at the reductionistic level
- Apply thermodynamic principles to biological systems.
- Identify and classify microorganisms.

TEXT / REFERENCES:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A global approach”, Pearson Education Ltd, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, “Outlines of Biochemistry”, John Wileyand Sons, 2009.
3. D. L. Nelson and M. M. Cox, “Principles of Biochemistry”, W.H. Freeman and Company, 2012.
4. G. S. Stent and R. Calendar, “Molecular Genetics”, Freeman and company, 1978
5. L. M. Prescott, J. P. Harley and C. A. Klein, “Microbiology”, McGraw Hill Higher Education,2005.

ELECTIVE-III

ETME-721	ENERGY CONSERVATION DEVICES	L	T	P	C	HOURSPER WEEK
		3	0	0	3	3

Course Objectives:

To understand the energy data from industries and carry out energy audit for energy savings

MODULE I: COMMERCIAL ENERGY 9

Coal, Oil, Natural Gas, Nuclear power and Hydro -their utilization pattern in the past, present and future projections of consumption pattern – Sector - wise energy consumption – environmental impact of fossil fuels – Energy scenario in India – Growth of energy sector and its planning in India.

MODULE II: SOLAR ENERGY 9

Solar radiation at the earth's surface – solar radiation measurements – estimation of average solar Radiation - solar thermal flat plate collectors - concentrating collectors, Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation Local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors Solar air heaters - types, solar driers, storage of solar energy - thermal storage, solar pond Solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications.

MODULE III: WIND ENERGY 9

Nature of the wind –power in the wind – factors influencing wind – wind data and energy estimation - wind speed monitoring -wind resource assessment - Betz limit - site selection - wind energy conversion devices - classification, characteristics, applications – offs hore wind energy- Hybrid systems - safety and environmental aspects – wind energy potential and installation in India - Repowering concept.

MODULE IV: BIO – ENERGY 9

Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - direct combustion – biomass gasification - pyrolysis and liquefaction - biochemical Conversion - anaerobic digestion - types of biogas Plants – applications - alcohol production from biomass - bio diesel production – Urban waste to energy conversion - Biomass energy programme in India.

MODULE V:TURBINES AND PUMPS 9

Introduction, turbines, different types turbines, pelton wheel (or turbine), velocity triangles, radial flow reaction turbine, Francis turbines, Axial flow reaction turbines, reciprocating pumps - variations of velocity and acceleration in the suction and delivery pipes due to acceleration of the piston, centrifugal pumps – work done by the centrifugal pump on water, minimum speed for starting a centrifugal pump, multistage centrifugal pumps for high head and high discharge.

Course Outcomes:

Upon completion of this course, the students will be able to perform of energy auditing for the energy consumption of industries

TEXT/REFERENCE BOOKS:

1. Non - conventional energy by B H Khan, Tata McGraw - Hill, New Delhi.

2. Fundamental of turbo machinery – B.K. Venkanna, PHI, New Delhi 2009 3. An introduction toEnergy Conversion: Turbo machinery, volume

3. (Second Edition) Manohar Prasad, V. Kadambi.

4. Fluid mechanics and Hydraulic Machines by Dr. R. K. Bansal laxmi publications.

ETME-722	AUTOMOBILE ENGINEERING	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives

- 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

MODULE I: VEHICLE STRUCTURE AND ENGINES

9Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functionsand materials, variable valve timing (VVT).

MODULEII: ENGINE AUXILIARY SYSTEMS

9Electronically controlled gasoline injection system for SI engines, electronically controlled diesel injection system (MODULE 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)

MODULE III: TRANSMISSION SYSTEMS 9

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.

MODULE IV: STEERING, BRAKES AND SUSPENSION SYSTEMS 9

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

MODULE V: ALTERNATIVE ENERGY SOURCES 9

Use of NaturalGas, LiquefiedPetroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and EmissionCharacteristics 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.

Course Outcomes:

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

- Recognize the various parts of the automobile and their functions and materials.
- Discuss the engine auxiliary systems and engine emission control.
- Distinguish the working of different types of transmission systems.

- Explain the Steering, Brakes and Suspension Systems.
- Predict possible alternate sources of energy for IC Engines.

TEXT BOOKS:

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

REFERENCES:

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,” TheGood heart - Will Cox Company Inc, USA ,1978.

ETME-723	INDUSTRIAL INSTRUMENTATION & METROLOGY	L	T	P	C	HOURSPI WEEK
		3	0	0	3	3

Course Objective:

- To provide knowledge on various Metrological equipments available to measure the dimension ofthe components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of thecomponents.

