आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
IFTM UNIVERSITY, MORADABAD.
www.iftmuniversity.ac.in

Study & Evaluation Scheme of
Bachelor of Technology (B.Tech) Mechanical Engineering

Programme:	***Bachelor of Technology in Mechanical Engineering***
Course Level:	***Graduate Degree***
Duration:	***04 Years (Eight semesters) Full Time***
Medium of instruction:	***English***
Minimum Required Attendance:	***75%***
Maximum credits:	***226***

Programme Outcomes (POs):

Students completing this programme will be able to:

- Ability to consider the impact of engineering solutions on environment and the need for sustainable development.
- Ability to include social, cultural, ethical issues with engineering solutions.
- Knowledge and understanding of principles of management and finance in relation to engineering projects.
- Ability to design and conduct experiments, and to analyze and interpret data.
- Ability to use the techniques, skills, and modern engineering tools necessary for mechanical engineering practice.
- Ability to formulate and analyze complex mechanical engineering problems.
- Ability to apply knowledge of mathematics, science and engineering for the solution of mechanical engineering problems.
- Ability to function effectively on multidisciplinary teams.
- Appreciation of technological change and the need for independent life-long learning.
- Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, and public health.
- Ability to communicate effectively.
- Ability to apply knowledge of engineering, Science and Technology for a successful career in Mechanical Engineering.

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Bachelor of Technology (B.Tech) Mechanical Engineering

STUDY AND EVALUATION SCHEME (Effective from 2018-19)
YEAR I, SEMESTER- I

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EMA -101	**Engineering Mathematics-I**	3	1	0	20	10	30	70	100	4
2.	EPH -101	**Engineering Physics-I**	3	1	0	20	10	30	70	100	4
3.	ECE -101 / ECH -101	**Environmental Science** / Engineering Chemistry	3	1	0	20	10	30	70	100	4
4.	PSD -101 / EME -101	**Professional Skill Development-I** / Engineering Mechanics	3	1	0	20	10	30	70	100	4
5.	EEE -101 / EEC -101	**Electrical Engineering** / Electronics Engineering	3	1	0	20	10	30	70	100	4
6.	EME -102 / ECS -101	**Materials & Manufacturing** / Computer Fundamentals & Programming	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
7.	EPH -151 / ECH -151	**Physics Lab** / Chemistry Lab	0	0	2	20	10	30	70	100	1
8.	EEE -151 / EEC -151	**Electrical Engg. Lab** / Electronics Engg. Lab	0	0	2	20	10	30	70	100	1
9.	EME-152 / ECS -151	**Materials & Manufacturing Lab** / Computer Lab	0	0	2	20	10	30	70	100	1
10.	EME-153 / EME -151	**Engineering Graphics Lab** / Mechanical Engg. Lab	0	0	2	20	10	30	70	100	1
11.	GP-101	**General Proficiency**	-	-	-	-	-	100	-	100	1
		TOTAL	**18**	**06**	**08**	**-**	**-**	**-**	**-**	**1100**	**29**

YEAR I, SEMESTER- II

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EMA -201	**Engineering Mathematics-II**	3	1	0	20	10	30	70	100	4
2.	EPH -201	**Engineering Physics-II**	3	1	0	20	10	30	70	100	4
3.	ECH -201 / ECE -201	**Engineering Chemistry** / Environmental Science	3	1	0	20	10	30	70	100	4
4.	EME -201 / PSD -201	**Engineering Mechanics** / Professional Skill Development-I	3	1	0	20	10	30	70	100	4
5.	EEC -201/ EEE -201	**Electronics Engineering** / Electrical Engineering	3	1	0	20	10	30	70	100	4
6.	ECS -201 / EME -202	**Computer Fundamentals & Programming** / Materials & Manufacturing	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
7.	ECH -251 / EPH -251	**Chemistry Lab** / Physics Lab	0	0	2	20	10	30	70	100	1
8.	EEC -251 / EEE -251	**Electronics Engg. Lab** / Electrical Engg. Lab	0	0	2	20	10	30	70	100	1
9.	ECS -251 / EME -252	**Computer Lab** / Materials & Manufacturing Lab	0	0	2	20	10	30	70	100	1
10.	EME -251 / EME-253	**Mechanical Engg. Lab** / Engineering Graphics Lab	0	0	2	20	10	30	70	100	1
11.	GP-201	**General Proficiency**	-	-	-	-	-	100	-	100	1
		TOTAL	**18**	**06**	**08**	**-**	**-**	**-**	**-**	**1100**	**29**

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B.Tech – I Year (I Semester)

EMA – 101: ENGINEERING MATHEMATICS –I **L T P 3 1 0**

Objective: -The main aims of this course are to recall and remember basics of matrices, differential, integral and vector calculus. The focus of the subject to understand the concepts of basic mathematical methods to solve engineering problems analyze engineering problems and evaluate the results.

UNIT – 1 **(08 Sessions)**
Matrices : Introduction of matrices, Special type of matrices, Elementary row and column transformation, Adjoint & inverse of matrices , Rank of matrix, , Consistency of linear system of equations, Characteristic equation, Cayley-Hamilton theorem, Eigen values and Eigen vectors, Linear dependency and Independency of vector, Diagonalisation of matrices.

UNIT – 2 **(08 Sessions)**
Differential Calculus–I: Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem, Change of variables, Total differentiation, Jacobian, Expansion of function of several variables.

UNIT – 3 **(08 Sessions)**
Differential Calculus–II: Asymptotes, Curve tracing, Approximation of errors, Maxima & Minima of functions of several variables, Lagrange's method of multipliers.

UNIT – 4 **(08 Sessions)**
Multiple Integrals : Definite integral, Double and triple integral, Change of order, Change of variables, Beta and Gamma functions, Dirichlet integral, Liouville's extension formula, Applications to area and volume.

UNIT – 5 **(08 Sessions)**
Vector Calculus: Point functions, Gradient, Divergence and Curl of a vector and their properties, Line, Surface and Volume integrals, Green's, Stoke's and Gauss divergence theorems, Statements and problems (without proof).

Course Outcome: The student is able to:
- Remember terminologies and formulae in matrices, differential, integral and vector calculus.
- Understand and interpret the concepts of matrices, differential, integral and vector calculus.
- Compare and analyze the methods in matrices, differential, integral and vector calculus.
- Predict and evaluate the problems in matrices, differential, integral and vector calculus.

Suggested Readings:

- Prasad C. Advanced Mathematics for Engineers, Prasad Mudralaya.
- B. S .Grewal, Engineering Mathematics, Khanna Publishers.
- E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
- C.Ray Wylie & Louis C . Barrett , Advanced Engineering Mathematics ,Tata Mc Graw –Hill Publishing Company Ltd.
- Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya.

Website Sources:
- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

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EPH-101: Engineering Physics-I **L T P 3 1 0**

Objective: The aim of this course is to impart knowledge of statistical mechanics, quantum mechanics, Laser system and their applications. The broad education is necessary to understand special theory of relativity.

UNIT- I **(08 Sessions)**
Relativistic Mechanics: Frame of reference, Michelson-Morley Experiment, Lorentz transformation equation, Length contraction & Time dilation, Addition of velocities, Variation of mass with velocity and Mass energy relation.

UNIT- II **(08 Sessions)**
Statistical Mechanics: Concept of phase space, Density of states as a function of energy, Maxwell- Boltzmann statistics, Distribution law and its application in case of ideal gas, Energy and velocity distribution.
Bose -Einstein statistics Distribution Law and its application to Black body radiation to obtain Plank's law of radiation.
Fermi –Dirac statistics, Distribution law and its application to electrons in metals, Calculation of Fermi energy and average energy of electrons in metals.

UNIT- III **(08 Sessions)**
Quantum Mechanics: De-Broglie Hypothesis, Davisson -Germer Experiment, wave function and its properties, Uncertainty principle. Time Dependent & Time Independent Schrodinger Equation, Particle in one dimensional box, Eigen values and eigen function

UNIT- IV **(08 sessions)**
Laser: Principle of Laser, Stimulated and spontaneous emission, Population inversion, Einstein's Coefficients, He-Ne Laser, Ruby Laser, Application of Lasers.

UNIT- V **(08 sessions)**
Fibre Optics: Fundamental ideas of optical Fiber, Propagation Mechanism, Numerical aperture, Acceptance angle and Acceptance cone, Single and multi-mode fibers, Applications of optical fibres.

Course Outcome: The students completing this course will be able to:
- Learn Frame of reference, Lorentz transformation equation
- Understand Statistical Mechanics, Maxwell- Boltzmann statistics and its applications.
- Study Bose -Einstein statistics and Fermi –Dirac statistics
- Understand De-Broglie Hypothesis, Davisson -Germer Experiment
- Study Time Dependent & Time Independent Schrodinger Equation and applications of these equations.
- Attain basic knowledge on different types of LASERs and their applications.
- Gain knowledge of optical fibre.

Suggested Readings:

- Beiser, "Concepts of Modern Physics
- Kittel, "Mechanics", Berkeley Physics Course, Vol.- I.
- W.T. Silf vast, "Laser Fundamental" Cambridge University Press (1996).
- G. Keiser "Optical Fiber Communication" New york.
- K.M. khanna" Statistical Mechanics"
- C.Kittel" Elementary Statistical Mechanics"

Website Sources:
- https://web.stanford.edu
- https://sites.google.com
- https://en.wikipedia.org
- https://www.khanacademy.org
- https://www.rp-photonics.com
- https://nptel.ac.in
- https://www.eatm.in

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ECE-101 / 201: Environmental Science **L T P 3 1 0**

Objective:
The goals of environmental science are to provide every student with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment. To develop and reinforce new patterns of environmentally sensitive behavior among individuals, groups and society as a whole for a sustainable environment. Understand the trans-national character of environmental problems such as global warming, climate change, ozone layer depletion etc. and ways of addressing them, including interactions across local to global scales.

Unit I: **(12 Sessions)**
Environment: Definition of environment. Environmental education. Need for the public awareness. : Concept of Ecology: Ecosystem, energy and nutrients flow in ecosystem food chain.
Environmental segment: Atmospheric structure. Classification of air pollutants, sources of air pollution and their effect on human health and property.

Unit II: **(10 Sessions)**
Air quality and standard: Meteorological phenomenon and their influence on air quality, lapse rates, dispersion of pollutants. Air pollution control: Introduction to particulates and gaseous pollutants such as SOx, NOx & CO, and their effects.

Unit III: **(10 Sessions)**
Water quality: Physical. Chemical &biological parameters. Water quality standard, BOD. COD and BOD COD calculations. :
Environmental Analysis: pH, alkalinity, conductivity, ammonia, fluoride, sulphate, chloride. Analysis and measurement of gaseous pollutants.

Unit IV: **(08 Sessions)**
Pollution: Pollution from industry and agriculture. Polymers and plastic, food additives, fertilizers, insecticides, fungicides and herbicides. Heavy metal and energy their environmental implications. Solid waste and its managements. Pollution and public health aspect Environmental Protection- Role of government, initiatives by non-governmental organizations (NGO).

Course outcome: After completion of this course student will be able to:
- Understand the issues and challenges related to environmental and ecosystem due to some human activities.
- Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Suggested Readings:

- "Environmental studies" Benny Joseph, Tata McgrawHill-2005
- "Environmental studies"-Dr D.L. Manjunath, Pearson Education-2006
- "Environmental studies" R. Rajagopalan, Oxford Publication-2005
- "Text book of environment science & Technology", M.Anji Reddy, BS Publication.

Website Sources:
- https://www.india.gov.in/official-website-ministry-environment-and-forests-0
- https://www.earthshare.org/environews/

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PSD-101 / 201: PROFESSIONAL SKILL DEVELOPMENT-I **L T P 3 1 0**

Objective: The objectives of Professional Skill Development-I are:

- To develop knowledge and understanding of grammar.
- To develop abilities to make use of the grammar in own writing English.
- To increase understanding and recall of what is read and listen including facts and main idea.
- To enhance competencies in writing paragraph, gist or abstract/précis of the passage in own words/ language and in writing resume, bio-data, letters and applications of different kinds.
- To develop all the four skills of English language.

Unit I **(10 Sessions)**

Basic Applied Grammar and Usage

The Sentences: Parts – Subject and Predicate; Kinds of Sentences and their Transformation. Parts of Speech. **Noun:** Kinds; Gender; Case; Number; Usage**. Pronouns:** Definition; Kinds; Usage. **Adjectives:** Kinds, Degrees of Comparison, Transformation of Degrees. **Determiners:** Kinds: many, many a, a great many; less and fewer; each and every; elder, eldest and older, oldest; much, many; little, a little, the little. **Articles:** Kinds, Articles and Number system, Articles and Gender system, Omission of Articles, Repetition of Articles. **Verbs:** Kinds; Auxiliaries: Principal Auxiliaries; Modal Auxiliaries; Semi-Modals; Usage

Unit II

Basic Applied Grammar Continued **(06 Sessions)**

Non-Finite Verbs: Kinds; Infinitives; Gerund; Participle. **Adverbs:** Kinds and Usage. **Prepositions:** Kinds and Usage. **Conjunctions:** Kinds; Usage. **Interjections:** Definition; Usage.

Unit III **(10 Sessions)**

Clauses and Phrases, Tenses, Active and Passive Voice, Direct and Indirect Speech

Unit IV **(06 Sessions)**

Précis Writing: Techniques of Précis Writing; examples**. Paragraph Writing:** Structure of Paragraph, Construction of Paragraphs; Techniques of Paragraph Writing: Unity, Coherence, Emphasis. **Reading Comprehension. Listening Comprehension.**

Unit V **(08 Sessions)**

Writing of Resume, Bio-Data. **Writing of Letters and Applications:** Formats; Elements; Kinds: Leave Applications, Job Applications, Order Letters, Letters of Claims and Complaints, Letters of Adjustment.

Course Outcome: Students completing this course will be able to:

- Write paragraph, gist or abstract/précis of the passage in own words/ language and resume, bio-data, letters and applications of different kinds.
- Use targeted grammatical structures meaningfully and appropriately in oral and written production.
- Enhance competence in the four modes of literacy: writing, speaking, reading & listening.
- Understand and recall of what read and listen is including facts and main idea.

Suggested Readings:

- Remedial English Language by Malti Agarwal, Krishna Publications, Meerut.
- Professional Communication by Malti Agarwal, Krishna Publications, Meerut.
- High School English Grammar & Composition by Wren & Martin, S. Chand & Company LTD., New Delhi.

Website Sources:

- www.wikipedia.com
- www.englishgrammar.org
- www.usingenglish.com
- www.grammarly.com

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B.Tech – I Year (I Semester)

EEE-101 / 201: ELECTRICAL ENGINEERING **L T P 3 1 0**

Objective:

- To provide comprehensive idea about AC and DC circuits and its analysis
- To provide the working principles and applications of basic machines in electrical engineering.

UNIT-I **(08 Sessions)**

D.C. Circuit Analysis: Network, Active And Passive Elements, Concept of Linearity And Linear Network, Unilateral And Bilateral Elements, Sources, Source Transformation, Kirchhoff's Laws, Star-Delta Transformation, **Network Theorems:** Thevenin's Theorem, Superposition Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT-II **(08 Sessions)**

Single Phase AC Circuits: AC Waveforms, Average and Effective Values, Form and Peak Factors, Analysis of Series, Parallel and Series-Parallel RLC Circuits, Active, Reactive and Apparent Powers, Power Factor, Causes of Low Power Factor, Resonance in Series and Parallel Circuits.

UNIT-III **(08 Sessions)**

Three Phase AC Circuits: Three Phase System, Advantages, Phase Sequence, Star and Delta Connections, Balanced Supply and Balanced Load, Three-phase Power and its Measurement,

Measuring Instruments: Types of Instruments, PMMC and Moving Iron Instrument, Single-Phase Dynamometer Wattmeter, Induction Type Energy Meter

UNIT-IV **(08 Sessions)**

Magnetic Circuits: Magnetic Circuit Concepts, Analogy between Electric & Magnetic Circuits, Magnetic Circuits with DC and AC Excitations, B-H Curve, Hysteresis and Eddy Current Losses,

Single Phase Transformer: Principle, Working, Construction, E.M.F. Equation, Power Losses, Efficiency, Introduction to Auto-Transformer (Excluding Numericals)

UNIT-V **(08 Sessions)**

Principles of Electro-Mechanical Energy Conversion,

DC Generator: Construction & Working, E.M.F. Equation of Generator, Types of D.C. Generator, Applications, **D.C. Motor:** Principle of operation, Torque Equation of a Motor, Types of D.C. Motor, Applications (Excluding Numericals)

Three Phase Induction Motor: Construction-(Squirrel cage and slip-ring motor), Principle of Operation, Applications (Excluding Numericals)

Course Outcome: On completion of the course students will be able to:

- Predict the behavior of any electrical and magnetic circuits.
- Formulate and solve complex AC, DC circuits.
- Identify the type of electrical machine used for that particular application.
- Realize the requirement of transformers in transmission and distribution of electric power and other applications.
- Function on multi-disciplinary teams.
- Awareness of general structure of power systems.
- Acquire knowledge about the single phase and three base electrical circuits

Suggested Readings:

- V. Del Toro, "Principles of Electrical Engineering" Prentice Hall International
- I.J. Nagarath, "Basic Electrical Engineering" Tata McGraw Hill
- D.E. Fitzgerald & A. Grabel Higginbotham, "Basic Electrical Engineering" Mc- Graw Hill
- T.K. Nagsarkar & M.S. Sukhija, "Basic Electrical Engineering" Oxford University Press
- W.H. HaytP, "Engineering Circuit Analysis" Mc Graw Hill

Website Sources:

- www.lecturenotes.in
- www.examupdates.in
- www.iare.ac.in
- www.notes.specworld.in
- www.ocw.mit.edu
- www.nptel.ac.in
- www.vlab.co.in

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B.Tech – I Year (I Semester)

EME-102 / 202: MATERIALS & MANUFACTURING L T P 3 1 0

Objective: The objective of this course is to familiarize the students with different types of engineering materials and manufacturing processes and to understand the design, selection and processing of materials for a wide range of applications in engineering and elsewhere.

UNIT I (09 Sessions)

Basic Manufacturing: Importance of Materials & Manufacturing towards Technological & Socio-Economic developments, Classification of manufacturing processes, Plant location, Plant layout and its types, Production and its classification, Production versus Productivity, Misc. Processes: Powder-metallurgy process and its applications, Plastic-products manufacturing, Galvanizing and Electroplating, Properties of Engineering Materials: Mechanical properties, Chemical properties, Electrical properties, Dielectric and Magnetic properties, Optical and Physical properties, Introduction to elementary corrosion and oxidation, Elementary ideas of fracture, fatigue & creep.

UNIT II (09 Sessions)

Engineering Materials: Ferrous Materials, Iron ore and its extraction, Furnaces, Cast iron, Steels & its classification based on percentage of carbon, its properties & applications. Alloy steels: stainless steel and tool steel, Non-Ferrous metals & alloys: Various non-ferrous metals, Common uses of various non-ferrous metals. Alloying elements and their effect, Cu-alloys: Brass, Bronze, Al-alloys such as Duralumin, Non-Metallic Materials: Common types & uses of different non-metals such as Wood, Cement-concrete, Ceramics, Rubber, Plastics and Composite materials.

UNIT III (09 Sessions)

Introduction to Metal Forming and its applications: Basic metal forming process: hot working and cold working process, Rolling, Forging, Extrusion, Drawing, Wire & Tube-drawing, Product applications and their defect. Press - work, Die & Punch assembly, Sheet metal operations, Cutting and forming and its applications. Casting: Casting terms. Casting processes, Pattern & allowances, Pattern and mold making materials and its desirable properties, Molding method, mould making with the use of a core, Gating system, Die-casting and its uses, Casting defects & remedies, Heat Treatment: Elementary introduction to Heat- treatment of carbon steels: annealing, normalizing, quenching, tempering and case-hardening.

UNIT IV (07 Sessions)

Introduction to Metal Cutting: Cutting tool, Chips and its formation process; Working principle, classification and operations performed on Lathe machine, Shaper machine and Planer machine. Operations performed on Drilling, Milling & Grinding machine.

UNIT V (06 Sessions)

Introduction to Welding and its applications: Importance and basic concepts of welding, Classification of welding processes. Gas-welding, Types of flames, Electric-Arc welding, Resistance welding, Soldering & Brazing and its uses.

Course Outcome: Students completing this course will be able:

- To understand how and why the properties of materials are controlled.
- To understand how and why the structure and composition of a material may be controlled by processing.
- To identify the positive and negative impacts of manufacturing on society.
- To apply the knowledge in industries and organizations.

Suggested Readings:

- *Manufacturing Process*, B.S Raghuvanshi, Dhanpat Rai Publication.
- *Manufacturing Processes*, R.S. Khurmi and J.K. Gupta, S. Chand Publishing.
- *Materials Science*, Narula & Narula, McGraw Hill Education Private Limited.
- *Manufacturing Technology*, R. K. Rajput, Laxmi Publications Private Limited.
- *An Introduction to Engineering Materials and Manufacturing Processes*, NIIT, Prentice Hall of India Private Limited.

Website Sources:

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- www.sciencedaily.com
- www.youtube.com
- www.slideshare.net
- https://onlinecourses.nptel.ac.in

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EPH-151 / 251: Physics Lab **L T P 0 0 2**

Objective: To achieve perfectness in experimental skills. The study of practical applications will bring more confidence and to learn the usage of electrical and optical systems for various measurements.

List of Experiments: (Minimum 10 experiments are required to be performed) **(20 Sessions)**

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall-effect set up.
11. To determine energy bank gap of a given semiconductor material.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the ballistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

Course Outcome: The students completing this course will be able to:

- Understand principle, concept, working and application of technology and comparison of results with theoretical calculations.
- Apply the various procedures and techniques for the experiments.
- Understand usage of instruments and real time applications in engineering studies.
- Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Suggested Readings:

- Engineering Practical Physics by S. L. Gupta
- Engineering Practical Physics by Navneet Gupta
- Engineering Practical Physics by S. K. Gupta

Website Sources:

- http://www.iiserpune.ac.in
- https://www.toppr.com
- https://wp.optics.arizona.edu
- https://www.gopracticals.com
- http://vlab.amrita.edu
- https://circuitglobe.com

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B.Tech – I Year (I Semester)

EEE-151 / 251: ELECTRICAL ENGINEERING LAB **L T P 0 0 2**

Objective:

- To design electrical circuits on bread board.
- To analyze a given network by applying various network theorems.
- To expose the students to the operation of dc generator
- To expose the students to the operation of dc motor and transformer.
- To examine the self -excitation in dc generators.

List of Experiments: (Minimum 08 experiments are required to be performed) **(16 Sessions)**

1. Verification of Kirchhoff's current law.
2. Verification of Kirchhoff's voltage law
3. Verification of Superposition theorem.
4. Verification of Thevenin's Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. To study a Single phase induction motor and its various methods of starting.
7. To study running and speed reversal of a Three Phase Induction Motor and determine the slip.
8. To determine the transformation ratio and turns ratio and current ratio of a single-phase transformer.
9. To study the construction of a dc machine.
10. To study a single phase Induction type Energy meter.

Course Outcome: After successfully studying this course, students will be able to:

- Explain the concept of circuit laws and network theorems and apply them to laboratory measurements.
- Be able to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both single phase and DC Machines
- Acknowledge the principles of operation and the main features of electric machines and their applications.
- Acquire skills in using electrical measuring devices.

Suggested Readings:

- V. Del Toro, "Principles of Electrical Engineering" Prentice Hall International
- I.J. Nagarath, "Basic Electrical Engineering" Tata McGraw Hill
- D.E. Fitzgerald & A. Grabel Higginbotham, "Basic Electrical Engineering" Mc- Graw Hill
- T.K. Nagsarkar & M.S. Sukhija, "Basic Electrical Engineering" Oxford University Press
- W.H. HaytP, "Engineering Circuit Analysis" Mc Graw Hill

Website Sources:

- www.iare.ac.in
- www.ocw.mit.edu
- www.nptel.ac.in
- www.vlab.co.in

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B.Tech – I Year (I Semester)

EME-152 / 252: MATERIALS & MANUFACTURING LAB **L T P 0 0 2**

Objective: The objective of this course is to meet curriculum requirements and provide knowledge of different types of tools, instruments and machines and their applications in manufacturing to produce different metal components and articles and develop skills in the students.

List of Experiments: (Minimum 10 experiments are required to be performed)

1. Carpentry Shop: **(03 Sessions)**
a. Study of tools & operations and carpentry joints.
b. Simple exercise using jack plane.
c. To prepare half-lap corner joint, mortise & tenon joints.
d. Simple exercise on woodworking lathe.

2. Fitting Bench Working Shop: **(03 Sessions)**
a. Study of tools & operations
b. Simple exercises involving fitting work.
c. Making perfect male-female joint.
d. Simple exercises involving drilling/tapping/dieing.

3. Black Smithy Shop: **(03 Sessions)**
a. Study of tools & operations
b. Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & Swaging.

4. Welding Shop: **(03 Sessions)**
a. Study of tools & operations of Gas welding & Arc welding
b. Making simple Butt and Lap arc welded joints.
c. Simple exercises involving Oxy-acetylene Gas welding.

5. Sheet-metal Shop: **(02 Sessions)**
a. Study of tools & operations.
b. Making Funnel complete with 'soldering'.
c. Fabrication of tool-box, tray, electric panel box etc.

6. Machine Shop: **(03 Sessions)**
a. Study of machine tools and operations.
b. Simple exercises involving Plane turning.
c. Simple exercises involving Step turning
d. Simple exercises involving Taper turning.

7. **Foundry Shop:** **(03 Sessions)**
a. Study of tools and operations.
b. Preparation of sand for moulding.
c. Mould making using core.

Course Outcome: Students completing this course will be able:

- To define and use different manufacturing process e.g. casting, forging, turning, drilling etc.
- To define and use different welding processes e.g. gas welding and electric arc welding.
- To acquire thorough knowledge of carrying out various operations in this lab.
- To acquire skills for creating different objects from raw materials.

Suggested Readings:

1. *Manufacturing Process*, B.S Raghuvanshi, Dhanpat Rai Publication.
2. *Manufacturing Processes*, R.S. Khurmi and J.K. Gupta, S. Chand Publishing.
3. *Materials Science*, Narula & Narula, McGraw Hill Education Private Limited.
4. *Manufacturing Technology*, R. K. Rajput, Laxmi Publications PVT. LTD.

Website Sources:

- www.wikipedia.org
- www.brcmcet.edu.
- www.slideshare.net
- https://onlinecourses.nptel.ac.in

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – I Year (I Semester)

EME 153 / 253: Engineering Graphics Lab **L T P 0 0 2**

Objective:

- The course is aimed at developing Basic Graphic skills.
- Develop Skills In Preparation Of Basic Drawings.
- Skills in Reading and Interpretation of Engineering Drawings.

1. Introduction **(03 Sessions)**

Introduction, Drawing Instruments and their uses, BIS conventions, Lines & Lettering, Dimensioning and free hand practicing. Coordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale.

2. Orthographic Projections **(05 Sessions)**

Introduction, Definitions- Planes of projection, reference line and conventions employed. Principle of Orthographic projections, First and Third Angle projections.

Projection of Points, Pictorial view.

Terms used in Projection of lines. Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes. Application to practical problems. **(First Angle Projection Only)**

3. Projections of Solids (First Angle Projection Only) **(06 Sessions)**

Introduction, Definitions- Projections of right regular- tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. Sections and Development of Lateral Surfaces of Solids, Sectional views, apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. Development of lateral surface of above solids, their frustums and truncations.

4. Isometric Projection (Using Isometric Scale Only) **(06 Sessions)**

Introduction, Principle of isometric projection, Terminology, Isometric scale, Isometric Projection of simple plane figures, Isometric Projection of tetrahedron, hexahedron (cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combination of solids.

Course outcome: Students completing this course will be able to:

- Use the drawing instruments effectively and able to dimension the given figures
- Appreciate the usage of engineering curves in tracing the paths of simple machine components
- Understand the concept of projection and acquire visualization skills, projection of points
- Able to draw the basic views related to projections of Lines, Planes

Suggested Readings:

- Engineering Drawing – N.D. Bhatt & V.M. Panchal, 48th edition, 2005 Charotar Publishing House, Gujarat.
- A Primer on Computer Aided Engineering Drawing-2006, Published by VTU, Belgaum.
- Engineering Graphics – K.R. Gopalakrishna, 32nd edition, 2005 – Subash Publishers Bangalore.
- Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production – Luzadder Warren J., duff John M., Eastern Economy Edition, 2005 – Prentice- Hall of India Pvt. Ltd., New Delhi.
- Engineering Drawing with an introduction to Auto CAD by Dhananjay A Jolhe, Tata Mc Graw Hill Book Company, New Delhi.

Website Sources:

- https://lecturenotes.in/
- http://home.iitk.ac.in/
- http://www.fkm.utm.my/
- https://lecturenotes.in/

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EMA – 201: ENGINEERING MATHEMATICS – II **L T P 3 1 0**

Objective: - The main aims of this course are to develop the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics Differential equation, series solutions, Fourier series and PDE introduced to serve as basic tools for specialized studies in many fields of engineering and technology.

UNIT – 1 **(08 Sessions)**
Differential Equations: Ordinary differential equations of first order and first degree, Linear differential equations of n^{th} order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solutions of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).

UNIT – 2 **(08 Sessions)**
Series Solutions and Special Functions: Series solutions of ODE of 2nd order with variable coefficients with special emphasis to differential equations of Legendre and Bessel, Legendre polynomials, Bessel's functions**.**

UNIT – 3 **(08 Sessions)**
Fourier Series: Periodic functions, Trigonometric series, Fourier series of period 2π , Euler's formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series.

UNIT – 4 **(08 Sessions)**
Partial Differential Equations: Introduction of partial differential equations, Solution of first order differential equations,Linear partial differential equations with constant coefficients of second order and their classification – Parabolic, Elliptic and Hyperbolic with illustrative examples.

UNIT – 5 **(08 Sessions)**
Applications of Partial Differential Equations : Method of separation of variables for solving partial differential equations, Wave equation upto two dimensions, Laplace equation in two-dimensions, Heat conduction equations upto two-dimensions, Equations of transmission Lines.

Course Outcome: The student is able to
- Classify differential equations according to certain features.
- Solve first order linear differential equations and nonlineardifferential equations of certain types and interpret the solutions.
- Solve second and higher order linear differential equations with constant coefficients and construct all solutions from the linearly independent solutions.
- Find series solutions about ordinary and regular singular points for second order linear differential equations.
- Apply Fourier series to analyze the engineering problem.
- Solve partial differential equations with methods & its Applications.

Suggested Readings:

- Prasad C. Advanced Mathematics for Engineers, Prasad Mudralaya.
- A Textbook of Differential Equations, Pitamber Publications.
- B. S .Grewal , Engineering Mathematics , Khanna Publishers, New Delhi.
- E.Kreyszig, Advanced Engineering Mathematics , John Wiley & Sons.
- C.Ray Wylie & Louis C . Barrett , Advanced Engineering Mathematics ,Tata Mc Graw –Hill Publishing Company Ltd.
- Chandrika Prasad ,Advanced Mathematics for Engineers, Prasad Mudranalaya.

Website Sources:
- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

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EPH-201: Engineering Physics-II **L T P 3 1 0**

Objective: The goal of this course is to familiarize students about electromagnetic theory, magnetic materials, solid state Physics, superconductors and their applications.

UNIT- I **(10 Sessions)**

Electromagnetic Theory

Gauss law, continuity equation, Ampere's Law, Maxwell's equations (differential and integral forms), Pointing vector and Pointing Theorem , propagation of plane electromagnetic waves in free space Non conducting and in conducting media, Skin depth.

UNIT- II **(08 sessions)**

Dielectric and Magnetic Properties of Materials

Dielectric Properties: Dielectric constants, Polarization of dielectric materials, Polarizability, Claussius- Mossotti Equation, Application of dielectric.

Magnetic Properties: Magnetization, Magnetic moment, Dia, Para and Ferro magnetism, Langevin theory for diamagnetic material, Hysteresis Curve.

UNIT - III **(08 Sessions)**

Solid State Physics

Energy bands in metals, Semiconductors and insulators, Intrinsic and extrinsic semiconductors, Fermi energy levels for doped, undoped semiconductors, P-N junction, Tunnel diode, Zener diode.

UNIT- IV **(08 Sessions)**

Superconductivity: Meissner Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), London's Equation, Properties of superconductors & applications of superconductors.

Nano Materials: Basic principle of nano science and technology, Structure, properties and uses of Fullerene and carbon nano tubes, Application of nano technology.

Unit- V **(08 Sessions)**

X-Rays: Diffraction of X-rays, Production and properties, Bragg's Law, Bragg's spectrometer, Applications of X-rays.

Ultrasonics: Introduction, Production of Ultrasonics (Magneto striction and piezoelectric methods), properties & applications of Ultrasonic waves.

Course outcome: The students completing this course will be able to:

- Understand Gauss law, Ampere's Law, Maxwell's equations and their applications.
- Study of Propagation of plane electromagnetic waves in free space.
- Understand Dielectric and magnetic properties of the materials.
- Explain Intrinsic and extrinsic semiconductors.
- Construction, Operation and characteristics of diodes.
- Understand concepts of superconductors, Properties of superconductors & applications of superconductors.
- Gain basic knowledge on the properties, production and applications of X-rays.
- Basic principle of nano science and technology and applications of nanotechnology.

Suggested Readings:

- Concept of Modern Physics: A. BEISER
- Atomic Physics: Rajam
- Greiner : Quantum Physics
- Griffth : Introduction to Electrodynamics
- S. K. Gupta: Engineering Physics
- Beiser : Perspective of Modern Physics

Website Sources:

- https://www2.ph.ed.ac.uk
- http://web.mit.edu
- http://pcwww.liv.ac.uk
- http://sites.science.oregonstate.edu
- https://eng.libretexts.org
- https://shodhganga.inflibnet.ac.in
- https://www.electrical4u.com
- https://vardhaman.org

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ECH – 101 / 201: ENGINEERING CHEMISTRY **L T P 3 1 0**

OBJECTIVE:

- To emphasize the relevance of fundamentals and applications of chemistry in the field of engineering.
- To take into account appropriate combinations of old and new emerging concepts for the potential uses in engineering.
- To address the principles of general chemistry and specific topics relevant to various engineering disciplines.
- To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
- To bring potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

UNIT-I: MATTER - CHEMICAL BONDING AND ITS STATES: **(08 Sessions)**

Types of bonds (Ionic, covalent and chemical bonds), valence bond theory, molecular orbital theory and its applications to homo and hetero (CO & NO) diatomic molecules. Solid state- Types of unit cells, space lattice (only cubes) calculation of density of the unit cell, two dimensional solids such as graphite and its conduction properties. Fullerenes and their applications.

UNIT-II: CHEMICAL KINETICS AND ELECTROCHEMISTRY: **(08 Sessions)**

Molecularity and order of reactions, zero, first and second order reactions, theories of reaction rates, electrode potential, electrochemical cells (galvanic and concentration), Nernst equation, electrochemical and galvanic series, definition, significance and classification of corrosion, electrochemical corrosion.

UNIT-III: REACTION MECHANISM AND SPECTROSCOPY: **(08 Sessions)**

Electrophile, Nucleophile (SN^1 and SN^2reactions)
Mechanism of the following reactions:
(i) Aldol condensation (ii) Beckmann rearrangement (iii) Cannizaro reaction
(iv) Hoffmann rearrangement (v) Diels-Alder reaction and ((vi) Friedel craft reaction
Basic principle, instrumentation and general application of UV, Visible, IR/ FTIR & ^{1H}NMR spectroscopy (excluding specific applications).

UNIT-IV: POLYMERS: **(08 Sessions)**

Polymers, classification and applications, polymerization (addition and condensation), Thermoplastic and Thermosetting polymers, preparation, properties and uses of PVC, Dacron, nylon66 and Bakelite. Elastomers (Natural rubber, buna-N, buna-S) vulcanization, conducting polymers (Intrinsic & Extrinsic), doping, ion exchange resins, biodegradable polymers.

UNIT-V: WATER TREATMENT AND FUELS: **(08 Sessions)**

Hardness of water, calculation on hardness and its determination by EDTA method, sludge and scale formation, causes and prevention of scale formation (colloidal, phosphate, and calgon conditioning), removal of hardness (Soda lime process, zeolite process & ion-exchange process), calculations based on lime soda process.
Definition of fuels, classification of fuels, calorific value, determination by Dulong's formula, analysis of coal (Proximate and ultimate analysis), petroleum, important fractions of petroleum and their uses, gaseous fuels (CNG & LPG)

COURSE OUTCOME:

- Demonstrate knowledge of science behind common impurities in water and methods to treat them and also different methods to remove hardness of water.
- Students will also be able to understand and relate electrochemistry and corrosion.
- to analyze the basic knowledge of various types of Fuels, their properties and Industrial Applications ALONG WITH THE determination OF the calorific value of fuels .
- Apply the science for understanding corrosion and its prevention.
- Demonstrate knowledge of superconducting and organic electronic materials.
- Students will be able to understand about different polymers.

SUGGESTED READINGS:

- Text Book of Polymer Science by F.W. Billmeyer, John Wiley & sons, 1994.
- Liquid Crystals and Plastic Crystals, vol.-I, edited by G.W. Gray and P.A. Winsor, Ellis Harwood Series in Physical Chemistry, New York.
- Corrosion Engineering by M.G. Fontana McGraw Hill Publications
- Engineering Chemistry by J C Kuriacose and J. Rajaram, Tata McGraw-Hill Co, New Delhi (2004)
- Chemistry of Engineering Materials by C.P. Murthy, C.V. Agarwal and A. Naidu BS Publication Hyd.

WEBSITE SOURCES:

- http://www.commonchemistry.org/
- https://uri.idm.oclc.org/login?url=https://www.engineeringvillage.com/search/quick.url?CID=quickSearch&database=1
- https://www.technicalsymposium.com/

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EME – 101 / 201: ENGINEERING MECHANICS **L T P 3 1 0**

Objective: The primary purpose of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowledge of the physical and mathematical principles of mechanics; also required is the ability to visualize physical configurations in terms of real materials, actual constraints ,and the practical limitations which govern the behavior of machines and structures.

Unit-1 **(10 Sessions)**
Two Dimensional Force Systems: Basic concepts, Laws of motion, Principle of Transmissibility of forces, Transfer of a force to parallel position , Resultant of a force system, Simplest Resultant of Two dimensional concurrent and non-concurrent force systems, Free body diagrams, Equilibrium and Equations of Equilibrium, Applications.

Unit-2 **(08 Sessions)**
Trusses: Introduction, Simple Truss and solution of simple truss, Method of Joints and Method of Sections.
Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Belt friction, Application.

Unit-3 **(08 Sessions)**
Centroid and Moment of Inertia: Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorem, Principal Moment Inertia, Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their Axis of Symmetry.

Unit-4 **(06 Sessions)**
Beam: Introduction, Shear force and Bending Moment, Differential Equations for Equilibrium, Shear force and Bending Moment Diagrams for Statically Determinate Beams.

Unit-5 **(08 Sessions)**
Kinematics of Rigid Body: Introduction, Plane Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational Motion. Relative Velocity.
Kinetics of Rigid Body: Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D'Alembert's Principles and Dynamic Equilibrium.

Course outcome: Students completing this course will be able to:
- Recognize different force systems, moments and couple.
- To draw Free Body Diagram and label the reactions on it.
- Apply equilibrium equations in statics.
- Understand Newton's law in motion, and recognize different kinds of particle motions.

Suggested Readings:
- Engineering Mechanics by Irving H. Shames, Prentice-Hall
- Mechanics of Solids by Abdul Mubeen, Pearson Education Asia.
- Engineering Mechanics by R.K.Bansal, Laxmi Publications, New Delhi.
- Engineering Mechanics by SS Bhavi Katti, New age International Publisher, New Delhi.

Website Sources:
- https://nptel.ac.in/courses/122/104/122104014/
- https://www.coursera.org/learn/engineering-mechanics-statics
- https://www.edx.org/course/engineering-mechanics-2
- https://www.youtube.com/watch?v=ADR04oYgpAM

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EEC 101 / 201: ELECTRONICS ENGINEERING **L T P 3 1 0**

Objective: The objective of the course is to familiarize the students with concepts of semiconductor and its working along with their applications in real life.

UNIT – I **(08 Sessions)**
Theory of Semiconductor material: Energy band Theory of crystals, Insulators, Semiconductors and Metals, classification of semiconductors, Mobility and Conductivity, Donor and Acceptor Impurities, Mass- Action law, Variation in semiconductor parameters with Temperature, Hall – Effect.

UNIT – II **(08 Sessions)**
Semiconductor Diodes and Applications: p-n junction, depletion layer, V-I characteristics, diode resistance, capacitance, p-n junction as rectifiers, filter (Shunt capacitor filter), clipping circuits, clamping circuits, breakdown mechanism, breakdown characteristics, zener resistance, zener diode application as shunt regulator. Introduction of LED, and Photo diode.

UNIT– III **(08 Sessions)**
Bipolar Junction Transistor (BJT): construction, transistor action, CB, CE and CC configurations, concept of voltage gain, current gain. Field Effect Transistor (FET): JFET: construction, principle of working, concept of pinch-off, drain saturation current, characteristics, characteristic equation, CG, CS and CD configurations, MOSFET: depletion and enhancement type, construction.