MODULE I: BASICS OF METROLOGY 9

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

MODULE II: LINEAR AND ANGULAR MEASUREMENTS 9

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

MODULE III: ADVANCES IN METROLOGY 9

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMMConstructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

MODULE IV: FORM MEASUREMENT 9

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

MODULE V: MEASUREMENT OF POWER, FLOW AND TEMPERATURE 9

Force, torque, power - mechanical, Pneumatic, Hydraulic and Electrical type, Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

Course Outcomes:

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

- Describe the concepts of measurements to apply in various metrological instruments
- Outline the principles of linear and angular measurement tools used for industrialapplications
- Explain the procedure for conducting computer aided inspection
- Demonstrate the techniques of form measurement used for industrial components
- Discuss various measuring techniques of mechanical properties in industrial applications

TEXT BOOKS:

1. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 2009.

REFERENCES:

1. Alan S. Morris, "The essence of Measurement", Prentice Hall of India 1996.
2. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2014.
3. Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning nEMEA,1990.
4. Donald Peckman, "Industrial Instrumentation", Wiley Eastern, 2004.
5. Raghavendra ,Krishnamurthy "Engineering Metrology & Measurements", Oxford Univ. Press,

ELECTIVE-IV

ETME-724	DVANCED MANUFACTURINGPROCESSES	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objective:

To motivate and challenge students to understand and develop an appreciation of the process in correlation with advanced manufacturing processes which change the shape, size and form of the raw materials into the desired product by conventional or non-conventional manufacturing methods.

MODULE I: METAL MACHINING 9

Tool Geometry, different system of representation, mechanics of orthogonal and oblique cutting, shear angle relation in orthogonal cutting, shear angle & chip flow direction in oblique cutting, chip control methods, analysis of cutting process like turning, drilling, milling. Temp. Distribution at the tool chip interface

MODULE II: THERMOELECTRIC NON-CONVENTIONAL METHODS 9

Principle, Working and Applications of Plasma Arc Machining, Laser Beam Machining, ElectronBeam Machining, Working principle and applications of Electric Discharge Machining, EDM machines, EDM process characteristics, Wire electric discharge machining.

MODULE III: ELECTRO-CHEMICAL PROCESSES 8

ECM, its working principle, advantages and applications, Electro-chemical grinding, Electro-chemical deburring, Chemical machining. Non-conventional welding processes: Explosive welding, Cladding etc., under water welding, Metalizing, Plasma are welding/cutting etc.

MODULE IV: NON-CONVENTIONAL FORMING PROCESSES 8

Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-discharge forming, water hammer forming, explosive compaction etc.Electronic-device Manufacturing, Diffusion and Photo- Lithography process forelectronic- device manufacturing.

MODULE V: ADVANCED WELDING PROCESSES 8

Advance welding process, Ultrasonic Welding, Electronic beam welding, Laser beam welding,

Explosive Welding, Plasma welding, Development in welding Technology, Some research trends in welding, quality control of weldments.

Course Outcome:

Upon completion of this course, students will be able to understand the different conventional and non-conventional manufacturing methods employed for making different products.

REFERENCE BOOKS:

1. Manufacturing Science, Ghosh and Malik, Affiliated East-West Press
2. Welding Processes and Technology, R.S. Parmar, Khanna Publishers
3. Advanced Manufacturing Processes, P. K. Ambadekar, Nirali Prakashan

ETME-725	AUTOMATION IN MANUFACTURING	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objective:

- To provide an overview of how computers are being used in mechanical componentdesign
- To understand the application of computers in various aspects of Manufacturing viz.,Design, Proper planning, Manufacturing cost, Layout & Material Handlingsystem.

MODULE I: COMPUTER AIDED DESIGN AND GEOMETRIC MODELING 9

Introduction – CAD definition – design process – CAD activities – benefits and scope of CAD, Transformations:Scaling, Rotation, Pan, Redraw, Regenerate-Geometric modeling techniques: wire frame, surface, solid modeling – Introduction to finite element methods – Procedure of finite element analysis.

MODULE II: CNC MACHINE TOOLS AND COMPONENTS 9

Numerical control – development of NC – DNC – CNC and adaptive control systems – Distinguishing features of turning and machining center – design considerations of NC machine tools. CNC EDM machine – Coordinate measuring machines: construction, working principles and specifications – maintenance of CNC machines. Recirculating ball screw, linear motion guide ways,tool magazines, ATC, APC, chip conveyors, tool turrets.