UNIT – IV **(08 Sessions)**
Number system: conversion of bases (decimal, binary, octal and hexadecimal numbers) addition and subtraction, BCD numbers, Boolean algebra, logic gates, concept of universal gates. Canonical forms, minimization using K-map (Upto four variable, don't care conditions also)

UNIT – V **(08 Sessions)**
Operational Amplifier (Op-Amp): concept of ideal operational amplifier, parameters. Inverting, non-inverting and unity gain configurations, Op-amp as adder, subtractor, Block diagram of Communication Systems, Introduction to Modulation, Need for modulation, Definition of AM and FM.

Course Outcome:

- Understand the basic of semiconductor technology
- Define the purpose of different diodes used in several applications
- Develop understanding and impact of resistance regions
- Discuss how basic communication occurs over wireless medium
- Discuss the benefits of transistors over conventional vacuum tubes

Suggested readings:

- S. Salivahanan, N Suresh Kumar, "Electronic Devices and circuits" 2nd Edition, TMH
- Robert L. Boylestad/ Louis Nashelsky "Electronic Devices and Circuit Theory", 9th Edition, Pearson Education
- Jacob Millman, Christos C. Halkias, "Integrated Electronics", TMH
- Morris Mano "Digital Computer Design", PHI 2003
- Kennedy, Davis, "Electronics Communication System" 4th Edition, TMH.

Website sources:

- www.sanfoundary.co.in
- Grade up online course on transistors (www.gradeup.org)
- www.nptel.ac.in
- en.wikipedia.org

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ECS-101 / 201: Computer Fundamentals and Programming **L T P 3 1 0**

Objective:

- This course introduces the concepts of computer basics & programming with particular attention to Engineering examples.
- The C programming language is used but the course will stress on fundamental parts of programming language, so that the students will have a basic concept for understanding and using other programming language.
- C is the easiest language to understand so basic constructs of C will be cleared.

Unit-I **(08 Sessions)**

Introduction: Introduction to Computer Systems, Generation of Computers, BIOS, Various types of memories, CPU organization, ALU, registers. Introduction to various operating Systems. Number systems: Binary, hexadecimal, octal and their inter conversions. Computer Languages and Software & hardware: High Level Languages and Low Level Language, Various types of software. Firmware, Compiler, Interpreter and Assembler. File Allocation Table, Hardware.

Unit –II **(08 Sessions)**

Input, Output and storage Units: Introduction to various Input and output Devices Printers: Various type of Impact and Non- Impact Printers. Introduction to algorithm and Flow chart: Representation of an algorithm, flowchart symbols and levels of flow chart, advantage and limitations of flowchart and pseudo code. Basics of programming: Introduction to the design and implementation of correct, efficient and maintainable programs. Use of high level programming languages for the development of programs.

Unit-III **(08 Sessions)**

Standard I/O in "C", Fundamental Data Types and Storage Classes: Character types, Integer, short, long, unsigned, single and double-precision floating point, storage classes, automatic, register, static and external, Operators and Expressions: Using numeric and relational operators, mixed operands and type conversion, Logical operators, Bit operations, Operator precedence and associatively.

Unit-IV **(08 Sessions)**

Conditional Program Execution: Applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch, Program Loops and Iteration: Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue.

Unit-V **(08 Sessions)**

Modular Programming: Passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules. Arrays: Array notation and representation, manipulating array elements, using multidimensional arrays, arrays of unknown or varying size, Structure, union, enumerated data types, Functions: Introduction, types of functions, functions with array, recursive functions, Introduction to pointers, Introduction to file handling, standard C preprocessors, defining and calling macros, conditional compilation, passing values to the compiler.

Course Outcome: On completion of the course students will be able to:

- Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming
- Write, compile and debug programs in C language and use different data types for writing the programs.
- Design programs connecting decision structures, loops and functions.
- Explain the difference between call by value and call by address.
- Understand the dynamic behavior of memory by the use of pointers.
- Use different data structures and create or manipulate basic data files and developing applications for real world problems.

Suggested Readings:

- "Let us C", Yashvant Kanitkar.
- "Programming with C", Byron Gottfried
- "Computer Fundamentals", Anita Goel, Pearson Education
- "Computer Concepts and Programming in C", E Balaguruswami, McGraw Hill
- "C programming", Kernighan and Ritchie, PHI
- "Computer Fundamentals and Programming in C", Reema Thareja, Oxford Publication

Website Sources:

- www.nptel.ac.in
- www.toptal.com/c/the-ultimate-list-of-resources-to-learn-c-and-c-plus-plus
- www.learn-c.org

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ECH 151 / 251: CHEMISTRY LAB **L T P 0 0 2**

OBJECTIVE:

- Practical implementation of fundamental concepts of qualitative and quantitative analysis.
- To gain the knowledge on existing future upcoming devices, materials and methodology used in chemistry practicals.
- To rely on elementary treatment and qualitative analysis and makes use of concepts involved.
- To provide an overview of preparation and identification of organic compounds

List of Experiments: (Minimum 08 experiments are required to be performed) **(16 Sessions)**

1. Determination of alkalinity of the given sample of water.
2. Determination of temporary and permanent hardness of water sample by Versinate method
3. Determination of available chlorine in bleaching powder.
4. Determination of quantity of dissolve oxygen in given sample of water.
5. Determination of iron content in the given water sample by Mohr's methods.
6. Determination of ion exchange capacity of given sample of ion-exchange material.
7. Determination of Equivalent weight of iron by the chemical displacement method. The equivalent weight of copper is 63.5.
8. Determination of viscosity of polystyrene by Ostwald Viscometer.
9. Preparation of Bakelite resin.
10. Element detection and functional group identification in organic

COURSE OUTCOME:

- Students are able to estimate the impurities present in water.
- Ability to prepare advanced polymer materials.
- Ability to know the strength of an acid present in secondary batteries.
- Ability to find the Fe^{+2}, Ca^{+2} & Cl^{-} present in unknown substances using titrimetric and instrumental methods.

SUGGESTED READINGS:

- Applied Chemistry by R. S. Katiyar & J.P. Chaudhary Publication B.B.P. & Co. Meerut
- March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure Smith, Michael B./March, Jerry, John Willey & sons, 6th Edition, 2007.
- Elements of Physical Chemistry, Glasstonne, Samuel B. ELBS, 2005.
- Organic Chemistry, Finar, I.L.: Addision – Wesley Longman, Limited, 2004.
- Principles of Physical Chemistry, by Puri B.R., Sharma L.R., S. Nagin & Company, Delhi

WEBSITE SOURCES:

- https://www.gopracticals.com/basic-engineering/
- https://edu.rsc.org/resources/practical
- https://play.google.com/store/apps/details?id=com.softwareindiavinod.chemistrypracticals&hl=en&gl=US

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EEC 151 / 251: ELECTRONICS ENGINEERING LAB **L T P 0 0 2**

Objective: The objective of this lab is to familiarize the students with the basic working of diodes and also help them calculate voltage and currents through simple devices such as multimeter.

List of Experiments: (Minimum 08 experiments are required to be performed) **(16 Sessions)**

1. To study of Digital Multimeters (measurement of AC and DC voltage, measurement of current, measurement of resistance, capacitance), passive components (resistor, capacitor) and verify using colour code.
2. To Study Cathode Ray Oscilloscope (To study of controls of CRO, to measure amplitude, time period and frequency of time varying signals), function generator, power supply & Bread Board.
3. To study the Characteristics of a P-N Junction diode in forward & reverse bias connection.
4. To draw wave shape of the electrical signal at input and output points of the half wave rectifier.
5. To draw wave shape of the electrical signal at input and output points of the full wave rectifiers.
6. To study the Zener diode characteristic graphical measurement of forward and reverse resistance.
7. To Plot input / output characteristics for common base transistor.
8. To verify the truth table of basic logic gates (AND, OR, NOT)
9. To build and test the clipper circuit using diode.
10. To build and test the clamper circuit using diode

Course Outcome: Students taking this lab will be able to:

- Measure voltage, current through multimeter.
- Understand the practical working of a diode
- Understand the graph transitions of a transistor
- Understand the concept of logic gates.

Suggested Readings:

- S. Salivahanan, N Suresh Kumar, “Electronic Devices and circuits” 2nd Edition, TMH
- Robert L. Boylestad/ Louis Nashelsky “Electronic Devices and Circuit Theory”, 9th Edition, Pearson Education 2007
- Jacob Millman, Christos C. Halkias, “Integrated Electronics”, TMH
- Morris Mano “Digital Computer Design”, PHI

Website Sources:

- www.nptel.ac.in
- www.gradeup.in
- en.wikipedia.org
- www.electr_basic.in

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ECS-151 / 251: Computer Lab **L T P 0 0 2**

Objective: The following student learning outcomes, goals, assessment methods and core competencies have been identified for the Learning Center computer lab:

- To provide students with an open access computer lab using up-to-date technology to complete their studies.
- To increase retention in reading, study skills, English, foreign language, nursing, psychology and other academic classes by providing a lab where students can make use of software products to supplement instruction.

List of Experiments: (Minimum 10 experiments are required to be performed) **(20 Sessions)**

1. Object: Apply basic operations in windows on a folder.
2. Object: Design front page of your practical file
3. Object: Prepare a PERSONAL LETTER.
4. Object: Create your resume using given Templates.
5. Object: Create a report containing the pay details of the employee.
6. Object: Create a student result sheet
7. Object: create a pie chart for a sample data and give legends.
8. Object: Prepare a Time Table in MS-Excel.
9. Object: Prepare a presentation in MS-Power point about "Fundamentals of Computer".
10. Object: Create your E-Mail ID on Gmail
11. Object: Search any topic related to your syllabi using any search.
12. Object: Write a program in C to print "I am a student of IFTM University".
13. Object: Write a program in C to take input from user using scanf.
14. Object: Write a program to add, subtract, multiplication and division of two numbers.
15. Object: Write a program in C to calculate Factorial of a Number
16. Object: Write a program in C to print a Table.
17. Object: Program to compute the compute the average.
18. Object: Write a program to check whether a number is even or odd.
19. Object: Write a program to check whether a number is prime number or not.
20. Object: Write a program to check whether a year is leap year or not.
21. Object: Write a program to find largest of three numbers. 28
22. Object: Program to compute the factorial of a given number.

Course Outcome: The end of this course:

- Students will be able to identify the Learning Center as a place for utilizing computers with specialized software as a resource for supplemental study.
- Students will find the Learning Center equipment, software, and facility adequate to meet their educational needs.
- The Learning Center will support or facilitate a positive learning or service environment for students.
- Each student should be able to choose appropriate data structures to represent data items in real world problems.
- Each student should be able to analyze the time and space complexities of algorithms .
- Each student should be able to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
- Each student should be able to analyze and implement various kinds of searching and sorting techniques.

Suggested Readings:

- "Let us C", Yashvant Kanitkar.
- "Programming with C", Byron Gottfried
- "Computer Fundamentals", Anita Goel, Pearson Education
- "Computer Concepts and Programming in C", E Balaguruswami, McGraw Hill
- "C programming", Kernighan and Ritchie, PHI
- "Computer Fundamentals and Programming in C", Reema Thareja, Oxford Publication

Website Sources:

- www.nptel.ac.in
- www.toptal.com/c/the-ultimate-list-of-resources-to-learn-c-and-c-plus-plus
- www.learn-c.org

SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
IFTM UNIVERSITY, MORADABAD.

Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – I Year (II Semester)

EME – 151 / 251: Mechanical Engineering Lab **L T P 0 0 2**

Objective: The objective of the course is to introduce students to different engineering material and create an understanding of different mechanical properties by using Destructive testing methods. Also the students will be familiar with the basic working of IC engines & boilers.

List of Experiments: (Minimum 08 experiments are required to be performed) **(16 Sessions)**

1. To conduct tensile test and determine the ultimate tensile strength, percentage elongation for a steel specimen using UTM Machine.
2. To conduct compression test and determine the ultimate compressive strength for a specimen using UTM Machine.
3. To conduct Impact-tests (Izod / Charpy) on Impact-testing machine to find the toughness.
4. To determine the hardness of the given specimen using Brinell/Rockwell hardness testing machine.
5. To study 2-stroke & 4-stroke I.C. Engine models.
6. To study Lancashire, Babcock Wilcox and Locomotive boiler models.
7. To study Steam Engine & Steam Turbine models.
8. To study vapor compression Refrigerator unit tutor / refrigerator.
9. To study window type Air conditioner.
10. To conduct torsion test on mild steel or cast iron specimens to find out modulus of rigidity.

Course outcome: Students completing this course will be able to:

- Describe the behavior of materials upon normal external loads.
- Predict the behavior of the material under impact conditions.
- Recognize the mechanical behavior of materials.
- Recognize parts of IC engines.
- Recognize components of boilers.

Suggested Readings:

- Engineering Mechanics by Irving H. Shames, Prentice-Hall
- Mechanics of Solids by Abdul Mubeen, Pearson Education Asia.
- Engineering Mechanics by R.K.Bansal, Laxmi Publications, New Delhi.
- Engineering Mechanics by SS Bhavi Katti, New age International Publisher, New Delhi.

Website Sources:

- https://www.sciencedirect.com/topics/engineering/izod-impact
- https://www.twi-global.com/technical-knowledge/faqs/faq-what-is-charpy-testing
- https://www.hardnesstesters.com/test-types/brinell-hardness-testing
- https://www.youtube.com/watch?v=liiopCScMck

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Bachelor of Technology (B.Tech) Mechanical Engineering

STUDY AND EVALUATION SCHEME (Effective from 2018-19)
YEAR II, SEMESTER-III

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EMA-301	Engineering Mathematics -III	3	1	0	20	10	30	70	100	4
2.	EME-301	Thermodynamics	3	1	0	20	10	30	70	100	4
3.	EME-302	Mechanics of Solids	3	1	0	20	10	30	70	100	4
4.	EME-303	Fluid Mechanics	3	1	0	20	10	30	70	100	4
5.	EME-304	Measurement & Metrology	3	1	0	20	10	30	70	100	4
6.	EME-307	Industrial Engineering	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
7.	EME-351	Thermodynamics Lab	0	0	2	20	10	30	70	100	1
8.	EME -352	Machine Drawing –I Lab	0	0	2	20	10	30	70	100	1
9.	EME -353	Fluid Mechanics Lab	0	0	2	20	10	30	70	100	1
10.	EME -354	Measurement & Metrology Lab	0	0	2	20	10	30	70	100	1
11.	GP-301	General Proficiency	-	-	-	-	-	100	-	100	1
		TOTAL	**18**	**06**	**08**	**-**	**-**	**-**	**-**	**1100**	**29**

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B.Tech – II Year (III Semester)

EMA – 301: ENGINEERING MATHEMATICS – III **L T P 3 1 0**

Objective: - The main aims of this course are to exposing the students to learn the Laplace transform and Z-transform and introduce the fundamental ideas of the functions of complex variables and developing a clear understanding of the fundamental concepts of Complex Analysis such as analytic functions, complex integrals and a range of skills which will allow students to work effectively with the concepts in the field of engineering.

UNIT – 1 **(08 Sessions)**
Laplace Transform : Existence theorem, Laplace transform of derivatives & Integrals inverse Laplace transforms, Unit step functions delta functions , Laplace transform of periodic functions, Convolution theorem, Applications to solve simple linear and simultaneous differential equations.

UNIT – 2 **(08 Sessions)**
Integral Transform: Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations. Z- Transforms and its applications to solve difference equations.

UNIT – 3 **(08 Sessions)**
Functions of a complex variable – I : Analytic functions, C- R equations and harmonic functions,Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Liouville's theorem, Fundamental theorem of algebra.

UNIT – 4 **(08 Sessions)**
Functions of a Complex Variable – II : Representation of a function by power series ,Taylor's series and Laurent's series, Singularities, Zeroes and poles, Residue theorem, Evaluation of real integrals of type $\int_0^{2\pi} f(cos\theta, sin\theta)d\theta$and $\int_{-\infty}^{+\infty} f(x)dx$, Conformal mapping and Bilinear transformations.

UNIT – 5 **(08 Sessions)**
Method of least squares and curve fitting of straight lines, Polynomials, Exponential curves etc., Solution of cubic and Bi-quadratic equations.

Course Outcome: The student is able to:

- Know the use of Laplace transform solving Boundary Value Problems.
- Use Z-transform in development of scientific simulation algorithms.
- Apply the concept and consequences of analyticity and the Cauchy-Riemann equations to analyze the results on harmonic and including the fundamental theorem of algebra.
- Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem and the Cauchy integral formulation its various versions.
- Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.
- Know the use and show the curve fitting of different functions.

Suggested Readings:

- B. S .Grewal , Engineering Mathematics , Khanna Publishers, New Delhi.
- B . S . Grewal , Higher Engineering Mathematics , Khanna Publishers,New Delhi.
- E.Kreyszig, Advanced Engineering Mathematics , John Wiley & Sons
- C.Ray Wylie & Louis C . Barrett , Advanced Engineering Mathematics ,Tata Mc Graw –Hill Publishing Company Ltd.
- Chandrika Prasad ,Advanced Mathematics for Engineers, Prasad Mudranalaya.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (III Semester)

EME -301: Thermodynamics **L T P 3 1 0**

Objective: The objective of this course is the study of energy and its transformation. Most studies of thermodynamics are primarily concerned with two forms of energy – heat and work. Thermodynamics study includes quantitative analysis of machine and processes for transformation of energy and between work and heat. In classical thermodynamics a macroscopic viewpoint is taken regarding such matters.

Unit – I **(06 Sessions)**
Fundamental Concepts and Definitions: Introduction and definition of thermodynamics, Dimensions and units, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and state, Thermodynamic properties, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasi static process, Energy and its forms, Work and heat, Gas laws, Ideal gas, Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases.
Zeroth law of thermodynamics: Zeroth law of thermodynamics, Temperature and its measurement, Temperature scales**.**

Unit-II **(10 Sessions)**
First law of Thermodynamics: Thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules' experiment, First law of thermodynamics, Internal energy and enthalpy, First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. First law analysis for closed system (non flow processes), Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer, Limitations of first law of thermodynamics, PMM-I.

Unit – III **(10 Sessions)**
Second law of Thermodynamics: Devices converting heat to work, Thermal reservoir, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, thermodynamic temperature scale, PMM-II.

Unit – IV **(07 Sessions)**
Entropy : Clausius inequality, Concept of Entropy, Entropy change in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.
Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function.

Unit – V **(07 Sessions)**
Properties of steam and thermodynamics cycles: Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier charts, Dryness factor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

Course Outcome: Students completing this course will be able to:
- Identify and use units and notations in Thermodynamics.
- State and illustrate first and second laws of Thermodynamics
- Explain the concepts of entropy, enthalpy, reversibility and irreversibility.
- Apply the first and second laws of Thermodynamics to various gas processes and cycles.
- To get conversant with properties of steam, dryness fraction measurement, vapor processes and Thermodynamic vapor cycles, performance estimation.
- To get conversant with Psychometric Charts, Psychometric processes, human comfort conditions.

Suggested Readings:
- Engineering Thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
- Fundamentals of Classical Thermodynamics by Van Wylen, John wiley & sons.
- Thermodynamics by J.P. Holman, McGraw Hill.
- Engineering Thermodynamics by P.K.Nag, Tata Mc Graw Hill Pub.
- Thermal Engineering by R.K. Rajput, Laxmi Publication.
- Engineering Thermodynamics by C.P. Arora.

Website Sources:
- https://nptel.ac.in/courses/112/104/112104113/
- https://www.ohio.edu/mechanical/thermo/
- https://freevideolectures.com/course/2681/basic-thermodynamics
- https://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring-2008/video-lectures/

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (III Semester)

EME -302: Mechanics of Solids **L T P 3 1 0**

Objective: To give the fundamental knowledge of deformation of solids under various type of external applied load. To understand the behavior of solid materials by their properties, under externally applied load, torque and pressure in case of cylinder and sphere.

Unit –I **(08 Sessions)**
Simple Stress and Strain: Introduction, normal shear stresses, Hooke's law, stress-strain diagrams for ductile and brittle materials, one dimensional loading of members of varying cross sections.
Elastic Constants: Introduction, longitudinal strain, lateral strain, Poisson's ratio, volumetric strain, Bulk modulus, repression for Young's modulus in terms of bulk modulus, relationship between modulus of elasticity and modulus of rigidity.

Unit –II **(10 Sessions)**
Compound Stress and Strains: Introduction, state of plane stress, principal stress and strain, Mohr's stress circle.
Strain Energy and Impact Loading: Introduction, definitions of resilience, proof resilience, modulus of resilience, expression for strain energy stored in a body when the load is applied gradually, suddenly and with impact.

Unit –III **(06 Sessions)**
Pure Bending of Beams: Introduction, type of beams, pure bending, simple bending theory, normal stresses, shear stresses in beams of different cross sections.