MODULE III: CNC CONTROL SYSTEM AND PART PROGRAMMING 9

Pneumatic and hydraulic control system, Open loop and closed loop control system, microprocessor based CNC system, description of hardware and software interpolation system, feedback devices: encoders – linear and rotary transducers – in-process probing. NC dimensioning – reference points – machine zero, work zero, tool zero and tool offsets, compensation. Coordinate system – types of motion control: point-to-point, paraxial and contouring – Types of NC part programming – G and M codes - turning and milling part programming examples - interpolation – macro – subroutines – canned cycles – mirror images.

MODULE IV: FLEXIBLE MANUFACTURING SYSTEMS 9

Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In- Time Production. Concurrent Engineering – FMS - Components of FMS - Types - FMS workstation

-Material handling and storage systems- FMS layout -Application and benefits.

MODULE V: COMPUTER INTEGRATED MANUFACTURING SYSTEMS 9

Evolution of CAD/CAM and CIM - Integration of CNC machines in CIM environment, Definition- CIM Wheel- -CIM concepts – Computerized elements of CIM system –Types of production Communication fundamentals- local area networks -topology -LAN implementations - Network management and installations - networking concepts, devices-CIM implementation

Course Outcome:

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

- Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics
- Explain the fundamentals of parametric curves, surfaces and Solids
- Summarize the different types of Standard systems used in CAD
- Apply NC & CNC programming concepts to develop part programme for Lathe & MillingMachines
- Summarize the different types of techniques used in Cellular Manufacturing and FMS

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill PublishingCo.2007

2. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.

3. Radhakrishnan P, SubramanyanS.andRaju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi,2000.

REFERENCES:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles", "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.

2. Donald Hearn and M. Pauline Baker “Computer Graphics”’. Prentice Hall, Inc,1992.

3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education -2003

4. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.

ETME-726	FRACTURE AND FATIGUE	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objectives:

The main objective is to give an opportunity to the student to get knowledge about fracture.

MODULE I: INTRODUCTION FRACTURE 9

Fracture: History and overview of Fracture Mechanics; Structural failure and design philosophies; Ductile and brittle fracture of materials; The fracture mechanics approach to design; Griffith's theory of brittle failures; Irwin's stress intensity factors.

MODULE II: LINEAR ELASTIC FRACTURE MECHANICS (LEFM) 9

LEFM; Stress concentration, Energy balance criteria, stress intensity factor, crack tip plastic zone, crack resistance, KIc, the critical value, Relation of G&K, KIc measurement.

MODULE III: ELASTIC PLASTIC FRACTURE MECHANICS (EPFM) 9

EPFM: Fracture beyond yield, CTOD, experimental determination of CTOD, use J integrals and measurement of JIc and JR. Fracture Toughness measurement: Standards and its application in design.

MODULE IV: FATIGUE CRACK PROPAGATION 9

Fatigue crack propagation: Fatigue crack growth theories, crack closure, Microscopic theories of fatigue crack growth; Application of theories of fracture mechanics in design and materials development.

MODULE V: INTRODUCTION AND CHARACTERISTICS OF FATIGUE FRACTURE 9

Fatigue Introduction, Characteristics of Fatigue Fracture, Evaluation of Fatigue Resistance , Fatigue-Crack Growth Rates, Design against Failure, Cyclic Stress-Strain Behavior, Creep-Fatigue Interactions, Polymeric Fatigue, Fatigue of Composites Summary

Course Objectives:

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

- Summarize the various types of Fibers, Equations and manufacturing methods for Compositematerials

TEXT/REFERENCE BOOKS:

1. Fracture Mechanics: Fundamentals and Applications, Third Edition

2. Mechanical Behavior of Materials. Second Edition. Thomas H. Courtney

3. Mechanical Behavior of Materials: Engineering Methods for Deformation, Fracture, and Fatigueby Norman E. Dowling

ETME-713	MINOR PROJECT	L	T	P	C	HOURS PER WEEK
		0	0	10	3.5	10

Course Objective:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION:

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment bya Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Course Outcomes:

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

- Design and fabricate the machine element or the mechanical product.
- Demonstrate the working model of the machine element or the mechanical product.

ETME-714	**INDUSTRIAL TRAINING**	**C**	**ks Vocational Training after6th semester**
		1.5	

The curricula for all B.Tech, would include compulsory industrial training for 4 weeks carrying 2 credits to be carried out in the summer vacation at end of the sixth semester

The four-week industrial training undergone by the student in the summer vacation after the sixth semester would be assessed within five weeks after commencement of the seventh semester. The students are required to submit a report on the training received and give a seminar on the basis of which a grade would be awarded. The students are also required to submit to Head of department a completion certificate in the prescribed form the competent authority of the organization where the training was received without which he/she would not be assessed.