Unit-IV **(06 Sessions)**
Torsion: Introduction, torsion of shafts of circular section, torsion equation, shear stress due to torque, torque and twist. Combined torsion and bending of solid shafts, torsion of thin walled tubes

Unit –V **(10 Sessions)**
Thin cylinders & spheres: Introduction; difference between thick and thin walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.
Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders. Stresses in rotating shaft and cylinders, stresses due to interference fits

Course Outcome: The outcomes of this course for the students are as follows:
- Will be able to find the mechanical properties of solids under various type of applied load.
- Will be able to design the beams and shafts which may be used in some structure.
- Will be able to understand the deformation in pressure vessels (static and rotating state) due to internal and external force.

Suggested Readings:
- Introduction to Solid Mechanics by Shames, PHI
- Strength of Materials by Timoshenko and & Yσungs
- Fundamental of Solid Mechanics by Gambhir, PHI
- Strength of Materials by Ryder.
- Strength of Materials by Dr. R. K. Bansal
- Strength of Materials by S. Ramamrutham.

Website Sources:
- www.nptel.ac.in
- www.utube.com
- gradeup.co/gate-me-notes
- alphalearning.in/ese-gate/strength-of-material

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (III Semester)

EME 303: Fluid Mechanics **L T P 3 1 0**

Objective: The objective of this course is to familiarize the students with the properties of fluids and the applications of fluid mechanics. To formulate and analyze the problems related to fluid flow. To understand the concept of flow measurement, types of flows and dimensional analysis.

UNIT I: Introduction and Kinematics of Fluid flow **(08 Sessions)**
Fluid and continuum, Physical properties of fluids, Rheology of fluids. Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational, flows, compressible and incompressible flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential, source, sink.

UNIT II: Fluid Statics **(08 Sessions)**
Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

UNIT III: Dynamics of Fluid Flow **(08 Sessions)**
Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends.

UNIT IV: Dimensional Analysis and Hydraulic Similitude **(08 Sessions)**
Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies. Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sublayer, separation and its control, drag and lift, drag on a sphere.

UNIT V: Laminar, Turbulent Flow and Boundary Layer Analysis **(08 Sessions)**
Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipes in series and parallel, power transmission through a pipe, siphon, water hammer.

Course Outcome: Students completing this course will be able to:
- Understand stress-strain relationship in fluids, classify their behavior and also establish force balance in static systems.
- To apply Bernoulli principle and compute pressure drop in flow systems of different configurations.
- To describe function of flow measuring devices and apply Bernoulli equation to determine the performance of these devices.
- To measure the fluid pressure using various types of pressure measuring devices.

Suggested Readings:

- Som, S K & Biswas, G: Introduction of fluid mechanics and fluid machines, TMH, 2000, 2nd edition.
- Das, M M: Fluid mechanics & turbomachines , Oxford University Press.
- Agarwal, S K: Fluid mechanics and machinery, TMH.
- Garde, R J: Fluid mechanics through problems, New Age International Pvt. Ltd, New Delhi, 2nd Edition.
- Rouse, H: Elementary mechanics of fluids, John Wiley & Sons, 1946.
- Gupta, V and Gupta, S K: Fluid Mechanics and its Applications, Wiley Eastern Ltd, 1984.

Website Sources:
- nptel.ac.in/course.html
- www.nsf.gov
- en.wikipedia.org
- www.sciencedirect.com
- www.slideshare.net
- www.researchgate.net

SCHOOL OF ENGINEERING & TECHNOLOGY
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IFTM UNIVERSITY, MORADABAD.

Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (III Semester)

EME 304: Measurement & Metrology **L T P 3 1 0**

Objective: The students will learn:

- Inspection of engineering parts with various precision instruments.
- Design of part, tolerances and fits.
- Principles of measuring instruments and gauges and their uses.
- Evaluation and inspection of surface roughness.

Unit-I **(06 Sessions)**

Mechanical Measurements

Introduction: Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors.

UNIT-II **(06 Sessions)**

Sensors and Transducers: Types of sensors, types of transducers and their characteristics.
Signal transmission and processing: Devices and systems. Signal Display & Recording Devices

Unit-III **(12 Sessions)**

Time related measurements: Counters, stroboscope, frequency measurement by direct comparison. Measurement of displacement
Measurement of pressure: Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures.
Strain measurement: Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.
Measurements of force and torque: Different types of load cells, elastic transducers, pneumatic & hydraulic systems.
Temperature measurement: Thermometers, bimetallic thermocouples, thermistors and pyrometers.
Vibration: Seismic instruments, vibration pickups and decibel meters, vibrometers accelerometers.

Unit-IV **(08 Sessions)**

Metrology

Metrology and Inspection: Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability and standardization. Linear and angular measurements devices and systems Comparators: Sigma,
Johansson's Microkrator. Limit gauges classification, Taylor's Principle of Gauge Design.

Unit-V **(08 Sessions)**

Measurement of geometric forms like straightness, flatness, roundness. Tool maker's microscope, profile project autocollimator. Interferometry: principle and use of interferometry, optical flat.. Measurement of screw threads and gears. Surface texture: quantitative evaluation of surface roughness and its measurement.

Course Outcome:

Students will be able to design tolerances and fits for selected product quality. They can choose appropriate method and instruments for inspection of various gear elements and thread elements. They can understand the standards of length, angles; they can understand the evaluation of surface finish and measure the parts with various comparators. The quality of the machine tool with alignment test can also be evaluated by them.

Suggested Readings:

- Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House, N. Delhi.
- Doeblein E.O., "Measurement Systems, Application Design", McGraw Hill, 1990.
- Kumar D.S., "Mechanical Measurements and Control", Metropolitan, N. Delhi.
- Hume K.J., "Engineering Metrology", MacDonald and Co. 1963
- Gupta, I.C., "Engineering Metrology", Dhanpat Rai & Sons, New Delhi, 1994
- Jain, R.K., "Engineering Metrology" Khanna Publishers
- Jain, R.K., "Mechanical Measurement" Khanna Publishers

Website Sources:

- https://www.mechanical.in/engineering-metrology-and-measurements-subject-notes/
- http://www.darshan.ac.in/Upload/DIET/Documents/ME/2141901_MMM_E-Note_22032016_031012AM.pdf
- https://easyengineering.net/me6504-metrology-and-measurements/
- https://lecturenotes.in/subject/239/engineering-metrology-and-measurements-emm

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (III Semester)

EME – 307: Industrial Engineering **L T P 3 1 0**

Objective: The objective of this course is to learn how to organize the production facilities like machines, men, material etc. to achieve stated production objectives with respect to quantity, quality, time and cost.

Unit-I **(08 Sessions)**
Productivity: Introduction, definition, measurement, productivity index, ways to improve productivity, Types of Production System.
Work study: Meaning and benefits of work study, time & motion study. Micro motion study P.M.T.S. man machine Diagram flow chart. Motion economy, Method study, work measurement, work sampling, standard time.

Unit-II **(08 Sessions)**
Plant layout and materials handling: Plant location, type of layout, principles of facility layout principles of material handling, Material Handling equipment's.
Production planning and control: Objectives, Forecasting, product design and development functions, steps in PPC. Planning routine, scheduling, Dispatching & follow-up, Effectiveness of PPC, Introduction of JIT.

Unit-III **(10 Sessions)**
Managerial Economics : Introduction, Assumptions, Time Value of money, apprised, criteria step-in BEA, purpose, costs & overheads fixed & variable costs, margin of safety, Angle of incidence profit volume graph.
Replacement Analysis: Depreciation causes, obsolescence, service life of assets, Replacement of items.
Maintenance Management: Maintenance Planning & Control, Maintenance Strategy

Unit-IV **(06 Sessions)**
Inventory Control: Inventory, function, cost, deterministic models, Introduction to MRP, supply chain Management
Quality Control: Introduction, process control, SQC control Charts, Single double & sequential sampling, Introduction to TQM & bench marking.

Unit-V **(08 Sessions)**
Industrial Ownership: Proprietorship, partnership, Joint stock & co-operative stores.
Manpower Planning: Resources, Human relationship.
Organization: Principles of organization, Development of Organizational charts like line, staff, line and staff & Functional types.

Course Outcome: Students completing this course will be able:

- To be employed as a practicing engineer in fields such as design, develop, implement and improve integrated systems that include people, materials, information, equipment and environments.
- Contribute to the success of companies through effective problem solving techniques, effective utilization of resources and provide excellent quality product for better customer service.
- To develop the skill in students to help them to engage in a career path into operational management that can eventually lead to a managerial level role in a small to very large enterprise.

Suggested Readings:

- Principles of management. An analysis of management functions-H.Koontz & C.O. Donnel. Tata McGrow-Hall Co.
- Manufacturing Management-J Moore Prentice Hall Englewoon cliffs :New jersey.
- Modern production operations Management-Buffam E.S. Wiley eastern.
- Industrial Engg. & Management O.P. Khanna.
- Industrial Engineering by Ravi Shanker.
- Industrial Engineering by Mahajan.

Website Sources:

- www.iise.org
- onlinecourses.nptel.ac.in
- www.edx.org/learn/industrial-engineering
- www.accessengineeringlibrary.com/front
- https://guides.libraries.psu.edu/industmanu
- https://wne.libguides.com/industrial_engineering/websites

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B.Tech – II Year (III Semester)

EME -351: Thermodynamics Lab **L T P 0 0 2**

Objective: The objective of this lab is to familiarize the students able to understand the water tube boiler and fire tube boiler working and its parts, working and study of different parts of two stroke and four stroke petrol and diesel engine, working of steam engine and gas turbine and study of ignition engine.

List of Experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Study of Fire Tube boiler.
2. Study of Water Tube boiler.
3. Study and working of two stroke petrol Engine.
4. Study and working of four stroke petrol Engine.
5. Study and working of two stroke Diesel Engine.
6. Study and working of four stroke Diesel Engine.
7. Study of Steam Engine model.
8. Study of Gas Turbine Model
9. Study of Ignition system of I.C .Engine.

Course Outcome: The students will be able to understand the knowledge of:

- Water tube boiler and fire tube boiler working and its parts
- Working and study of different parts of two stroke and four stroke petrol and diesel engine
- Working of steam engine and gas turbine
- Study of ignition engine.

Suggested Readings:

- Engineering Thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
- Fundamentals of Classical Thermodynamics by Van Wylen, John wiley & sons.
- Thermodynamics by J.P. Holman, McGraw Hill.
- Engineering Thermodynamics by P.K.Nag, Tata Mc Graw Hill Pub.
- Thermal Engineering by R.K. Rajput, Laxmi Publication.
- Engineering Thermodynamics by C.P. Arora.

Website Sources:

- https://nptel.ac.in
- https://www.wikipedia.org
- https://www.youtube.com

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EME -352: Machine Drawing -I Lab **L T P 0 0 2**

Objective:

- To explain about the basics (IS codes for machine drawing, lines, scales, dimensioning and standard abbreviations) of engineering drawing.
- To explain about the basic of orthographic drawing (First angle projection, Third angle projection).
- Student will understand about various types of threaded fasteners and their nomenclature.
- To understand the concept of various machine parts (Key, cotter, coupling and rivet joint).
- To understand the concept of assembly drawing of various parts (Engine parts, stuffing box and screw jack)
- To explain the basic concept and importance of free hand sketching.
- To understand and apply national and international standards while drawing machine component.
- To familiarize in drawing assembly, orthographic and sectional views of various machine components.

List of Experiments: **(16 Sessions)**

1. **Introduction:** Graphic language, classification principles of drawing, IS codes for machine drawing, lines, scales, dimensioning, standard abbreviations.
2. **Orthographic projection:** First & third angle projection, drawing and sketching of machine elements.
3. **Threaded fasteners:** Introduction, nomenclature, forms of thread, thread designation, Representation of thread, Foundation bolt.
4. **Keys and cotter:** Keys and cotter joint
5. **Shaft couplings:** Introduction, rigid and flexible coupling.
6. **Riveted joint:** Introduction, Rivets and riveting, Rivet head, Classification.
7. **Assembly drawing:** Introduction, Engine parts, Stuffing box, screw jack.
8. **Free hand sketching:** Introduction, need for free hand sketching, Free hand sketching of some machine component.

Course Outcome: On successful completion of the course, the student will be able to:

- Identify the national and international standards pertaining to machine drawing.
- Illustrate various machine components through drawings
- Student will get the concept of orthographic projection at the same time he will also be able to draw orthographic projections of isometric views.
- Student will understand about the threaded fasteners.
- Student will know about the keys, cotter, rivet joint and shaft couplings.
- Student will be able to make assembly drawing as well as free hand sketching of various mechanical parts.

Suggested Readings:

- Engineering Graphics (K.C. John)
- Machine Drawing (N.D. Bhatt)
- Machine Drawing (P.S. Gill)
- Machine Drawing (Dr R K Dhawan)

Website Sources:

- https://d2t1xqejof9utc.cloudfront.net/files/16515/MachineDrawing.pdf?1354775841
- https://www.pdfdrive.com/machine-drawing-books.html
- https://easyengineering.net/machine-drawing-by-narayana/
- https://in.pinterest.com/pin/274367802285638925/
- https://www.researchgate.net/publication/313472842_Machine_Drawing

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (III Semester)

EME 353: Fluid Mechanics Lab **L T P 0 0 2**

Objective: The objective of this course is to familiarize the students with the application of Bernoulli's theorem for calculating velocity of flow and discharge through different types of notches and weirs, calculation of the discharge through orifice meter and venturimeter. To study the significance of Reynolds number and friction factor in pipe flow.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. To determine the energy at a particular point in a pipe or verify the Bernoulli's theorem.
2. To determine the coefficients of velocity, contraction and discharge of an orifice (or a mouth piece) of a given shape.
3. To measure the velocity of water flow in an open channel by a current meter.
4. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
5. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile using Pitot static tube apparatus.
6. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
7. To verify the momentum equation experimentally by use of Impact of jet on vane apparatus.
8. To study about Notches and weirs.
9. To measure the surface tension of a liquid.
10. To study the flow behavior in a pipe bend and to calibrate the pipes bend for discharge measurement.
11. To determine coefficient of discharge of a Venturimeter.
12. To determine coefficient of discharge of an Orificemeter.

Course Outcome: Students completing this course will be able to:

- Understand the application of Bernoulli's theorem to various flow measuring devices.
- Understand the significance of Reynolds number.
- Learn the concept of surface tension of various liquids.
- Understand the application of momentum equation in turbines.
- Understand the concept of friction factor in pipe flow.

Suggested Readings:

- Som, S K & Biswas, G: Introduction of fluid mechanics and fluid machines, TMH, 2000, 2nd edition.
- Das, M M: Fluid mechanics & turbomachines , Oxford University Press.
- Agarwal, S K: Fluid mechanics and machinery, TMH.
- Garde, R J: Fluid mechanics through problems, New Age International Pvt. Ltd, New Delhi, 2nd Edition.
- Rouse, H: Elementary mechanics of fluids, John Wiley & Sons, 1946.
- Gupta, V and Gupta, S K: Fluid Mechanics and its Applications, Wiley Eastern Ltd, 1984.

Website Sources:

- nptel.ac.in/course.html
- www.nsf.gov
- en.wikipedia.org
- www.sciencedirect.com
- www.slideshare.net
- www.researchgate.net

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (III Semester)

EME 354: Measurement & Metrology Lab **L T P 0 0 2**

Objective:

- To provide students with the necessary skills for calibration and testing of different gauges and instruments.
- To provide students with the necessary skills to collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures using various metrology instruments.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Study & working of simple measuring instruments- Vernier calipers, micrometer, tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sine bar & slip gauges.
4. Study of limit gauges.
5. Study & angular measurement using level protector
6. Adjustment of spark plug gap using feeler gauges.
7. Study of dial indicator & its constructional details.
8. Use of dial indicator to check a shape run use.
9. Study and understanding of limits, fits & tolerances
10. Study of Pressure & Temperature measuring equipment.
11. Strain gauge measurement.
12. Speed measurement using stroboscope.
13. Flow measurement experiment
14. Vibration/work measuring experiment.
15. Experiment on Dynamometers.

Course Outcome: Upon completion of this course, students should be able to:

- Demonstrate the necessary skills for calibration and testing of different gauges and instruments.
- Demonstrate the necessary skills to collect data perform analysis and interpret results to draw valid conclusions through standard test procedures using various metrology instruments.

Suggested Readings:

- Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House, N. Delhi.
- Doeblein E.O., “Measurement Systems, Application Design”, McGraw Hill, 1990.
- Kumar D.S., “Mechanical Measurements and Control”, Metropolitan, N. Delhi.
- Hume K.J., “Engineering Metrology”, MacDonald and Co. 1963
- Gupta, I.C., “Engineering Metrology”, Dhanpat Rai & Sons, New Delhi, 1994
- Jain, R.K., “Engineering Metrology” Khanna Publishers
- Jain, R.K., “Mechanical Measurement” Khanna Publishers

Website Sources:

- https://www.mechanical.in/engineering-metrology-and-measurements-subject-notes/
- http://www.darshan.ac.in/Upload/DIET/Documents/ME/2141901_MMM_E-Note_22032016_031012AM.pdf
- https://easyengineering.net/me6504-metrology-and-measurements/
- https://lecturenotes.in/subject/239/engineering-metrology-and-measurements-emm

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Bachelor of Technology (B.Tech) Mechanical Engineering

STUDY AND EVALUATION SCHEME (Effective from 2018-19)
YEAR II, SEMESTER-IV

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EME -401	Applied Thermodynamics	3	1	0	20	10	30	70	100	4
2.	EME -402	Advance Mechanics of Solids	3	1	0	20	10	30	70	100	4
3.	EME -403	Materials Science	3	1	0	20	10	30	70	100	4
4.	EME -404	Kinematics of Machines	3	1	0	20	10	30	70	100	4
5.	EEE -405	Electrical Machines & Automatic Control	3	1	0	20	10	30	70	100	4
6.	PSD-401	Professional Skill Development - II	3	1	0	20	10	30	70	100	4
7.	EHU-401	Disaster Management **(Audit Paper) #**	3	0	0	20	10	30	70 *****	100 *****	3 *****
PRACTICALS / PROJECT											
8.	EME -451	Applied Thermodynamics Lab	0	0	2	20	10	30	70	100	1
9.	EME -452	Machine Drawing -II Lab	0	0	2	20	10	30	70	100	1
10.	EME -453	Materials Testing Lab	0	0	2	20	10	30	70	100	1
11.	EEE -455	Electrical Machines Lab	0	0	2	20	10	30	70	100	1
12.	GP-401	General Proficiency	-	-	-	-	-	100	-	100	1
		TOTAL	**18**	**06**	**08**	**-**	**-**	**-**	**-**	**1100**	**29**

*** Internal Assessment**

 # The Subject (EHU-401), Disaster Management will be offered as a compulsory audit course and each student has to pass the subject at the minimum by getting 35 marks out of 100.

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B.Tech – II Year (IV Semester)

EME -401: Applied Thermodynamics **L T P 3 1 0**

Objective: The objective of this course is to familiarize the students able to use the First Law of Thermodynamics to estimate the potential for thermo-mechanical energy conversion in aerospace power and propulsion systems.

Unit-I **(06 Sessions)**

Thermodynamic relations: Mathematical conditions for exact differentials. Maxwell Relations, Clapeyron Equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic & Isothermal compressibility

Fuels and Combustion: Combustion analysis, Heating Values, Air requirement, Air/Fuel ratio, Standard heat of Reaction and effect of temperature on standard heat of reaction, heat of formation, adiabatic flame temperature.

Unit-II **(06 Sessions)**

Boilers: Steam generators-classifications. Working of fire-tube and water-tube boilers, boiler mountings & accessories, Draught & its calculations, air pre heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

Condenser: Classification of condenser, Air leakage, Condenser performance parameters.

Unit-III **(08 Sessions)**

Steam Engines: Rankine and modified Rankine cycles, Working of stream engine, Classification of steam engines, Indicator diagram, Saturation curve, Missing quantity, Heat balance.

Steam& Gas Nozzles: Flow through nozzle, Variation of velocity, Area and specific volume, Choked flow, Throat area, Nozzle efficiency, off design operation of nozzle, Effect of friction on nozzle, super saturated flow. **.**

Unit-IV **(10 Sessions)**

Vapour Power cycles: Carnot vapour power cycle, Effect of pressure & temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, combined cycles, Cogeneration.

Steam Turbines : Classification of steam turbine, Impulse and reaction turbines, Staging, Stage and overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple & compound multistage impulse & reaction turbines & related calculations work done efficiencies of reaction, Impulse reaction Turbines, state point locus, Comparison with steam engines, Losses in steam turbines, Governing of turbines.

Unit-V **(10 Sessions)**

Gas Turbine: Gas turbine classification Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles.

Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines & their processes, Principle of rocket propulsion, Introduction to Rocket Engine**.**

Course Outcome: Students completing this Course will be able to:

- To be able to state the First Law and to define heat, work, thermal efficiency and the difference between various forms of energy.
- To be able to identify and describe energy exchange processes (in terms of various forms of energy, heat and work) in aerospace systems.
- To be able to explain at a level understandable by a high school senior or non-technical person how various heat engines work (e.g. a refrigerator, an IC engine, a jet engine).
- To be able to apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (heaters, coolers, pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow.
- To be able to apply ideal cycle analysis to simple heat engine cycles to estimate thermal efficiency and work as a function of pressures and temperatures at various points in the cycle.

Suggested Readings:

- Applied thermodynamics by Onkar Singh, New Age International (P) Publishers Ltd.
- Basic and Applied Thermodynamics by P.K. Nag, Tata Mc Graw Hill Pub.
- Thermal Engg. By P.L. Ballaney, Khanna Publisher
- Theory of Stream Turbine by W.J. Kearton
- Steam & Gas Turbine by R.Yadav, CPH Allahabad
- Thermal Engg. By R.K. Rajput, Laxmi Publication
- Gas Turbine, by V. Ganeshan, Tata Mc Graw Hill Publishers.
- Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Long man

Website Sources:

- https://nptel.ac.in/courses/112/106/112106133/
- https://www.wikipedia.org/
- https://www.youtube.com/
- https://www.pdfdrive.com/applied-thermodynamics-books.html
- http://www.freepdfbook.com/applied-thermodynamics-by-rk-rajput-pdf/

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EME -402: Advance Mechanics of solids **L T P 3 1 0**

Objective: This subject is useful for a detailed study of forces and their effects which is very essential for an engineer, to enable him, in designing all type of structure and machine. Also To provide the basic concepts and principles of strength of materials and to give an ability to analyze a given problem in a simple manner. The subject gives an ability to calculate stresses and deformations of objects under external forces, to give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

UNIT-I **(08 Sessions)**
3-D Stress, Theory of failure, Castigliano's Theorem, Impact load: Three-dimensional state of stress & strain, equilibrium equations. Generalized Hook's Law. Theories of Failure. Castigliano's Theorem. Impact load & stresses.

UNIT –II **(08 Sessions)**
Stresses in Beams: Review of pure Bending**.** Direct and shear stresses in beams due to transverse and axial loads, composite beams.
Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams.

UNIT-III **(08 Sessions)**
Helical and Leaf Springs: deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

UNIT-IV **(08 Sessions)**
Columns and Struts: Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions. Euler's theory and experimental results, Ranking Gardon Formulae, Examples of columns in mechanical equipments and machines.

UNIT-V **(08 Sessions)**
Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.
Unsymmetrical Bending: Properties of beam cross-section slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

Course outcome: Students completing this course will be able to

- Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
- Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.
- Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts.

Suggested Readings:

- Mechanics of Materials by Pytel
- Strength of Materials by Ryder
- Strength of Materials by Timoshenko and & Yσungs
- Mechanics of Materials by Bear Jhonson

Website Sources:

- https://web.mit.edu/emech/dontindex-build/
- https://www.britannica.com/science/mechanics-of-solids
- https://www.springer.com/journal/11964
- https://nptel.ac.in/courses/105/104/105104160/
- https://www.sciencedirect.com/topics/engineering/solid-mechanics

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (IV Semester)

EME -403: Materials Science **L T P 3 1 0**

Objective: To study how the properties of materials may be changed through understanding atomic, molecular, crystalline and microscopic structures of engineering materials. To test and analyze the engineering properties of metals, nonmetals and composites.

Unit-I **(08 Sessions)**

Introduction: Historical perspective and importance of materials. Brief review of modern atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bonding.

Crystallography and Imperfections: Concept of unit cell, space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques. Imperfections/defects in solids.

Unit-II **(10 Sessions)**

Mechanical properties and Testing: Stress/Strength, Stress strain diagram for ductile & brittle material, Stress vs strength. Toughness, Hardness, Fracture, Fatigue and Creep, Testing such as Hardness testing, Impact testings, Fatigue testing Creep testing, Non-destructive testing (NDT).

Micro structural Exam: Microscope principle and methods. Preparation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of various metals and alloys such as Mild steel, Cast Iron and Brass

Phase Diagram and Equilibrium Diagram: Phase rules, Unary and Binary diagrams, Types of equilibrium diagrams: Solid solution, eutectic type and combination type. Iron-carbon equilibrium diagram

Unit-III **(08 Sessions)**

Ferrous materials: Brief introduction of iron and steel making furnaces. Type of carbon steels, alloy steels and cast irons. Properties and uses.

Non-Ferrous metals and alloys: Non-ferrous metals such as Cu, Al, Zn, Cr, Ni etc. and their applications. Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin.

Heat Treatment: Various types of heat treatment process such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams.

Unit-IV **(08 Sessions)**

Magnetic properties: Concept of magnetism, magnetic materials and their classification, Hysteresis curve. Soft and hard magnetic materials, Magnetic storages

Electric properties: Energy band concept of conductor, insulator and semi-conductor. Intrinsic and extrinsic semi-conductors, P-n junction and transistors. Basic devices and its application. Diffusion of Solid. Messier effect, Super conductivity and its applications. Type I& II superconductors. High T_c superconductors

Unit-V **(06 Sessions)**

Ceramics: Structure types and properties, Processing of Ceramics, Mechanical and Electrical behavior. Applications of ceramics

Plastics: Various types of polymers/plastics. Processing of plastics, Mechanical behavior, Applications and future of plastics

Other materials: Brief description of other material such as optical, thermal materials, concrete, composite materials and its uses. Introduction to Smart materials/ Nano-materials. Corrosion and its control.

Course Outcome: After completion of this course the students will be able:

- To apply the knowledge of science and engineering in synthesis of new materials
- To serve their service concerned to the industry in the area of materials testing and engineering.
- To understand and explain the phase diagram of different engineering materials.

Suggested Readings:

- W.D. Callister, Jr, - Material Science & Engineering Addition-Wesley Publication.
- K.M.Gupta, Materials Science, Umesh Publication.
- Van Vlash - Elements of Material Science & Engineering John Wiley & Sons.
- V. Raghvan - Material Science, Prentice Hall.
- Narula - Material Science, TMH.

Website Sources:

- www.e-education.psu.edu/matse81/node/2094
- http://nptel.ac.in
- http://lecturenotes.in/notes/23951-note-for-material-science-and-engineering
- https://www.youtube.com/watch?v=b4jvpYxxZco

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (IV Semester)

EME -404: Kinematics of Machines **L T P 3 1 0**

Objective: The study of kinematics is an applied field of mechanical engineering that is concerned with understanding the relationship between the geometry and the motions of the parts of a machine and the forces that produce this motion. We have to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines. This includes relative motion analysis and design of gears, gear trains, cams, and linkages, simultaneous graphical and analytical analysis of position, velocity, and acceleration, considering static and inertial forces.

UNIT I **(12 Sessions)**
Introduction Links-types, Kinematics pairs-classification, Constraints-types, Degree of Freedom, Grubler's equation, linkage mechanisms, inversions of four bar linkage, slider crank chain and double slider crank chain
Velocity in Mechanisms Velocity of point in mechanism, relative velocity method, instantaneous point in mechanism, Kennedy's theorem, instantaneous center method.

UNIT II **(10 Sessions)**
Acceleration in Mechanisms Acceleration diagram, Coriolis component of acceleration, Klein's construction for Slider Crank and Four Bar mechanism, Analytic method for slider crank mechanism.
Mechanisms with Lower Pairs Pantograph, Exact straight line motion mechanisms - Peaucellier's, Hart and Scott Russell mechanisms, Approximate straight line motion mechanisms – Grass-Hopper, Watt and Tchebicheff mechanisms, Analysis of Hook's joint, Davis and Ackermann Steering gears.

UNIT III **(06 Sessions)**
Kinematics Synthesis of Planar Linkages Movability of four bar linkages, Grashoff's law, Graphical methods of synthesis – Two and Three position synthesis of four bars and slider crank mechanisms, Analytical method-Freudenstein's equation for function generation (three positions).

UNIT IV **(06 Sessions)**
CAM Cams and Followers - Classification & terminology, Cam profile by graphical methods for uniform velocity, simple harmonic motion and parabolic motion of followers, Analytical cam design – tangent and circular cams.

UNIT V **(06 Sessions)**
Gears Classification & terminology, law of gearing, tooth forms, interference, under cutting, minimum number of teeth on gear and pinion to avoid interference, simple, compound and planetary gear trains.

Course outcome: Students completing this course will be able to
- Distinguish kinematic and kinetic motion
- Identify the basic relations between distance, time, velocity, and acceleration.
- Drawing velocity and acceleration diagrams for different mechanisms
- Selecting gear and gear train depending on application.
- Drawing displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers,

Suggested Readings:
- Theory of machines - Thomas Bevan
- Theory of machines and mechanisms- Shigley
- Theory of machines and mechanisms-Ghosh & Mallik
- Theory of machines and mechanisms- Rao & Dukkipati
- Theory of Machines – R. K. Bansal

Website Sources:
- https://www.youtube.com/watch?v=pTJWuvDlTNU
- https://www.youtube.com/watch?v=MJeRFzs4oRU
- https://www.springer.com/gp/book/9789400711556
- https://www.nature.com/articles/014213a0
- https://www.coursera.org/lecture/dynamics/module-1-course-introduction-v9YXC

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EEE – 405: ELECTRICAL MACHINES & AUTOMATIC CONTROL L T P 3 1 0

Objective:

- To introduce the concepts of ideal synchronous machines and poly-phase induction machines. Applications which will be utilized in the electrical machines with its performance and theory of operation.
- To deal with the control system techniques which will provide the information of electrical system and it's characteristic.

UNIT I: (08 Sessions)

Single phase Transformer: Efficiency Voltage regulation, O.C. & S.C. Tests. **Three Phase Transformer:** Three phase transformer connections, 3-phase to 2-phaseor6-phase connections and their applications. **Auto Transformer:** Volt- Amp relations, efficiency, advantages & disadvantages, applications. **D.C. Motors:** Concept of starting, speed control, losses and efficiency.

UNIT II: (08 Sessions)

Three phases Induction Motor: Construction, equivalent circuit, torque equation and torque- slip characteristics, speed control. **Alternator:** Construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method. **Synchronous Motor:** Starting, effect of excitation on line current (V-curves), synchronous condenser. **Servo Motor:** Two phase a.c. servo motor & its application.

UNIT III: (08 Sessions)

Modeling of Mechanical System: linear mechanical elements, force-voltage and force current analogy, and electrical analog of simple mechanical systems; concept of transfer function& its determination for simple systems.
Control System: Open loop & closed loop controls, servo mechanisms; concept of various types of system.
Signals: Unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics**.**

UNIT IV: (08 Sessions)

Time Response Analysis: Time response of a standard second order system and response specifications, steady state errors and error constants.
Stability: Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability, limitations.

UNIT V: (08 Sessions)

Root Locus Techniques: Concept of root locus, construction of root loci.
Frequency Response Analysis: Correlation between time and frequency responses of a second order system; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots.
Process control: Introduction to PD, PI and PID controllers their characteristics, representation and applications.

Course Outcome: On completion of the course, student will be able to:

- Illustrate constructional features of synchronous machines, winding details, induce EMF
- Develop phasor diagram & examine steady state performance of synchronous machines, determine voltage regulation of an alternator
- Interpret parallel operation of alternators & determine various sequence reactance's of synchronous machines
- Analyze the behavior of synchronous machine connected to infinite bus
- Explain transient behavior of synchronous machines & determination of time constant and equivalent circuit parameters under transient conditions
- Explain working principle of special machines

Suggested Readings:

- J. Nagrath& D. P. Kothari, "Electrical machines" Tata McGraw Hill.
- .B.C. Kuo, "Automatic Control systems." Wiley India Ltd.
- B.R. Gupta &Vandana Singhal, "Fundamentals of Electrical Machines", New Age International.
- K. Ogata, "Modern Control Engineering" Prentice Hall of India.
- Irvin L. Kosow, "Electric Machinery and Transformers" Prentice Hall of India.

Website Sources:

- www.lecturenotes.in
- www.docsity.com
- www.electrical-engineering-portal.com
- www.springerprofessional.de

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (IV Semester)

PSD-401: PROFESSIONAL SKILL DEVELOPMENT-II **L T P 3 1 0**

Objective: The objectives of Professional Skill Development-II are:

- To develop critical thinking, creativity and effective communication.
- To provide the essential foundational elements for leadership skill-building and student success.
- To explore self-awareness that involves identification and articulation of various facets – cultural, social, and familial that contributes to the formation of one's identity.
- To develop mutually beneficial relationships through communication and cooperation with others, collaborate to achieve group goals, practice living and leading with integrity, and learn about issues of local and global significance in order to become active members of their communities.

Unit I: Communicative Skills **(07 Sessions)**

Communication: Concept, Classification, Purpose, Process, Importance, Flow & Level of Communication, Barriers & Gateways in Communication, 7 C's of Communication, Types of Communication & communication without words

Unit II: Intrapersonal Relationship Skills **(07 Sessions)**

Personality: Characteristics of Healthy & Sick Personality
Self-Awareness
Self Esteem
Self Confidence
Assertiveness V/S Aggressiveness
Values: Types & Importance

Unit III: Interpersonal Relationship Skills **(08 Sessions)**

Group: Concepts, Types, Stages
Team: Concepts, Elements, Types, Stages
Presentation Skills& strategies
Interview: Concepts, Types, Process, Interview Preparation Checklist, Interview Handling Skills, Common Interview mistakes

Unit IV: Argumentative Skills **(10 Sessions)**

Debate
Role Play
Speeches
Elocution
Group Discussion

Unit V: Campus to Company Skills **(08 Sessions)**

The corporate Fit: Dressing and Grooming
Basic Etiquette: Office (Do's and Don'ts for men and women), Telephone, Email
Dealing with People in Corporate

Course Outcome: Students completing this course will be able to:

- Apply the comprehensive set of skills and knowledge for life success.
- understand the communication process, its benefits and challenges
- Learn to effectively lead others on a project or in an organization
- Develop and articulate respect for the diversity of talents, ways of knowing and learning.

Suggested Readings:

- M.K. Sehgal & V. Khetrapal's Business Communication published by Excel Books.
- Rajendra Pal's Business Communication published by Sultan Chand & Sons Publication.
- P. D. Chaturvedi's Busines Communication published by Pearson Education, Delhi.
- Elizabeth B. Hurlock's Personality Development by Tata McGraw Hills, Delhi.

Website Sources:

- www.wikipedia.com
- www.fluentu.com
- www.mindstool.com
- www.digitalcommons.pace.edu

SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
IFTM UNIVERSITY, MORADABAD.

Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – II Year (IV Semester)

EHU-301 / 401: DISASTER MANAGEMENT **L T P 3 0 0**

Objective: The objective of this course is to provide students an understanding to the concepts and aspects of disaster and its relationship with development. To ensure awareness of Disaster Risk Reduction (DRR) approaches among students. To assist students develop ability to respond to their environment with potential response to disaster.

UNIT I: Introduction to Disasters **(12 Sessions)**
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks; Types of disasters – Earthquake, Landslide, Flood, Drought, Fire, campus shooting, bomb threat, terrorist incidence and financial emergency etc.; Causes and Impacts including social, economic, political, environmental, health, psychosocial, etc.; Differential impacts- in terms of caste, class, gender, age, location, disability; Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II: Approaches To Disaster Risk Reduction **(10 Sessions)**
Disaster life cycle – its analysis, phases, culture of safety, prevention, mitigation and preparedness; Community based DRR (Disaster Risk Reduction), Structural-nonstructural measures; Roles and responsibilities of community: Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders

UNIT III: Inter-Relationship between Disasters and Development **(08 Sessions)**
Factors affecting Vulnerabilities, impact of Development projects such as dams, embankments, changes in Land-use etc.; Climate Change Adaptation-IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources; Role of international cooperation's in Disaster Management

UNIT IV: Disaster Risk Management In India **(08 Sessions)**
Hazard and Vulnerability profile of India. Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management; Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation; Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V: Disaster Management: Applications, Case Studies and Field Works **(07 Sessions)**
The project /fieldwork are meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located. A few ideas or suggestions are discussed below:
Several governmental initiatives require Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) to be proactive in preparing DM plans and community based disaster preparedness plans. Information on these would be available with the district collector or Municipal corporations.
Teachers could ask students to explore and map disaster prone areas, vulnerable sites, vulnerability of people (specific groups) and resources. The students along with teacher could work on ways of addressing these vulnerabilities, preparing plans and consultation with local administration or NGOs.
Students could conduct mock drills in schools, colleges or hospitals. They could also work on school safety, safety of college buildings, training in first aid.
Other examples could be- identifying how a large dam, road/ highway or an embankment or the location of an industry affects local environment and resources or how displacement of large sections of people creates severe vulnerabilities may be mapped by student project work.

The suggested topics for Project work for student could be as follows:

- Monitoring and evaluation plan for disaster response
- Low cost Home based water purification methods
- Planning Nutrition intervention programmes
- Safety tips before during and after earthquake, cyclone, floods and fire accidents.
- Mock Drills
- Major disasters in India
- Disaster Management in India
- Flood affected areas and damages in India
- Heat waves in India
- Earth quakes in India
- Historical Tsunamis in India
- Nuclear emergence
- Traffic accidents in India
- Train Accidents
- Major disease outbreak
- Disaster management structure in India
- Precaution, mitigation of disaster in India
- Warning system in India to prevent disaster
- Bhopal gas tragedy
- Kutch earth quake
- Tsunami (2004)
- Kosi Calamity 2008
- Mayapuri radiation exposure Delhi (2010)

- Mock exercises

Course Outcome: The students will be able to identify the nature and causes of disaster. Also the students will be able to apply the disaster risk reduction mechanism.

Suggested Readings:

- Satish Modh, Introduction to Disaster Management, Macmillan Publisher India Ltd
- Alexander David, Introduction in 'Confronting Catastrophe', Oxford University Press
- Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.
- Damon P. Coppola, Introduction to International Disaster Management, Butterworth-Heinemann,
- Singhal J.P. "Disaster Management", Laxmi Publications. ISBN-10: 9380386427 ISBN-13: 978-9380386423
- Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., . ISBN-10: 1259007367, ISBN-13: 978-1259007361]
- Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi
- KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi.
- Carter, Nick. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
- Cuny, F. Development and Disasters, Oxford University Press. Document on World Summit on Sustainable Development.
- Govt. of India: Disaster Management Act 2005, Government of India, New Delhi. Government of India, 2009.
- Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi Indian Journal of Social Work.
- Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April.

Website sources:

- https://www.physio-pedia.com/Disaster_Management
- http://www.ifrc.org/en/what-we-do/disaster-management
- http://www.wcpt.org/disaster-management/what-is-disaster-management
- en.wikipedia.org

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EME -451: Applied Thermodynamics Lab **L T P 0 0 2**

Objective: The objective of this lab is to familiarize the students able to find out the Indicated H.P. of I.C. Engine by Morse Test, Prepare the heat balance sheet for Diesel Engine and Petrol Engine by test rig and also understand the working of velocity and pressure compounded steam turbine and Impulse & Reaction turbine. Students also understand the working of vapour compression Refrigerator unit tutor / refrigerator and window type Air conditioner. Moreover students also understand the working of braking system of any vehicle and types of Dynamometer.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Determination of Indicated H.P. of I.C. Engine by Morse Test
2. Prepare the heat balance sheet for Diesel Engine test rig
3. Prepare the heat balance sheet for Petrol Engine test rig
4. Study of Velocity compounded steam turbine
5. Study of Pressure compounded steam turbine
6. Study of Impulse & Reaction turbine
7. To study of vapor compression Refrigerator unit tutor / refrigerator.
8. To study of window type Air conditioner.
9. Study of braking system of any vehicle.
10. Study of types of Dynamometer.

Course Outcome: The students will be able to understand the knowledge of:

- Find out the Indicated H.P. of I.C. Engine by Morse Test
- Prepare the heat balance sheet for Diesel Engine and Petrol Engine by test rig
- Understand the working of velocity and pressure compounded steam turbine and Impulse & Reaction turbine.
- Students also understand the working of vapor compression Refrigerator unit tutor / refrigerator and window type Air conditioner. Moreover students also understand the working of braking system of any vehicle and types of Dynamometer.

Suggested Readings:

- Applied thermodynamics by Onkar Singh, New Age International (P) Publishers Ltd.
- Basic and Applied Thermodynamics by P.K. Nag, Tata Mc Graw Hill Pub.
- Thermal Engg. By P.L. Ballaney, Khanna Publisher
- Theory of Stream Turbine by W.J. Kearton
- Steam & Gas Turbine by R.Yadav, CPH Allahabad
- Thermal Engg. By R.K. Rajput, Laxmi Publication
- Gas Turbine, by V. Ganeshan, Tata Mc Graw Hill Publishers.
- Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Long man

Website Sources:

- https://nptel.ac.in
- https://www.wikipedia.org
- https://www.youtube.com

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EME -452: Machine Drawing -II Lab **L T P 0 0 2**

Objective:

- To explain about the basics (IS codes for machine drawing, lines, scales, dimensioning and standard abbreviations) of engineering drawing.
- To explain about the basic of orthographic drawing (First angle projection, Third angle projection).
- To understand the concept of assembly drawing of various parts (Engine parts, stuffing box, Lathe head stock, connecting rod, screw jack, etc.)
- To give the knowledge of specifications of material.
- To give the knowledge of limits, fits and tolerances
- To explain about surface roughness their different symbols and drawing.
- To understand and apply national and international standards while drawing machine component.
- To explain about basic concept of production drawing.