EIGHTH SEMESTERELECTIVE-V

ETME-821	OPTIMIZATION TECHNIQUES	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objective:

The main objective is to give an opportunity to the student to get knowledge about Optimization Techniques.

MODULE I: UNCONSTRAINED OPTIMIZATION TECHNIQUES 9

Introduction to optimum design - General principles of optimization formulation of an objective function Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search Methods – Interpolation methods,Classification of optimization problems.

MODULE II: CONSTRAINED OPTIMIZATION TECHNIQUES 9

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - Geometric programming- Linear Programming.

MODULE III:DYNAMIC PROGRAMMING 9

Multi stage optimization – dynamic programming; stochastic programming; Multi objective programming techniques in optimization – Formation of dynamic programming and Network techniques

MODULE IV: UNCONVENTIONAL OPTIMIZATION TECHNIQUES 9

Genetic algorithms, Genetic programming, Simulated Annealing; Neural network and Fuzzy logic principles and their applications in design of experiments in optimization

MODULE V: APPLICATIONS 9

Structural applications – Design of simple truss members – Design applications – Design of simple axial, weight –Optimization of parameters in heat exchangers, cooling towers and IC engines-Engineering application of optimization

Course Objective:

Upon the completion of this course the students will be able toSummarize the various Optimizations of parameters

TEXT BOOKS:

1. Singiresu S. Rao, "Engineering Optimization – Theory and Practice", 4thEdition,New Age International Publications, Chennai, 2013. (MODULE I, II, III, IV, V).

2. Jasbin. S. Arora, "Introduction to Optimum Design", 4th Edition, Tata McGraw Hill PublishingCompany Pvt Ltd., New Delhi, 2009. (MODULE I, II, III, IV, V).

REFERENCES:

1. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples",2ndEdition,Prentice Hall of India Pvt. Ltd, New Delhi,2006(MODULE III,IV,V).

2. Rao, Singaresu, S., "Engineering Optimization – Theory and Practice", 4th Edition, New AgeInternational (P) Limited, New Delhi, 2009(MODULE I, II, III).

3. Yogesh Jaluria, "Design and Optimization of thermal Systems",3rd Edition

ETME-822	MECHANICS OF COMPOSITE MATERIAL	L	T	P	C	HOURSP WEEK
		3	0	0	3	3

Course Objectives:

•To understand the fundamentals of composite material strength and its mechanical behavior

• Understanding the analysis of fiber reinforced Laminate design for different combinations of plieswith different orientations of the fiber.

• Thermo-mechanical behavior and study of residual stresses in Laminates during processing

• Implementation of Classical Laminate Theory (CLT) to study and analysis for residual Stresses in an isotropic layered structure such as electronic chips

MODULE I: INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS MANUFACTURING 9

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramicand Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law.Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

MODULE II: FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 9

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli.Evaluation of Lamina Properties from Laminate Tests.Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

MODULE III:LAMINA STRENGTH ANALYSIS 9

Introduction - Maximum Stress and Strain Criteria.Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

MODULE IV: THERMAL ANALYSIS **9**

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations –Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi- Isotropic Laminates

MODULE V: ANALYSIS OF LAMINATED FLAT PLATES **9**

Equilibrium Equations of Motion.Energy Formulations. Static Bending Analysis,Buckling Analysis, Free Vibrations – Natural Frequencies

Course Outcomes:

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

- Summarize the various types of Fibers, Equations and manufacturing methods for Compositematerials
- Derive Flat plate Laminate equations
- Analyze Lamina strength
- Analyze the thermal behavior of Composite laminates
- Analyze Laminate flat plates

TEXT BOOKS:

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, CRCpress in progress, 1994, -.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw Hill, 1998

REFERENCES:

1. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
2. Halpin, J.C., "Primer on Composite Materials, Analysis", Technomic Publishing Co., 1984.
3. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition - 2007
4. Mallick, P.K., Fiber, "Reinforced Composites: Materials, Manufacturing and Design", Marcel Dekker Inc, 1993.
5. Mallick, P.K. and Newman, S., (edition), Composite Materials Technology: Processes and

Properties", Hansen Publisher, Munish, 1990.

ETME-823	ROBOT KINEMATICS AND DYNAMICS	L	T	P	C	HOURSPER WEEK
		3	0	0	3	3

Course Objectives

To understand the functions of the basic components of aRobot.
To study the use of various types of End of Effectors andSensors
To impart knowledge in Robot Kinematics andProgramming
To learn Robot safety issues andeconomics.

MODULE I: INTRODUCTION 9

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

MODULE II: CO-ORDINATE OF ROBOTS 9

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

MODULE III: KINEMATICS MECHANISAM 9

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

MODULE IV: MOTION OF ROBOT 9

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

MODULE V:LARGRANGIAN MECHANICS 9

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

Course Outcomes:

- Explain the concepts of industrial robots, classification, specifications and coordinate systems.
- Also summarize the need and application of robots in different sectors.

- Illustrate the different types of robot drive systems as well as robot end effectors.
- Apply the different sensors and image processing techniques in robotics to improve the Ability of robots
- Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.
- Examine the implementation of robots in various industrial sectors and interpolate the economicanalysis of robots.

TEXT BOOKS:

1. Groover M.P., "Industrial Robotics -Technology Programming andApplications", McGraw Hill, 2012.
2. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - AnIntegrated 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. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Visionand Intelligence", McGraw Hill Book Co., 1987.
4. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill,1995.
5. Koren Y., "Robotics for Engineers", Mc Graw Hill Book Co.,1992.

ELECTIVE-VI

ETME-824	MECHATRONICS SYSTEM	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives

- To impart knowledge about the elements and techniques involved in Mechatronics systemswhich are very much essential to understand the emerging field ofautomation.

MODULEI:INTRODUCTION 9

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers**:** Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

MODULE II:MICROPROCESSORANDMICROCONTROLLER 9

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

MODULE III: PROGRAMMABLE PERIPHERALINTERFACE 9

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

MODULE IV: PROGRAMMABLE LOGICCONTROLLER 9

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

MODULEV:ACTUATORSAND MECHATRONICSYSTEMDESIGN 9

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.

Course Objective:

- Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and ComputerSystems for the Control of Mechanical, Electronic Systems and sensor technology.
- Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressin Modesof Microprocessor and Microcontroller.
- Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various deviceinterfacing
- Explain the architecture, programming and application of programmable logic controllers toproblems and challenges in the areas of Mechatronic engineering.
- Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

TEXT BOOKS:

1. Bolton, “Mechatronics”, Prentice Hall,2008
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, andApplications with the 8085”, 5th Edition, Prentice Hall,2008.

REFERENCES:

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

ETME-825	IC ENGINE	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objectives:

- To familiarize with the terminology associated with ICengines.
- To understand the basics of ICengines.
- To understand combustion, and various parameters and variables affecting it in various types of ICengines.
- To learn about various systems used in IC engines and the type of IC engine required for variousapplications

MODULE I: INTRODUCTION 9

Internal Combustion Engine: S.I. and C.I. engines of two and four stroke cycles, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, cylinder arrangement, firing order, power balance for multi-cylinder engines, valve timing. Thermodynamic properties of fuel-air mixture before and after combustion, deviations of actual cycle from Ideal conditions.

MODULE II: COMBUSTION IN S.I. ENGINES 9

Combustion in S.I. Engines: The Process of combustion, Effects of engine variables on ignition lag and flame propagation, abnormal combustion, knocking, effects and control of knock, Knock theory, effects of engine variable on knock, S.I. Engine fuel properties, Knock rating of fuel, octane number, additives, requirements of combustion chamber, Design Principles, Types of combustion chambers, merits. Combustion in C.I. Engines: Combustion Process, Stages, diesel knock, effects of operating parameters on knock, knock Control, rating of C.I. engine fuels, Cetane number, types and requirements of the combustion chambers. Emission and Control: SI and CI engine emissions, effects of pollutants on human health and biological sphere, Control of emissions from SI and CI Engines, Introduction to Noise Pollution & its Control.

MODULE III: ENGINE OPERATING SYSTEMS 9

Engine Operating Systems: Valves and valve gear, lubrication systems, and system components, lubricating oils, properties and rating, additives. Cooling systems, temperature gradients in engine parts, various methods of cooling, Power absorbed in cooling, Properties of coolants, additives. Fuel systems for SI and CI engines, F/A ratio requirements for different operating conditions, fuel

transfer pump, fuel injection pump, injector, Modern carburetors, MPFI in SI engines. Conventional & Modern Ignition system, firing order

MODULEIV: ENGINE PERFORMANCE 9

Engine Performance: Testing of Engines - their performance characteristics, Heat Balance sheet, Scavenging processes, Volumetric, charging and scavenging efficiencies, scavenging methods and systems of four stroke and two stroke engines.