List of experiments: **(16 Sessions)**

1. **Review:** Orthographic drawing
2. **Parts and assembly drawing:** Introduction, Assembly drawing of machine component like screw jack, stuffing box, lathe head stock, connecting rod, crankshaft, spark plug, tool post, safety valves, etc.
3. **Specification of material:** Designation of material and their representation.
4. **Limits, fits and tolerances:** Introduction, limit system, tolerance, fits, drawing and exercise.
5. **Surface roughness:** Introduction, surface roughness, machining symbols, indication of surface roughness, drawing and exercise.
6. **Production drawing:** Introduction to developing and reading of production drawing of simple machine elements like gears, flange, connecting rod, etc.

Course Outcome: On successful completion of the course, the student will be able to:

- Identify the national and international standards pertaining to machine drawing.
- Illustrate various machine components through drawings
- Student will get the concept of orthographic projection at the same time he will also be able to draw orthographic projections of isometric views.
- Student will be able to make assembly drawing of different mechanical components like as (Screw jack, connecting rod, stuffing box etc.).
- Student will learn to specify the material; he will also understand material different designation system.
- Student will learn about the limits, fits and tolerances system, he will also understand the meaning of different system
- Student will understand the different surface roughness symbol.
- Student will get the basic concept of production and at the same time he will be able to make the production rawing.

Suggested Readings:

- Engineering Graphics (K.C. John)
- Machine Drawing (N.D. Bhatt)
- Machine Drawing (P.S. Gill)
- Machine Drawing (Dr R K Dhawan)

Website Sources:

- https://d2t1xqejof9utc.cloudfront.net/files/16515/MachineDrawing.pdf?1354775841
- https://www.pdfdrive.com/machine-drawing-books.html
- https://easyengineering.net/machine-drawing-by-narayana/
- https://in.pinterest.com/pin/274367802285638925/
- https://www.researchgate.net/publication/313472842_Machine_Drawing

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EME 453: Materials Testing Lab **L T P 0 0 2**

Objective: The objective of this course is to familiarize the students with the physical, electrical, thermal and mechanical properties of materials by performing tests on different testing machines. Second objective is to make them understand various destructive and non-destructive testing methods and examining the properties of materials.

List of experiments (Part A): (Minimum 4 experiments are required to be performed) **(08 Sessions)**

1. Making a plastic mould for small metallic specimen.
2. Specimen preparation for micro structural examination - cutting, grinding, polishing and etching.
3. Grain size determination of a given specimen.
4. Comparative study of microstructures of different given specimen (mild steel, grey cast iron, brass, copper, etc.)
5. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
6. Material identification of, say, 50 common items kept in a box.
7. Faradays law of electrolysis experiment.
8. Study of corrosion and its effects.
9. Study of microstructure of welded component and HAZ. Macro and micro examination.
10. Suitable experiment on Magnetic/ Electrical/Electronic materials.

List of experiments (Part B): (Minimum 4 experiments are required to be performed) **(08 Sessions)**

1. Strength testing of a given mild steel specimen on UTM with full details and stress-strain plot on the machine.
2. Other tests such as shear bend test on UTM.
3. Impact testing on impact testing machine like Charpy, Izod or both.
4. Hardness testing of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index testing on spring testing machine.
6. Fatigue testing on fatigue testing machine.
7. Creep testing on creep testing machine.
8. Deflection of beam experiment, comparison of actual measurement of deflection with dial gauge with the calculated one and evaluation of young's modulus of beam.
9. Torsion testing of a rod on torsion testing machine.
10. Study of non-destructive testing methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant test.

Course Outcome: Students completing this course will be able to:

- Understand the physical properties of various materials by examining the colour, odor, density and surface finish.
- Understand the mechanical properties of materials by performing tests on Universal Testing Machine (UTM), Impact Testing Machine, Hardness Testing Machine, Creep Testing Machine, Fatigue Testing Machine and Spring Testing Machine.
- Understand the micro structure of different materials by examining them under microscope.
- Understand the basics of Non Destructive Testing methods.
- Understand the concept and importance of various heat treatment processes such as annealing, normalizing, quenching, case hardening, etc.

Suggested Readings:

- Gupta, N, 'Principles of Materials Science and Engineering', Dhanpat Rai & Co. Publications.
- Gupta, K M, 'Materials Science in Engineering', Umesh Publications.
- Rajput, R K, 'Material Science', Kataria Publications.

Website Sources:

- nptel.ac.in/course.html
- www.nsf.gov
- en.wikipedia.org
- www.sciencedirect.com
- www.slideshare.net
- www.researchgate.net

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EEE-455: ELECTRICAL MACHINES AND AUTOMATIC CONTROL LAB **L T P 0 0 2**

Objective:

- To analyze the working principle and performance index of DC machine.
- To expose the students toward the transformer working and performance evaluation.
- To expose the students to the speed control methods of DC machine and induction machine.
- To expose the students for the working of P, PI, PD & PID controllers for performance enhancement.
-

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. To obtain speed-torque characteristics and efficiency of a dc shunt motor by direct loading.
2. To obtain efficiency of a dc shunt machine by no load test.
3. To obtain speed control of dc shunt motor using (a) armature voltage control (b) field control.
4. To determine polarity and voltage ratio of single phase and three phase transformers.
5. To obtain efficiency and voltage regulation by performing O.C. and S.C. tests on a single phase transformer at full load and 0.8 p.f. loading.
6. To perform load test on a 3-phase induction motor and determine (i) speed- torque characteristics (ii) power factor v/s line current characteristics.
7. To study speed control of a 3-phase induction motor using (a) Voltage Control, (b) Constant (Voltage/ frequency) control.
8. To study D.C. speed control system on open loop and close loop.
9. To study of speed control of AC servo motor.
10. To study of performance of PID controller.

Course Outcome: After successfully studying this course, students will be able to:

- Explain the working of transformer and its performance characteristics.
- Understand the working of induction motor and different kinds of controllers.
- Speed controlling methods of servomotor.

Suggested Readings:

- J. Nagrath& D. P. Kothari, “Electrical machines” Tata McGraw Hill.
- .B.C. Kuo, “Automatic Control systems.” Wiley India Ltd.
- B.R. Gupta &Vandana Singhal, “Fundamentals of Electrical Machines”, New Age International.
- K. Ogata, “Modern Control Engineering” Prentice Hall of India.
- Irvin L. Kosow, “Electric Machinery and Transformers” Prentice Hall of India.

Website Sources:

- www.lecturenotes.in
- www.docsity.com
- www.electrical-engineering-portal.com
- www.springerprofessional.de

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STUDY AND EVALUATION SCHEME (Effective from 2018-19)
YEAR III, SEMESTER-V

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EME -501	Heat Transfer	3	1	0	20	10	30	70	100	4
2.	EME -502	Machine Design -I	3	1	0	20	10	30	70	100	4
3.	EME -503	Manufacturing Engineering - I	3	1	0	20	10	30	70	100	4
4.	EME -504	Fluid Machinery	3	1	0	20	10	30	70	100	4
5.	EME -507	I.C.Engines	3	1	0	20	10	30	70	100	4
6.	DEME - 1	Departmental Elective - 1	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
7.	EME -551	Heat Transfer Lab	0	0	2	20	10	30	70	100	1
8.	EME -552	Machine Design –I Lab	0	0	2	20	10	30	70	100	1
9.	EME -553	Manufacturing Engineering Lab	0	0	2	20	10	30	70	100	1
10.	EME -554	Fluid Machinery Lab	0	0	2	20	10	30	70	100	1
11.	GP-501	General Proficiency	-	-	-	-	-	100	-	100	1
		TOTAL	**18**	**06**	**08**	**-**	**-**	**-**	**-**	**1100**	**29**

Departmental Elective – I

1. EME – 011: Operations Research
2. EME – 012: Mechanical System Design
3. EME – 013: Tribology
4. **EME – 014: Advanced Welding Technology**
5. EME – 015: Reliability Engineering
6. EME – 016: Thermal Turbo Machines

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EME - 501: Heat Transfer **L T P 3 1 0**

Objective: This course is designed to introduce a basic study of the phenomena of heat transfer such as conduction convection and radiation, and to provide useful information concerning the performance and design of particular heat exchanger systems and processes. A knowledge-based design problem requiring the formulations of solid conduction and fluid convection and the technique of numerical computation progressively elucidated in different chapters will be assigned and studied in detail.

UNIT-1 **(10 Sessions)**

Introduction to Heat Transfer: Introduction and mechanisms of heat flows; Conduction (Fourier's law), convection and radiation; Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism

Conduction: One-dimensional general differential heat conduction equation in the rectangular, cylindrical and spherical coordinate systems; Initial boundary conditions.

Steady State one-dimensional Heat conduction: Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Thermal resistance concept; Analogy between heat and electricity flow; Thermal contact resistance; Critical thickness of insulation, concept of lagging.

UNIT-2 **(06 Sessions)**

Fins: Heat transfer from extended surfaces, Type of fins, Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells.

T**ransient Conduction:** Transient heat conduction; Lumped capacitance method; Time constant; unsteady state heat conduction in one dimension only, Heisler charts.

UNIT-3 **(10 Sessions)**

Forced Convection: Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Empirical heat transfer relations; Relation between fluid friction and heat transfer; Liquid metal heat transfer.

Natural Convection : Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere, Combined Natural and forced convection.

UNIT-4 **(07 Sessions)**

Heat Exchanger: Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) Effectiveness-NTU method; Compact heat exchangers.

Condensation and Boiling: Introduction to condensation phenomena; Heat transfer relations for laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases; Drop wise condensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convective boiling.

UNIT-5 **(07 Sessions)**

Thermal Radiation: Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wein's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray body; Shape factor; Black-body radiation; Radiation exchange between diffuse non-black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Greenhouse effect.

Course Outcome: Students completing this course will be able to:

- Understand the basic laws of heat transfer.
- Analyze problems involving steady state heat conduction in simple geometries.
- Understand the fundamentals of convective heat transfer process.
- Evaluate heat transfer coefficients for natural convection and forced convection inside ducts.
- Calculate radiation heat transfer between black body surfaces & heat exchange between gray body surfaces

Suggested Readings:

- Heat Transfer, by J.P. Holman, McGraw-Hill International edition.
- Principles of Heat Transfer by Frank Kreith, McGraw-Hill Book co.
- Fundamentals of Momentum, Heat and Mass Transfer by James R.Welty; John Wiley & Sons (Pvt). Ltd.
- Heat Transfer, by Vijay Gupta, New Age International (P) Ltd. Publishers

Website Sources:

- https://www.brighthubengineering.com/hvac/5231-what-is-heat-transfer/
- https://www.researchgate.net/profile/Md_Washim_Akram/post/Good_books_on_Fluid_mechanics_and_Heat_Transfer/attachment/5ab22ae44cde266d5892d50a/AS%3A606556357918729%401521625713296/download/heat-transfer-a-practical-approach-by-y-a-cengel.pdf
- https://scholars.unh.edu/day20/33/
- https://nptel.ac.in/courses/112/107/112107211/

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EME - 502: Machine Design-I **L T P 3 1 0**

Objective: To familiarize the students how to apply the concepts of stress analysis, Data book techniques in the analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.

UNIT 1 **(06 Sessions)**

(a). Introduction: Definition, Design requirement of machine component, Design procedure, Types of design, Standards in design, preferred numbers, Indian standards of designation of cast iron and different types of steel, Ergonomics in design, Aesthetic consideration in design.

(b). Material properties and selection for design: Stress strain diagram, Mechanical properties, cast iron, plain carbon steel, Alloy steels, Heat treatment process, Nonferrous metals and their alloys, Ceramics, Plastics, Nature and synthetic rubber, Creep, Selection of material.

UNIT 2 **(10 Sessions)**

(a)Design for static load: Types of failure, Factor of safety, Shear stress and shear strain, Stresses due to bending and torsion, Eccentric loading, Principal stresses, Theories of failure, selection and use of theories of failure, Design of simple machine component and lever.

(b) Design for fluctuating load: Stress concentration, stress concentration factor, Fluctuating stress, Fatigue failure, Endurance strength, Notch sensitivity, Endurance strength approximation, Fatigue design under combined stress, Use of Gerber equation, and Goodman and soderberg method.

UNIT 3 **(08 Sessions)**

(a) Power screws: Introduction, Forms of thread, Terminology of power screws, Torque requirement to raise and to lower the load, Efficiency of Screw, ACME Thread, Collar friction, Design of screw jack, Recirculation ball screws.

(b)Shaft, Keys and coupling: Introduction, Shaft design based on strength, Torsional rigidity, ASME code for design, Design of hollow shaft,

Keys: Introduction, Types, Designing

Coupling: Introduction, Requirement of coupling, Flexible and rigid coupling.

UNIT 4 **(08 Sessions)**

(a)Springs: Introduction, Types, Terminology, Material, End connection, Stress& deflection in springs, Design of helical spring for static and fluctuating load, Surge and Buckling of spring, Leaf springs, nipping of leaf springs, designing of leaf springs.

(b) Riveted joint: Introduction, Method of riveting, Materials, Types, Caulking and fullering, Failure of joint, Efficiency, Design of boiler joint.

UNIT 5 **(08 Sessions)**

(a) Welded joint: Introduction, Types, Strength, Axially loaded unsymmetrical welded joint, eccentric loading of welded joint, Welded joint subjected to bending and torsion.

(b) Cotter and Knuckle Joint: Introduction, Types of cotter joint, Socket and spigot cotter joint, Design of sleeve and cotter joint, Dimension of various parts of the knuckle joint. Methods of failure of knuckle joint. Design procedure of Knuckle joint.

Course Outcome:

- The students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of machine components.
- The students will demonstrate the ability to make proper assumptions, perform correct analysis while drawing upon various mechanical engineering subject areas.
- Specifically, the students will demonstrate the preceding abilities by performing correctly:
- The design, analysis and sizing of shafts, Keys and Coupling.
- Student will Learn how to design a power screw, rivet joint and welded joint.
- The selection, sizing and analysis of springs and other mechanical components/systems.
- Students will learn the use of data book.

Suggested Readings:

- Design of machine element (B.V.Bhandri)
- Machine Design (R.S.khurmi)
- Machine Design (Sharma &Agrawal)
- Machine Design (Sadhu Singh)
- Design Data Book (B V Bhandari)
- Design Data Book (Abdullaha Shareef)

Website Sources:

- https://www.machinedesign.com/
- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=125510
- https://www.autodesk.in/solutions/3d-mechanical-engineering
- https://onlinecourses.nptel.ac.in/

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EME-503: MANUFACTURING ENGINEERING-I **L T P 3 1 0**

Objective: The objective of this course is to familiarize the students about various basic Manufacturing processes used in industry for converting raw materials into finished products and the principles and science of various basic manufacturing processes.

UNIT-I **(08 Sessions)**
Introduction: Importance of manufacturing, Economic & technological considerations in manufacturing, Classification of manufacturing processes, Materials & manufacturing processes for common items, Metal Forming Processes: Elastic & plastic deformation, yield criteria, Hot working vs cold working, Analysis (equilibrium equation method) of forging process for load estimation with sliding friction sticking friction and mixed condition for slab and disc, Work required for forging, Hand, Power, Drop Forging.

UNIT-II **(08 Sessions)**
Metal Forming Processes (continued): Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application, Condition for Rolling force and power in rolling, Rolling mills & rolled-sections, Design, lubrication and defects in metal forming processes.

UNIT-III **(07 Sessions)**
Sheet Metal working: Presses and their classification Die & punch assembly and press work methods and processes, Cutting/Punching mechanism, Blanking vs Piercing, Compound vs Progressive die, Flat-face vs. Inclined-face punch and Load (capacity) needed, Analysis of forming process like cup/deep drawing, Bending & spring-back.

UNIT-IV **(09 Sessions)**
Unconventional Metal forming processes: Unconventional metal forming processes such as explosive forming, electromagnetic, electro-hydraulic forming, Powder Metallurgy: Powder metallurgy manufacturing process, The need, process, advantage and applications, Jigs & Fixtures: Locating & Clamping devices & principles, Jigs and Fixtures and its applications, Manufacturing of Plastic components: Review of plastics, and its past, present & future uses, Injection molding, Extrusion of plastic section, Welding of plastics, Future of plastic & its applications, Resins & Adhesives.

UNIT-V **(08 Sessions)**
Casting (Foundry): Basic principle & survey of casting processes, Types of patterns and allowances, Types and properties of moulding sand, Elements of mould and design considerations, Gating, Riser, Runners, Core, Solidification of casting, Sand casting, defects & remedies and inspection, Cupola furnace, Die Casting, Centrifugal casting, Investment casting, CO_2 casting and Stir casting etc.

Course Outcome: Students completing this course will be able:
- To acquire fundamental knowledge of very important manufacturing processes such as casting, joining and forming.
- To acquire knowledge about the various tools, equipment, machinery and operations required for these basic manufacturing processes.
- Understand the application, advantages and limitations of various manufacturing processes.
- To apply the knowledge in industries and organizations.

Suggested Readings:
- *Manufacturing Processes*, H.N. Gupta & R.C. Gupta, New Age International Publishers.
- *Manufacturing Processes*, R.S. Khurmi and J.K. Gupta, S. Chand Publishing.
- *Production Technology*, R.K. Jain, Khanna Publishers
- *Manufacturing Technology*, R. K. Rajput, Laxmi Publications PVT. LTD.
- *Manufacturing Engineering & Technology***,** Kalpakjian, Pearson Publications.

Website Sources:
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SCHOOL OF ENGINEERING & TECHNOLOGY
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IFTM UNIVERSITY, MORADABAD.

Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – III Year (V Semester)

EME 504: Fluid Machinery **L T P 3 1 0**

Objective: This course offers basic knowledge on fluid statics, dynamics and hydraulic machines. The objective of this course is to enable the student to understand laws of fluid mechanics and evaluate pressure, velocity and acceleration fields for various fluid flows and performance parameters for hydraulic machinery.

UNIT-I **(06 Sessions)**
Introduction: Classification of Fluid Mechanics, Application of momentum and momentum equation to flow through hydraulic machinery, Euler's fundamental equation.
Impact of jet: Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), effect of inclination of jet with the surface.

UNIT-II **(08 Sessions)**
Hydraulic Turbines: Classification of turbines, Impulse turbines, constructional details, velocity triangles, power and efficiency calculations, governing of Pelton wheel.
Reaction Turbines: Francis and Kaplan turbines, constructional details, velocity triangles, power and efficiency calculations, degree of reaction, draft tube, Cavitation's in turbines, principles of similarity, unit and specific speed, performance characteristics, selection of water turbines.

UNIT-III **(06 Sessions)**
Centrifugal Pumps: Classifications of centrifugal pumps, vector diagram, and work done by impellor, efficiencies of centrifugal pumps, specific speed, model testing, cavitation's and separation, performance characteristics.

UNIT-IV **(10 Sessions)**
Positive Displacement Pumps: Reciprocating pump theory, slip and coefficient of discharges, indicator diagram, effect and acceleration work saved by fitting air vessels, comparison of centrifugal and reciprocating pumps, positive rotary pumps, Gear and Vane pumps, performance characteristics.

UNIT-V **(10 Sessions)**
Other Machines: Hydraulic accumulator, Intensifier, Hydraulic press, Lift and Cranes, theory of hydraulic coupling and torque converters, performance characteristics.
Water Lifting Devices: Hydraulic ram, Jet pumps, Airlift pumps.

Course Outcome: The student will be able to:

- Identify importance of various fluid properties at rest and in transit.
- Derive and apply general governing equations for various fluid flows
- Understand the concept of boundary layer theory and flow separation.
- Plot velocity and pressure profiles for any given fluid flow.
- Evaluate the performance characteristics of hydraulic turbines and pumps

Suggested Readings:

- Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
- Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
- Applied Hydraulics by Addison
- Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
- Hydraulic Machines by D S Kumar

Website Sources:

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- http: // web.mit.edu / hml / ncfmf.html
- https://easyengineering.net/fluid-machinery-handwritten-study-materials/
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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – III Year (V Semester)

EME -507: I.C .Engines **L T P 3 1 0**

Objective: The objective of this course is to familiarize the students able to understand the operation of internal combustion engines. To perform theoretical calculations to obtain thermodynamic efficiencies and then assess operating losses. To calculate engine operating parameters. To understand the implications of a trade-off between performance, efficiency, emissions.