MODULE V: SUPERCHARGING 9

Supercharging: Supercharging suitability for SI and CI engines and effect of attitude on mixture strength and output of S.I. engines, Types of supercharging, analysis and performance, low and high pressure super charging, exhaust, gas turbo-charging, supercharging of two stroke engines

Course Outcomes:

Students who have done this course will have a good idea of the basics of IC enginesand how different parameters influence the operational characteristics of ICEngines

REFERENCE BOOKS:

1. I.C. Engine by M.L. Mathur, R.P.Sharma; Dhatpat Rai Pub.

2. I.C. Engine by V. Ganeshan ; Tata McGra Hill.

3 I.C. Engines by Anand V. Domkundwar, V.M. Domkundwar; Dhatpat Rai Pub

ETME-826	WORK STUDY & ERGONOMICS	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objective:

- To understand the basics of Work study & Ergonomics.

MODULE I: METHOD STUDY 9

purpose of work study, its objectives, procedure and applications; method study definition and basic procedure, selection of job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram, flow diagram, multiple activity chart, simo, cyclographs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study.

MODULE II: WORK MEASUREMENT 9

Introduction & definition, objectives and basic procedure of work measurement; application of work measurement in industries; time study: basic procedure, equipments needed, methods of measuring time, selection of jobs, breaking a job into elements; numbers of cycles to be timed; rating and methods of rating, allowances, calculation of standard time. Work sampling: Basic procedure, design of work sampling study conducting work sampling study and establishment of standard-time.

MODULE III: JOB EVALUATION AND INCENTIVE SCHEMES 9

Starlight line, Tailor, Merrick and Gantt incentive plans Standard data system; elemental and non-elemental predetermined motion systems, work factors system; Methods Time Measurement (MTM), MOST

MODULE IV: HUMAN FACTOR ENGINEERING 9

Definition and history of development of human factors engineering, types & characteristics of man-machine-system, relative capabilities of human being and machines; development and use of human factor data; information input and processing; introduction to information theory; factors effecting information reception and processing; coding and selecting of sensory inputs.

MODULE V: DISPLAY SYSTEMS AND ANTHROPOMETRIC DATA **9**

Display- types of visual display, visual indicators and warning signals; factorial and graphic display; general principles of auditory and tactral display, characteristics and selection

Course Outcome:

- To understand the basics concept of Work study & Ergonomics.

REFERENCE BOOKS:

1.ILO;work-study;InternationalLabourOrganization 2.han MI; Industrial Ergonomics; PHI Learning 3.Barrnes RM; Motion and Time Study; Wiley pub 4.Megaw ED; Contenmprory ergonomics; Taylor &fracis

5.Sandera M and McCormick E; Human Factors in Engg and design; MGHill6.Currie RM; Work study; BIM publications

7. Mynard; Hand book of Industrial Engg;

OPEN ELECTIVE-II

ETME-827	INDUSTRIAL POLLUTION	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

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 threeenvironmental compartments i.e. air, water and soil.

MODULE I: INTRODUCTION 8

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

MODULE II: ENVIRONMENTAL IMPACTS 8

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

MODULE III: AIR POLLUTION 9

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-

MODULE IV: WATER POLLUTION 10

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.

MODULE V: SOLID WASTE MANAGEMENT 10

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 andcoal industries

Course Outcome:

- To know about pollution and pollution types

TEXT BOOK:

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

ETME-828	SUSTAINABLE DEVELOPMENT	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objective:

- To study aboutsustainable development.

MODULE I: ECOSYSTEM 9

Ecosystem: Concept, Type, Structure, Function; Ecological succession, Pyramid, degradation and its remedies from Unsustainable development to sustainable development, Concept of sustainable development: Social and environmental issues (local, national and international), Need for studying the economics for sustainable development

MODULE II: ENVIRONMENT AND REHABILITATION 8

Environment and Rehabilitation: Mined area, Habitats, Water bodies, Mangroves; Global Changes, Biodiversity concerns and precautionary principles, Evaluation of sustainable development

MODULE III: VALUING MARKET AND NON-MARKET ECOSYSTEM 7

Valuing Market and Non-Market Ecosystem: Use of monetary valuation, Cost benefit analysis, Technique of monetary valuation, Definition of conventional and green GNP

MODULE IV: INTERNATIONAL TRADE AND SUSTAINABLE DEVELOPMENT 8

International trade and sustainable development: Free trade and globalization vs environment and community, obstacle of free trade

MODULE V: STRATEGIC APPROACHES AND LAWS TO SUSTAINABILITY 9

Strategic approaches and laws to sustainability: New international institutional contexts, commission on sustainable development; Environmental ethics and laws, India's move towards sustainable development

Course Outcome:

- To know about sustainable development.