Unit-1 **(06 Sessions)**
Introduction to I.C Engines: Engine classification, Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles, Stirling cycle, Ericsson cycles, Atkinson cycle, Actual cycle analysis, Two and four stroke SI and CI engines, Valve timing diagram.
Fuels: Fuels for SI and CI engine , Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. **.**

Unit–2 **(06 Sessions)**
SI Engines:
Combustion in SI engine, Flame speed, Ignition delay, abnormal combustion and its control, combustion chamber design for SI engines. Carburetion, Mixture requirements, Carburettor types, Theory of carburettor, MPFI. Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition.

Unit–3 **(08 Sessions)**
CI Engine:
Combustion in CI engines, Ignition delay, Knock and its control, Combustion chamber design of CI engines. Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. Scavenging in 2 Stroke engines.

Unit-4 **(10 Sessions)**
Engine Cooling: Different cooling systems, Radiators, thermostat and cooling fans.
Lubrication: Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation.
Supercharging: Effect of altitude on power output, Types of supercharging, Turbo charging, Methods of Turbo charging.

Unit-5 **(10 Sessions)**
Compressors:
Classification, Reciprocating compressors, Single and Multi stage compressors, Intercooling, Volumetric efficiency. Rotary compressors, Classification, Centrifugal compressor, axial compressors, Surging, choking and stalling, Roots blower, Sliding vane compressor. .

Course Outcome: Students completing this Course will be able to:
- Students will demonstrate knowledge of the operating characteristics of common IC engines.
- Students will demonstrate the ability to perform a thermodynamic analysis of Otto, Diesel, and Dual cycle models.
- To teach students to analyse the combustion process of common fuels.

Suggested Readings:
- Fundamentals of Internal Combustion Engine by Gill, Smith,Ziurs, Oxford & IBH Publishing Co.
- IC Engines, by Rogowsky, International Book Co.
- A Course in International Combustion Engines, by Mathur & Sharma, Dhanpat Rai & Sons.
- I.C Engine Analysis & Practice by E.F Obert.
- I.C Engine, by Ganeshan, Tata Mc Graw Hill Publishers.
- I.C Engine, by R. Yadav, Central Publishing House, Allahabad
- Turbines, Compressors and Fans, by S.M.Yahya, Tata Mc Graw Hill Pub.

Website Sources:
- https://nptel.ac.in
- https://www.wikipedia.org
- https://www.youtube.com
- https://www.energy.gov
- https://energyeducation

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – III Year (V Semester)

DEPARTMENTAL ELECTIVE – I

EME–014: ADVANCED WELDING TECHNOLOGY L T P 3 1 0

Objective: The objective of this course is to familiarize the students with application, principle and working of various existing as well as advanced welding techniques and their selection in different environmental conditions.

Unit-I **(10 Sessions)**

Introduction: Survey of welding and allied processes, Importance and application of welding, classification of welding process, Selection of welding process.

Brief review of conventional welding process: Gas welding and cutting, Arc welding: Power Sources and Consumables, MIG and TIG welding, Atomic hydrogen, Electro slag and submerged arc welding, Resistance welding, Friction welding etc. Soldering & Brazing.

Unit-II **(06 Sessions)**

Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

Unit-III **(08 Sessions)**

Advanced welding Techniques (continued): Principle and working and application of advanced welding techniques such as explosive welding, Diffusion welding, Underwater welding, Metal surfacing: cladding, Hard facing, Spray-welding/Metalizing

Unit-IV **(08 Sessions)**

Weld Design: Welding machines/equipments and its characteristics and arc-stability, Weld defects and distortion and its remedies, Inspection/testing of welds, Weld Design, Welding of pipe-lines and pressure vessels.

Unit-V **(08 Sessions)**

Thermal and Metallurgical consideration: Thermal considerations for welding, temperature distribution, Heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure, Shrinkage/Residual stress in welds, Solidification of weld and properties

Course Outcome: Students completing this course will be able to:

- Define welding and its concepts.
- Describe the principle, working and application of advanced welding techniques.
- Determine/inspect and analyze the weld through various techniques.

Suggested Readings:

- Parmar R. S., Advanced welding Technology. Khanna Publisher.
- Yadav K. S., "Advanced welding Technology". Rajsons Publication Pvt. Ltd.
- Khanna O. P., A Text Book of Welding Technology. Dhanpat Rai Publications.
- Norrish J., Advanced Welding Processes. Woodhead Publishing Ltd. Cambridge, London.
- Rizvi S. A., Advanced Welding Technology. S. K. Kataria and Sons.
- Welding Hand Book

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- nptel.ac.in/course.html
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- en.wikipedia.org
- http://www.elcoweld.com/files/editor/downloads/elmi/AWP1
- www.slideshare.net
- https://www.elsevier.com/books/advanced-welding-processes
- www.researchgate.net
- https://lecturenotes.in/subject/1132/advanced-welding-technology-awt
- www.sanfoundry.com

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EME – 551: Heat Transfer Lab **L T P 0 0 2**

Objective: Define the fundamental concepts to students in the area of heat transfer and its applications and Recognize the practical significance of various parameters those are involved in different modes of heat transfer, also enable them to apply the knowledge of heat transfer in an effective manner for different applications.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Conduction - Composite wall experiment
2. Conduction - Composite cylinder experiment
3. Convection - Pool Boiling experiment
4. Convection - Experiment on heat transfer from tube-natural convection.
5. Convection - Heat Pipe experiment.
6. Convection - Heat transfer through fin-natural convection.
7. Convection - Heat transfer through tube/fin-forced convection.
8. Any experiment on radiation - Such as on Stefen's Law, determination of emissivity, etc.
9. Any experiment on radiation - Such as on solar collector, etc.
10. Heat exchanger - Parallel flow experiment.
11. Heat exchanger - Counter flow experiment
12. Any other suitable experiment such as on critical insulation thickness.
13. Conduction - Determination of thermal conductivity of fluids.
14. Conduction - Thermal Contact Resistance Effect.

Course Outcome: Students completing this course will be able to:

- Evaluate heat transfer through lagged pipe, Insulating powder and Drop and Film wise condensation.
- Experiment the Thermal conductivity of a given metal Rod.
- Measure the Heat transfer coefficient for Pin Fin, Forced convection, Natural Convection and parallel and counter flow heat exchanger and to Experiment on Transient heat conduction.
- Test Emissivity, Stefan Boltzmann Constant and Critical Heat flux.

Suggested Readings:

- Heat Transfer, by J.P. Holman, McGraw-Hill International edition.
- Principles of Heat Transfer by Frank Kreith, McGraw-Hill Book co.
- Fundamentals of Momentum, Heat and Mass Transfer by James R.Welty; John Wiley & Sons (Pvt). Ltd.
- Heat Transfer, by Vijay Gupta, New Age International (P) Ltd. Publishers

Website Sources:

- https://www.youtube.com/watch?v=x484U7M5L28
- https://www.youtube.com/watch?v=HbzUeBCmjNQ
- https://www.youtube.com/watch?v=EZ2aUI_f4l8
- https://www.youtube.com/watch?v=GmggAmO7pJg
- https://books.google.com/books/about/Heat_Transfer_Laboratory_Manual.html?id=BezANxDVK-0C

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EME - 552: Machine Design – I Lab **L T P 0 0 2**

Objective:

- To teach students how to apply the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.
- To illustrate to students the variety of mechanical components available and emphasize the need to continue learning
- To teach students how to apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.
- To teach students how to apply Data book techniques in the analysis, design and/or selection of machine components.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Design for static load
2. Design for fluctuating load
3. Design of riveted joint
4. Design of welded joint
5. Design of shaft
6. Design of coupling
7. Design of Keys
8. Design of screw jack
9. Design of springs

Course Outcome:

- The students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of machine components.
- The students will demonstrate the ability to make proper assumptions, perform correct analysis while drawing upon various mechanical engineering subject areas.
- Specifically, the students will demonstrate the preceding abilities by performing correctly:
  - The design, analysis and sizing of shafts, Keys and Coupling.
  - Student will Learn how to design a power screw, rivet joint and welded joint.
  - The selection, sizing and analysis of springs
  - The selection, sizing, design, and analysis of other mechanical components/systems
- Students will demonstrate the ability to seek and learn new material in addition to the class topics through the completion of an open-ended project. The amounts as well as the depth of new material identified and used by the students are measurable indicators of the students' performance.
- The breadth and depth of the issues taken into account by students are measurable indicators of their performance
- Students will learn the use of data book.

Suggested Readings:

- Design of machine element (B.V.Bhandri)
- Machine Design (R.S.khurmi)
- Machine Design (Sharma &Agrawal)
- Machine Design (Sadhu Singh)
- Design Data Book Sadhu Singh
- Design Data Book B V Bhandari
- Design Data Book Abdullaha Shareef

Website Sources:

- https://www.sciencedirect.com/topics/engineering/machinedesign#:~:text=Machine%20design%20focuses%20on%20the,basic%20mechanical%20parts%20of%20machines.
- https://www.machinedesign.com/
- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=125510
- https://www.autodesk.in/solutions/3d-mechanical-engineering
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EME-553: MANUFACTURING ENGINEERING LAB **L T P 0 0 2**

Objective: The objective of this course is to meet curriculum requirements and provide knowledge of different types of tools, instruments and machines and their applications in manufacturing to produce different metal components and articles and develop skills in the students.

List of experiments: (Minimum 10 experiments are required to be performed) **(20 Sessions)**

1. Design of pattern for a desired casting (containing hole).
2. Pattern making.
3. Making a mould (with core) and casting.
4. Injection molding with plastics.
5. Forging - hand forging processes.
6. Tube bending with the use of tube bending m/c.
7. Press work experiment such as blanking/piercing, washer making etc.
8. Gas welding experiment
9. Arc welding experiment
10. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
11. Bolt (thread) making on Lathe machine
12. Machining a block on shaper machine
13. Drilling holes on drilling machine and study of twist-drill.
14.. Finishing of a surface on surface-grinding machine.
15. Resistance welding experiment (Spot Welding).

Course Outcome: Students completing this course will be able:

- To acquire knowledge about the various tools, equipment, machinery and operations required for these basic manufacturing processes.
- To define and use different manufacturing process e.g. casting, forging, turning, drilling etc.
- To define and use different welding processes e.g. gas welding and electric arc welding.
- To acquire thorough knowledge of carrying out various operations in this lab.

Suggested Readings:

- *Manufacturing Process*, B.S Raghuvanshi, Dhanpat Rai Publication.
- *Manufacturing Processes*, R.S. Khurmi and J.K. Gupta, S. Chand Publishing.
- *Workshop/Manufacturing Practices*, Virender Narula, Bhavya Books.
- *Manufacturing Technology*, R. K. Rajput, Laxmi Publications Private Limited.

Website Sources:

- www.wikipedia.org
- www.brcmcet.edu.
- www.youtube.com
- www.slideshare.net

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B.Tech – III Year (V Semester)

EME-554: Fluid Machinery Lab **L T P 0 0 2**

Objective:

- To conduct experimentation for
- Calibration of flow measuring devices
- Determination of friction factor for pipes
- Determination of minor losses in pipes
- Verification of Bernoulli's theorem.
- Studying the performance of hydraulic turbines and pumps

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Impact of Jet experiment.
2. Turbine exp. on Pelton wheel.
3. Turbine exp. on Francis turbine.
4. Turbine exp. on Kaplan turbine.
5. Exp. on reciprocating pump.
6. Exp. on centrifugal pump.
7. Exp. on Hydraulic Jack/Press
8. Exp. on Hydraulic Brake
9. Exp. on Hydraulic Ram
10. Study through first visit of any pumping station/plant
11. Study through second visit of any pumping station/plant.

Course Outcome: The student will be able to:

- Calibrate flow measuring devices such as Venturimeter, orifice meter and v-notch
- Determine friction factor in pipes
- Determine minor losses in the pipes
- Verify Bernoulli's theorem.
- Understand the performance of hydraulic turbine and pumps under different working conditions

Suggested Readings:

- Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
- Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
- Applied Hydraulics by Addison
- Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
- Hydraulic Machines by D S Kumar

Website Sources:

- http: // nptel.ac.in / courses / 112105171/1 2.
- http: // web.mit.edu / hml / ncfmf.html
- https://easyengineering.net/fluid-machinery-handwritten-study-materials/
- http://www.crectirupati.com/sites/default/files/.pdf

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STUDY AND EVALUATION SCHEME (Effective from 2018-19)
YEAR III, SEMESTER-VI

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EME -601	Refrigeration & Air Conditioning	3	1	0	20	10	30	70	100	4
2.	EME -602	Machine Design -II	3	1	0	20	10	30	70	100	4
3.	EME -603	Dynamics of Machines	3	1	0	20	10	30	70	100	4
4.	EME -604	Manufacturing Engineering - II	3	1	0	20	10	30	70	100	4
5.	EME -605	Production Planning & Control	3	1	0	20	10	30	70	100	4
6.	EHU -601	Human values & Professional Ethics	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
7.	EME -651	Refrigeration & A.C. Lab	0	0	2	20	10	30	70	100	1
8.	EME -652	Machine Design – II Lab	0	0	2	20	10	30	70	100	1
9.	EME -653	Dynamics of Machine Lab	0	0	2	20	10	30	70	100	1
10.	EME -654	Seminar	0	0	2	-	100	100	-	100	1
11.	GP-601	General Proficiency	-	-	-	-	-	100	-	100	1
		TOTAL	**18**	**06**	**08**	**-**	**-**	**-**	**-**	**1100**	**29**

Note: ***Industrial Training of 3 – 4 Weeks after VI Semester which will be evaluated in VII Semester.***

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EME 601: Refrigeration and Air Conditioning **L T P 3 1 0**

Objective: The objective of this course is to familiarize the students with the fundamental principles and different methods of refrigeration and air conditioning. Study of various refrigeration cycles and evaluate performance using Mollier charts and refrigerant property tables. Comparative study of different refrigerants with respect to properties, applications and environmental issues. Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning. Study of the various equipment's operating principles and safety controls employed in refrigeration air conditioning systems.

Unit-1 **(08 Sessions)**
Refrigeration: Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P, working principle of Refrigerator.
Air Refrigeration cycle: Air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

Unit-2 **(08 Sessions)**
Vapor Compression System: Single stage system, Analysis of vapor compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapor on C.O.P of the cycle, Actual vapor compression refrigeration cycle, Multistage vapor compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.

Unit-3 **(08 Sessions)**
Vapor Absorption system: Working Principal of vapor absorption refrigeration system and its significance Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, Ammonia – Water vapor absorption system, Lithium- Bromide water vapor absorption system, Comparison.
Refrigerants: Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants.

Unit-4 **(08 Sessions)**
Air Conditioning: Introduction to air conditioning, Psychometric properties uses and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP).

Unit-5 **(08 Sessions)**
Refrigeration Equipment & Application: Elementary knowledge of refrigeration & air conditioning equipment's e.g. compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

Course Outcome: Students completing this course will be able to:
- Illustrate the fundamental principles and applications of refrigeration and air conditioning system.
- Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems.
- Present the properties, applications and environmental issues of different refrigerants.
- Calculate cooling load for air conditioning systems used for various applications.
- Operate and analyze the refrigeration and air conditioning systems.

Suggested Readings:

- Prasad, M. 'Refrigeration and Air conditioning', New Age International (P) Ltd. Publications.
- Arora, C P, 'Refrigeration and Air conditioning', McGraw Publications.
- Rajpur, R K, 'Refrigeration and Air conditioning', Katson Publications.
- Arora and Domkundwar, 'Refrigeration and Air conditioning', Dhanpat & Co. Publications.

Website Sources:
- nptel.ac.in/course.html
- www.nsf.gov
- en.wikipedia.org
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- www.slideshare.net
- www.researchgate.net

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EME - 602: Machine Design-II **L T P 3 1 0**

Objective:

- To teach students how to apply the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components like as gear, bearings and I.C. engine parts.
- To illustrate to students the variety of gears and bearings available and emphasize the need to continue learning
- To teach students how to design a gear, bearing and I.C. engine components.

UNIT-I **(12 Sessions)**

Spur gear: Mechanical drives, Gear drives, classification, selection, law of gearing, nomenclature of gear, gear System, Interference, backlash, force analysis, gear tooth failure, Beam strength of gear tooth, permissible Bending stress, Effective load on gear tooth, estimation of module, Wear strength of gear tooth, gear lubrication.

Helical gear: Introduction, nomenclature, virtual number of teeth, tooth proportions, force analysis, beam strength, Effective load, wear Strength, Herringbone gear.

UNIT-II **(08 Sessions)**

Bevel Gear: Introduction, nomenclature, force analysis, beam & wear strength, Effective load, spiral gear

Worm gear: Introduction, nomenclature, proportions, force analysis, friction, selection of material, strength rating, Wear rating, thermal considerations.

UNIT-III **(05 Sessions)**

Sliding contact bearing: Basics of lubrication, viscosity, petroffe equation, McKee investigation, Hydrostatic step bearing Energy losses, Reynolds equation, Raimondi Boyd method, Bearing design, material, lubricating oil, selection of lubricants, failure, comparison with rolling bearing.

UNIT-IV **(05 Sessions)**

Rolling contact bearing: Introduction, types, selection, static & dynamic load carrying rating, Stribecks equation, Load factor, Design of cyclic load and speed, needle. Bearing, bearing failure, lubrication, mounting.

UNIT-V **(10 Sessions)**

Design of I.C. Engine component: Cylinder, piston, connecting rod, crankshaft, valves, rocker arms.

Course Outcome:

- The students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of gears, bearings and I.C. Engine components.
- The students will demonstrate the ability to make proper assumptions, perform correct analysis while drawing upon various mechanical engineering subject areas.
- Specifically, the students will demonstrate the preceding abilities by performing correctly:
    - The design, analysis and sizing of spur gear, helical gear, bevel gear and worm and worm gear.
    - Student will learn how to design and select a bearing for different purpose.
    - The selection, sizing, design, and analysis of Internal Combustion Engine components (Cylinder, Piston, connecting rod and crank shaft)
- Students will demonstrate the ability to seek and learn new material in addition to the class topics through the completion of an open-ended project. The amounts as well as the depth of new material identified and used by the students are measurable indicators of the students' performance.
- The breadth and depth of the issues taken into account by students are measurable indicators of their performance
- Students will learn the use of data book.

Suggested Readings:

- Design of machine element (B.V.Bhandri)
- Machine Design (R.S.khurmi)
- Machine Design (Sharma &Agrawal)
- Machine Design (Sadhu Singh)
- Design Data Book (B V Bhandari)
- Design Data Book (Abdullaha Shareef)

Website Sources:

- https://www.sciencedirect.com/topics/engineering/machinedesign#:~:text=Machine%20design%20focuses%20on%20the,basic%20mechanical%20parts%20of%20machines.
- https://www.machinedesign.com/
- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=125510
- https://www.autodesk.in/solutions/3d-mechanical-engineering
- https://onlinecourses.nptel.ac.in/

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Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – III Year (VI Semester)

EME - 603: Dynamics of Machine **L T P 3 1 0**

Objective: The objective is to introduce some of the components mainly used in IC Engines and make analysis of various forces involved. Subject's deals with topics like inertia forces in slider crank mechanism; IC Engine components & the analysis like governors is introduced. It also deals with balancing of rotating & reciprocating parts. The study deals with linear, longitudinal, & torsional vibrations. The idea is to introduce the concept of natural frequency and the importance of resonance and critical speeds.

UNIT-I **(12 Sessions)**
Static & Dynamic Force Analysis Static equilibrium of two/three force members, Static equilibrium of member with two forces and torque, Static force analysis of linkages, D'Alembert's principle, Equivalent offset inertia force, Dynamic force analysis of four link mechanism and slider crank mechanism, Engine force analysis-Piston and crank effort.
Turning Moment & Flywheel Turning moment on crankshaft, Turning moment diagrams-single cylinder double acting steam engine, four stroke IC engine and multi-cylinder steam engine, Fluctuation of energy, Flywheel.

UNIT-II **(06 Sessions)**
Balancing of machines: Static and dynamic balancing, Balancing of several masses in the same plane and different planes, Balancing of reciprocating masses, Balancing of primary force in reciprocating engine, Partial balancing of two cylinder locomotives, Variation of tractive force, swaying couple, hammer blow.

UNIT-III **(10 Sessions)**
Friction: Laws of friction, Friction on inclined plane, Efficiency on inclined plane, Friction in journal bearing-friction circle, Pivots and collar friction-uniform pressure and uniform wear, Belt and pulley drive, Length of open and cross belt drive, Ratio of driving tensions for flat belt drive, centrifugal tension, condition for maximum power transmission, V belt drive.
Brakes and Dynamometers (Mechanical Type): Shoe brake, Band brake, Band and Block brake, Absorption and transmission type dynamometers

UNIT-IV **(06 Sessions)**
Governors: Terminology, Centrifugal governors-Watt governor, Dead weight governors-Porter & Proell governor, Spring controlled governor-Hartnell governor, Sensitivity, Stability, Hunting, Isochronism, Effort and Power of governor, Controlling force diagrams for Porter governor and Spring controlled governors.