TEXT BOOK:

1. S. Deswal, A. Deswal, An Introduction to environmental science, Dhanpat Rai and Co
2. N. Das Gupta, Environmental Accounting, Wheeler and co.
3. Daly H.E, Beyond Growth: The Economics of Sustainable Development, Beacon Press

4. D.K. Asthana, Meera Asthana, Environmental Science, S. Chand and co.

5. P.Rogers, K.F Jalal and J.A Boyd, An introduction to sustainable development, Earthscan

REFERANCE BOOK:

1. Willian P. Cunningham,Mary Ann Cunninggham, Principles of environmental science, T.M.H

ETME-829	RENEWABLE ENERGY RESOURCES	L	T	P	C	HOURSPER WEEK
		3	0	0	3	3

Course Objectives

- At the end of the course, the students are expected to identify the newmethodologiestechnologies for effective utilization of renewable energy sources.

MODULE I: INTRODUCTION

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials Achievements / Applications – Economics of renewable energy systems.

MODULE II: SOLAR ENERGY

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III: WIND ENERGY

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

MODULE IV: BIO -ENERGY

Biomassdirectcombustion–Biomassgasifiers–Biogasplants–Digesters–Ethanolproduction Bio diesel – Cogeneration – Biomass Applications

Module V: OTHER RENEWABLEENERGY SOURCES

Tidalenergy–WaveEnergy–OpenandClosedOTECCycles–SmallHydro-Geothermal Energy Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems

Course Outcomes:

- Discuss the importance and Economics of renewable Energy
- Discuss the method of power generation from Solar Energy
- Discuss the method of power generation from Wind Energy
- Explain the method of power generation from Bio Energy
- Explain the Tidal energy, Wave Energy, OTEC, Hydro energy, Geothermal Energy, Fuel

Cellsand Hybrid Systems.

TEXT BOOKS:

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi,2011.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK,2006.

REFERENCES:

1. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi,2015.
2. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor &Francis Group, USA 2017
3. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK,1990.
4. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future",Oxford University Press, U.K.,2012.
5. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York,1985

OPENELECTIVE-III

ETCS-821	INFORMATION SECURITY	L	T	P	C	HOURS PERWEEK
		3	0	0	3	3

Course Objectives:

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

MODULE I: INTRODUCTION 9

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

MODULE II: SECURITY INVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

MODULE III: SECURITY ANALYSIS 9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

MODULE IV: LOGICAL DESIGN 9

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

MODULE V: PHYSICAL DESIGN 9

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

Course Outcomes:

At the end of this course, the students should be able to:

- Discuss the basics of information security
- Illustrate the legal, ethical and professional issues in information security

- Demonstrate the aspects of risk management.
- Become aware of various standards in the Information Security System
- Design and implementation of Security Techniques.

TEXT BOOK:

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Security‖, Vikas Publishing House, New Delhi, 2003

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, — Handbook of Information Security Management‖, Vol 1-3 CRCPress LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposed‖, Tata McGraw-Hill,2003
3. Matt Bishop, —Computer Security Art and Science‖, Pearson/PHI, 2002.

ETCS-830	MANAGEMENT INFORMATION SYSTEM	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objectives:

- To understand the basics of Management Information System.
- To know the legal, ethical and Decision Making.
- To know the Enterprise Management Systems.

MODULE I: INTRODUCTION TO MIS 12

Strategic View of Management Information System : Introduction to MIS : Concept, definition, role, Impact etc., E-business Enterprise : Introduction, E-business, E-commerce, E-communication, e-collaboration, Strategic Management of Business : Corporate Planning, Strategic Planning, Development of Business Strategies, Types of Strategies, Short-Range Planning, MIS : Business Planning, Information Security Challenges in E-enterprises.

MODULE II: DECISION MAKING 12

Basics of Management Information Systems: Decision Making: Concepts, Process, behavioural concepts, Organisational Decision Making, MIS and Decision Making Concepts, Information : Concepts, Classification, Methods of Collection, Value, Knowledge. Systems : Concepts, Control, Types, handling Complexity, Classes, General Model of MIS, Implementation Problems, MIS and System Concept. System Analysis &Design : Introduction, Need, System Development Model, Structured System Analysis & Design, Computer System Design, MIS and System Analysis. Development of MIS : Long Range Plans, Class of Information, Information Requirement, Implementation of MIS, Quality in the MIS, Organisation for development of the MIS, MIS : Development Process Model Business Process Re-Engineering : Business Process, Process Model, Value Stream Model, Relevance of IT, MIS and BPR.

MODULE III:APPLICATIONS OF MANAGEMENT INFORMATION SYSTEM 5

Applications of Management Information System to E-Business.

MODULE IV: ENTERPRISE MANAGEMENT SYSTEMS. 7

Application of MIS : Application in Manufacturing Sector. Applications in Service Sector, Decision Support Systems, Enterprise Management Systems.

MODULE V:CASE STUDIES **4**

Case Studies : Tata Home Finance Ltd. and Engineering Product Limited.

Course Outcomes:

At the end of this course, the students should be able to:

- Discuss the basics of Management Information System
- Illustrate the legal, ethical and Decision Making.
- Demonstrate the aspects of risk management. .

TEXT BOOK :

Management Information Systems by W. S. Jawadekar, TMH.

REFERENCE BOOKS :

1. Management Information Systems, Managing the digital firm by Laudon & Laudon, Pearson.
2. Management Information System by s. Sadagopan, PHI.

ETCS-824	GREEN COMPUTING	L	T	P	C	HOURS PER WEEK
		3	0	0	3	3

Course Objectives:

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies, Enterprise Management Systems.

MODULE I: FUNDAMENTALS 9

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

MODULE II: GREEN ASSETS AND MODELING 9

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

MODULE III: GRID FRAMEWORK 9

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

MODULE IV: GREEN COMPLIANCE 9

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

MODULE V: CASE STUDIES 9

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

Course Outcomes:

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

- Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.

- Enhance the skill in energy saving practices in their use of hardware.
- Evaluate technology tools that can reduce paper waste and carbon footprint by thestakeholders.
- Understand the ways tominimize equipment disposal requirements.

TEXT BOOKS:

1. Bhuvan Unhelkar, —Green IT Strategies and Applications-Using EnvironmentalIntelligence‖, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, —Green Home computing for dummies‖, August2012.

REFERENCE BOOKS:

1. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journey‖,Shroff/IBM rebook, 2011.
2. John Lamb, —The Greening of IT‖, Pearson Education, 2009.
3. Jason Harris, —Green Computing and Green IT- Best Practices on regulations & industry‖,Lulu.com, 2008
4. Carl speshocky, —Empowering Green Initiatives with IT‖, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), —Green computing: Large Scale energy efficiency‖, CRC Press

ETME-813	MAJOR PROJECT	L	T	P	C	HOURS PER WEEK
		0	0	12	8	12

Course Objective:

• To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination

GUIDELINE FOR REVIEW AND EVALUATION:

The students in a group of 3 to 4 works on a topic approved by the head of the department under theguidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Course Outcome:

- On Completion of the project work students will be in a position to take up any challengingpractical problems and find solution by formulating proper methodology

ETSH-801	INDIAN CONSTITUTION	L	T	P	C	HOURS PER WEEK
		3	0	0	0	3

Course Objective:

Objective of the Constitution is to 'Constitute India into a **SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC** and to secure to all its citizens 'social, economic, and political justice', 'liberty of thoughts, expressions, belief, faith and worship'. To secure equality of status and of opportunity

MODULE I: INTRODUCTION TO INDIAN CONSTITUTION 7

Meaning of the term Constitution, Preamble of the Constitution, Constituent Assembly, The Salient Features of Indian Constitution

MODULE II: FUNDAMENTAL RIGHTS 5

Fundamental Rights, Fundamental Duties, the Directive Principles of State Policy

MODULE III: UNION GOVERNMENT 9

Union Government, Union Legislature (Parliament), Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive, President of India (with Powers and Functions), Prime Minister of India (with Powers and Functions), Union Judiciary (Supreme Court), Jurisdiction of the Supreme Court

MODULE IV: STATE GOVERNMENT 12

State Government, State Legislature (Legislative Assembly/Vidhan Sabha, Legislative Council/ Vidhan Parishad), Powers and Functions of the State Legislature, State Executive, Governor of the State (with Powers and Functions), The Chief Minister of the State (with Powers and Functions), State Judiciary (High Courts)

MODULE V: LOCAL SELF GOVERNMENT (WITH SPECIAL REFERENCE TO BIHAR STATE) 6

Election Commission of India (with Powers and Functions)

The Union Public Service Commission (with Powers and Functions)

Course Outcome:

- To understand the philosophy of Indian constitutions
- To know the salient features in making of Indian constitution
- Understand the emergence and evolution of Indian Constitution.
- Understand the structure and composition of Indian Constitution