UNIT – V **(06 Sessions)**
Gyroscopic Motion Principles, Gyroscopic torque, Effect of gyroscopic couple on the stability of aero planes & automobiles
Mechanical Vibrations Types of vibrations, Degrees of freedom, Single degree free & damped vibrations, Forced vibration of single degree system under harmonic excitation, Critical speeds of shaft.

Course Outcome: Students completing this course will be able to:

- Be proficient in the use of mathematical methods to analyze the forces and motion of complex systems of linkages, gears and cams.
- Be able to design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship.
- Be able to analyze the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams.

Suggested Readings:

- Theory of Machine: Thomas Bevan (ELBS/CBS pub. New Delhi)
- Theory of Machine: S.S.Ratan (TMH)
- Theory of Machine & Mechanism-Shiglay
- Theory of Machine- R.K.Bansal (Laxmi publication)

Website Sources:

- https://www.springer.com/gp/book/9783540899396
- https://www.youtube.com/watch?v=GYtQFPA4DNI
- https://www.coursera.org/lecture/dynamics/module-21-acceleration-of-a-wheel-rolling-on-a-fixed-plane-curve-xAqsp
- https://www.youtube.com/watch?v=UFBSYk3aOcI&list=PLzkMouYverAJopEC46Cj_BwtZBlK-Oaak

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EME-604: MANUFACTURING ENGINEERING-II **L T P 3 1 0**

Objective: The objective of this course is to familiarize the students with the theory of metal cutting and Identify the mechanism of metal cutting process and recognize the working principles of different machine tools and various operations performed to produce different products from raw materials.

Unit-I **(08 Sessions)**
Metal Cutting: Mechanics of metal cutting, Geometry of tool and nomenclature, ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required, Cutting fluids/lubricants, Tool materials, Tool wear and tool life, Machinability, Dynamometer, Brief introduction to machine tool vibration and surface finish, Economics of metal cutting.

Unit-II **(08 Sessions)**
Lathe Machine: Principle, construction, types, operations, Turret/capstan lathe, semi/Automatic
Shaper: Principle, construction, types, operations, slotter
Planer: Principle, construction, types, operations and drives

Unit-III **(08 Sessions)**
Milling Machine: Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required
Drilling Machine: Construction, types, operations of Drilling machine, Boring, Reaming Tools. Geometry of twist drills

Unit-IV **(08 Sessions)**
Grinding: Grinding wheel, Grinding wheel specification, Grinding wheel wear: attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria, Surface and cylindrical grinding, Center less grinding.
Super finishing: Honing, lapping, and polishing. Introduction to Limits, Fits, Tolerances, Limit-gauges and surface-roughness

Unit-V **(08 Sessions)**
Introduction to Un-conventional Machining Processes: Need & benefits, applications and working principle of Electro-discharge machining, Electro-chemical machining, Laser beam machining, Electron beam machining, Ultrasonic machining, Abrasive jet machining, Water jet machining.

Course Outcome: Students completing this course will be able:

- To understand how and why the properties of materials are controlled.
- To understand how and why the structure and composition of a material may be controlled by processing.
- To identify the positive and negative impacts of manufacturing on society.
- To apply the knowledge in industries and organizations.

Suggested Readings:

- *Manufacturing Process,* B.S Raghuvanshi, Dhanpat Rai Publication.
- *Manufacturing Processes,* R.S. Khurmi and J.K. Gupta, S. Chand Publishing.
- *Manufacturing* Technology *Vol. II (Metal Cutting),* Narula & Narula, McGraw Hill Education Private Limited.
- *Manufacturing Technology,* R. K. Rajput, Laxmi Publications PVT. LTD.
- *Workshop Technology Vol. II (Machine Tools),* B.S. Raghuwanshi, Dhanpat Rai & Co.

Website Sources:

- www.wikipedia.org
- www.sciencedaily.com
- www.youtube.com
- www.slideshare.net
- https://onlinecourses.nptel.ac.in

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EME – 605: Production Planning & Control **L T P 3 1 0**

Objective: The objective of this course is to understand the production planning and control function in both manufacturing and service organizations and ability to apply principles and techniques in the design, planning and control.

Unit-I **(10 Sessions)**
Introduction: Types and characteristics of production systems Objective and functions of Production, Planning & Control, Place of production, planning in Engineering, manufactures organization.
Preplanning: Forecasting & Market Analysis. Factory Location & Layout, Equipment policy and replacement. Preplanning production, capacity planning.

Unit-II **(08 Sessions)**
Production Planning: Aggregate Planning, MPS, Material Resource Planning, Selection of material methods, machines & manpower. Routing, Scheduling and Dispatching and its sheets & charts, Production Line Balancing.

Unit-III **(10 Sessions)**
Production and Inventory Control: Progress control through records and charts. Types of inventories, Inventory Classification. Inventory Control under constraints Economic lot (batch) size. Trends in purchasing and store keeping, JIT production MRP II, comparison of Push & Pull systems, ERP, CAPPC.

Unit-IV **(06 Sessions)**
Productivity: Importance, Productivity patterns, productivity measurements & ratios, improvement-maintenance process.

Unit-V **(06 Sessions)**
Human Factors & Ergonomics: Human abilities, Training & motivation safety programs, workplace design & working conditions.

Course Outcome: Students completing this course will be able:

- To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics etc.
- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- The knowledge of production planning and control methods currently in use by industrial companies.

Suggested Readings:

- Elements of Production Planning & Control –Eilon
- Production Planning & Control – Jain and Agarwal
- Operations Management – Buffa.
- Production System – J.L. Riggs.
- Production Planning & Control – Dr. R.K.Singal, S.K. Kataria & Sons Publication (Katson), New Delhi.

Website Sources:

- www.researchgate.net/journal/0953-7287_Production_Planning_and_Control
- https://new.siemens.com/global/en/markets/automotive-manufacturing/digital-twin-production.html
- www.tandfonline.com/toc/tppc20/11/5
- http://www.ddegjust.ac.in/2017/Uploads/11/POM-326.pdf
- www.slideshare.net/kshipra007/production-planning-control-72991897
- onlinecourses.nptel.ac.in
- www.editage.com/journal/production-planning-control

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EHU 601: Human Values & Professional Ethics **L T P 3 1 0**

Objective:
• To create an awareness on Engineering Ethics and Human Values.
• To understand social responsibility of an engineer.
• To appreciate ethical dilemma while discharging duties in professional life.

UNIT I **(06 Sessions)**
HUMAN VALUES: Morals, Values and Ethics – Integrity – Work Ethic – Service – Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing - Honesty – Courage –Valuing Time – Co-operation – Commitment - Empathy – Self-Confidence – Character - Spirituality.

UNIT II **(07 Sessions)**
ENGINEERING ETHICS: Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - Moral dilemmas - Moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - custom and religion - uses of ethical theories. Valuing Time – Co-operation – Commitment.

UNIT III **(05 Sessions)**
ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

UNIT IV **(11 Sessions)**
SAFETY, RESPONSIBILITIES AND RIGHTS: Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.
Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual Property rights (IPR) – Discrimination.

UNIT V **(11 Sessions)**
GLOBAL ISSUES: Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers and engineers as expert witness and advisors -moral leadership – Sample code of Ethics like ASME, ASCE, IEEE, IETE etc.

Course Outcome:
- It ensures students sustained happiness through identifying the essentials of human values and skills.
- It facilitates a correct understanding between profession and happiness
- It helps students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature.
- Ability to develop appropriate technologies and management patterns to create harmony in professional and personal life.

Suggested Readings:

- Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.
- Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
- 3.Jayshree Suresh and B.S.Raghavan, "Human values and Professional Ethics", S.Chand & Company Ltd., New Delhi.

Website Sources:
- https://examupdates.in/professional-ethics-and-human-values
- https://www.uptunotes.com/universal-human-values-and-professional-ethics
- https://lecturenotes.in/

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EME 651: Refrigeration and Air Conditioning Lab **L T P 0 0 2**

Objective: The objective of this course is to familiarize the students with the fundamental principles and different methods of refrigeration and air conditioning. Study of various refrigeration cycles and evaluate the performance. Comparative study of different refrigerants with respect to properties, applications and environmental issues. Study of the various equipment's, operating principles and safety controls employed in refrigeration air conditioning systems.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Experiment on refrigeration test rig and calculation of various performance parameters.
2. To study different types of expansion devices used in refrigeration system.
3. To study different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. To study air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant.
10. Visit of cold storage.

Course Outcome: Students completing this course will be able to:

- Understand different refrigeration cycles.
- Understand the functions of basic components of air conditioning systems.
- Understand the working of window air conditioner.
- Determine the volumetric efficiency of compressor.
- Understand the working of a central air conditioning plant.

Suggested Readings:

- Prasad, M. 'Refrigeration and Air conditioning', New Age International (P) Ltd. Publications.
- Arora, C P, 'Refrigeration and Air conditioning', McGraw Publications.
- Rajpur, R K, 'Refrigeration and Air conditioning', Katson Publications.
- Arora and Domkundwar, 'Refrigeration and Air conditioning', Dhanpat & Co. Publications.

Website Sources:

- nptel.ac.in/course.html
- www.nsf.gov
- en.wikipedia.org
- www.sciencedirect.com
- www.slideshare.net
- www.researchgate.net

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EME - 652: Machine Design – II Lab **L T P 0 0 2**

Objective:

- To teach students how to apply the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components like as gear, bearings and I.C. engine parts.
- To illustrate to students the variety of gears and bearings available and emphasize the need to continue learning
- To teach students how to design a gear, bearing and I.C. engine components.
- To teach students how to apply Data book techniques in the analysis, design and/or selection of machine components.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Design of spur gear
2. Design of helical gear
3. Design of bevel gear
4. Design of worm gear
5. Design of sliding bearing
6. Design of rolling bearing
7. Design of cylinder
8. Design of piston
9. Design of connecting rod
10. Design of crank shaft
11. Design of valves
12. Design of rocker arms.

Course Outcome:

- The students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of gears, bearings and I.C. Engine components.
- The students will demonstrate the ability to make proper assumptions, perform correct analysis while drawing upon various mechanical engineering subject areas.
- Specifically, the students will demonstrate the preceding abilities by performing correctly:
    - The design, analysis and sizing of spur gear, helical gear, bevel gear and worm and worm gear.
    - Student will learn how to design and select a bearing for different purpose.
    - The selection, sizing, design, and analysis of Internal Combustion Engine components (Cylinder, Piston, connecting rod and crank shaft)
- Students will demonstrate the ability to seek and learn new material in addition to the class topics through the completion of an open-ended project. The amounts as well as the depth of new material identified and used by the students are measurable indicators of the students' performance.
- The breadth and depth of the issues taken into account by students are measurable indicators of their performance
- Students will learn the use of data book.

Suggested Readings:

- Design of machine element (B.V.Bhandri)
- Machine Design (R.S.khurmi)
- Machine Design (Sharma &Agrawal)
- Machine Design Sadhu Singh
- Design Data Book Sadhu Singh
- Design Data Book B V Bhandari
- Design Data Book Abdullaha Shareef

Website Sources:

- https://www.sciencedirect.com/topics/engineering/machinedesign#:~:text=Machine%20design%20focuses%20on%20the,basic%20mechanical%20parts%20of%20machines.
- https://www.machinedesign.com/
- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=125510
- https://www.autodesk.in/solutions/3d-mechanical-engineering
- https://onlinecourses.nptel.ac.in/

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EME - 653: Dynamics of Machine Lab **L T P 0 0 2**

Objective: The objective of this lab is to impart practical knowledge on design and analysis of mechanisms in the machine tools and automobiles. The experiments related to their theory subjects like Engineering Mechanics, Machines and Mechanisms and Fundamentals of Vibration and Noise. Various equipment like governors, gyroscopes, balancing machines and universal vibration testing are done to understand machine dynamics. The vibration equipment is well established in dynamics lab. The vibration exciter, accelerometers (uni-axial and tri axial), data acquisition system, force hammer are used to measure the vibration response under induced and self-excitation conditions.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Study of simple linkers/models/mechanisms.
2. Exp. on Velocity acceleration.
3. Exp. on cam.
4. Exp. on Governor.
5. Exp. on critical speed of shaft (whirling of shaft)
6. Exp. on Gyroscope
7. Exp. on Balancing (static & dynamic)
8. Exp. on 4-bar mechanism
9. Exp. on Gears (tooth profile, interference etc.)
10. Exp. on Gear trains.
11. Exp. on Brakes
12. Exp. on clutch
13. Exp. on synthesis of planner linkages
14. Exp. on Mechanism
15. Exp. on Vibration (spring)
16. Exp. on Vibration (beam)
17. Exp. on Vibration (Torsional)
18. Exp. on Engine

Course Outcome: Students completing this course will be able to:

- To analyze the forces and motion of complex systems of linkages, gears and cams.
- Design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship.
- Analyze the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams.

Suggested Readings:

- Theory of Machine: Thomas Bevan (ELBS/CBS pub. New Delhi)
- Theory of Machine: S.S.Ratan (TMH)
- Theory of Machine & Mechanism-Shiglay
- Theory of Machine- R.K.Bansal (Laxmi publication)

Website Sources:

- https://www.slideshare.net/rajasekaranp/dom-lab-manual-new
- http://lab.fs.uni-lj.si/ladisk/?what=incfl&flnm=research.php
- https://www.youtube.com/watch?v=Ru_4Z22PrRA
- https://www.youtube.com/watch?v=exQt6FGYOvc
- https://lemonbin.com/types-of-brake-pads-and-brakes/
- https://www.youtube.com/watch?v=VdKqwZCWrdk

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STUDY AND EVALUATION SCHEME (Effective from 2018-19)
YEAR IV, SEMESTER-VII

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EME -701	Power Plant Engineering	3	1	0	20	10	30	70	100	4
2.	EME -702	Computer Aided Design	3	1	0	20	10	30	70	100	4
3.	EME -703	Computer Aided Manufacturing	3	1	0	20	10	30	70	100	4
4.	EME -704	Automobile Engineering	3	1	0	20	10	30	70	100	4
5.	EME -705	Unconventional Manufacturing Processes	3	1	0	20	10	30	70	100	4
6.	DEME-2	Departmental Elective - II	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
7.	EME -751	Industrial Training (Evaluation & Viva)	-	-	2	-	100	100	-	100	1
8.	EME -752	Computer Aided Design Lab	0	0	2	20	10	30	70	100	1
9.	EME -753	Computer Aided Manufacturing Lab	0	0	2	20	10	30	70	100	1
10.	EME -754	Automobile Engineering Lab	0	0	2	20	10	30	70	100	1
11.	GP-701	General Proficiency	-	-	-	-	-	100	-	100	1
		TOTAL	**18**	**06**	**08**	**-**	**-**	**-**	**-**	**1100**	**29**

Departmental Elective – II

1. **EME – 021: Total Quality Management**
2. EME – 022: Mechanical Vibrations
3. EME – 023: Optimization Techniques in Engineering
4. EME – 024: Management Information System

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EME - 701: Power Plant Engineering **L T P 3 1 0**

Objective: To introduce students to different aspects of power plant engineering & familiarize the students to the working of power plants based on different fuels. Also expose the students to the principles of safety and environmental issues.

Unit-I **(06 Sessions)**

Introduction: Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations. Economics of Power Generation: Terms and definitions, Types of loads, Principles of power plant design, location of power plant, layout of power plant building, cost analysis, selection of type of generation, selection of power plant equipment, economics in plant selection, factor affecting economics of generation and distribution of power, performance and operating characteristics of power plants, economic load sharing.

Unit-II **(12 Sessions)**

Steam power plant: General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, condenser and cooling towers and cooling ponds. Operation and maintenance of steam power plant. Site selection of a steam power plant.
Water Treatment: Impurities in water and methods to resolve it, Working of DM Plant and its component.

Unit-III **(10 Sessions)**

Diesel power plant: General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, supercharging system, exhaust system. Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant.
Gas turbine power plant: Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, Site selection of gas turbine power plant.

Unit-IV **(06 Sessions)**

Nuclear power plant: Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, nuclear waste disposal, Site selection of nuclear power plants. Hydroelectric station Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, operation and maintenance, hydro systems.

Unit-V **(06 Sessions)**

Electrical system: Generators and generator cooling, transformers and their cooling, bus bar, etc.
Instrumentation: Purpose, classification, selection and application, recorders and their use, listing of various control rooms.
Pollution: Pollution due to power generation.

Course Outcome: Students completing this course will be able to:

- Describe and analyze different types of sources and various terms and factors involved with power plant operation.
- Analyze the working and layout of steam power plants and the different systems comprising the plant and economic and safety impacts.
- Combine concepts of previously learnt courses to define the working principle of diesel power plant, its layout, safety principles. Describe the working principle and basic components of the nuclear power plant and the economic and safety principles involved.
- Discuss and analyze the mathematical and working principles of different electrical equipment's involved in the generation of power.

Suggested Readings:

- "Power Plant Engineering" F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras.
- "Power Plant Engineering" Mahesh Verma, Metropolitan Book Company Pvt. Ltd. New Delhi.
- "Power Plant Technology" El-Vakil, McGraw Hill.
- Power Plant Engineering by P.K. Nag, Tata McGraw Hill.

Website Sources:

- http://www.syriadirect.org/power_plant_engineering_book.pdf
- https://nptel.ac.in/courses/112/107/112107291/
- https://www.youtube.com/watch?v=hZ66Xgr8ULE
- https://www.youtube.com/watch?v=1dLYszAypJw

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EME - 702: Computer Aided Design **L T P 3 1 0**

OJBECTIVE: The objective of the Computer-Aided Design Project is to evolve a man- machine system which will permit the human designer and the computer to work together on creative design problems. This document states the philosophy of approach being used by the computer applications group of the project.

UNIT-I **(10 Sessions)**

Introduction: Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications.

Computer Graphics-I: CAD/CAM systems, Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devices-Cathode Ray Tube, Random & Raster scan display, Colour CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters.

UNIT-II **(08 Sessions)**

Computer Graphics-II: Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm.

Geometric Transformations: World/device Coordinate Representation, Windowing and clipping, 2 D Geometric transformations-Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3 D transformations, multiple transformation.

UNIT-III **(06 Sessions)**

Curves: Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties, Periodic and non-periodic B-spline curves.

UNIT-IV **(08 Sessions)**

3D Graphics: Polygon surfaces-Polygon mesh representations, Quadric and Super quadric surfaces and blobby objects; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, Boundary representation, Constructive solid geometry, Sweep representation, Color models. Application commands for AutoCAD &ProE software.

UNIT-V **(08 Sessions)**

Numerical Methods: Introduction, Errors in numbers, Binary representation of numbers, Root finding- Bisection method, Newton Raphson method, Curve fitting-Least square method, Numerical differentiation-Newton's interpolation, Numerical Integration-Trapezoidal and Simpson method.

Finite Element Method: Introduction, Principles of Finite elements modeling, Stiffness matrix/displacement matrix, Stiffness matrix for spring system, bar & beam elements, bar elements in 2D space (truss element).

Course Outcome: Students completing this course will be able to:

- Ability to use, identify and explain standard features in solid modeling including protrusions, revolutions, and patterns
- Ability to use standard software tools to create engineering drawings, or other documents, to fully describe the geometries and dimensions of parts, as well as to document assemblies according to standard practice
- Ability to use standard software tools to create part assemblies and check for clearances.
- Ability to create the drawings of farm implements and their analysis.

Suggested Readings:

- Computer Graphics by Hearn & Baker (Pearson / Prentice hall)
- Computer Aided Design by R.K.Srivastava.
- CAD/CAM Theory and Practice – Ibrahim Zeid (McGraw Hill International)
- Computer Aided Analysis & Design of Machine Elements (Rao&Dukkipati)
- Computer Oriented Numerical Methods – Rajaraman (Prentice Hall)
- FEM – SS. Rao.
- Grover Mikell P. 2003. Automation, Production Systems and Computer Integrated Manufacturing. Prentice-Hall of India.
- Radhakrishnan P, Subramanyan S &Raju V. 2003. CAD/CAM/CIM. New Age International.
- Rao PN. 2002. CAD/CAM Principles and Applications. Tata McGraw Hill.

Website Sources:

- Computer-aided Drawing and Design
- Authors: Davies
- https://www.slideshare.net/search/slideshow
- https://www.researchgate.net
- https://www.youtube.com/watch?v=QuR-VKis3jU
- https://www.youtube.com/watch?v=WROFrYJ5rGs
- https://www.youtube.com/watch?v=PihEGns8USc

SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
IFTM UNIVERSITY, MORADABAD.

Bachelor of Technology (B.Tech) Mechanical Engineering
B.Tech – IV Year (VII Semester)

EME - 703: Computer Aided Manufacturing **L T P 3 1 0**

OBJECTIVE: To acquaint and equip with the computer aided manufacturing of farm machinery with the help of CAM.
Its primary purpose is to create a faster production process and components and tooling with more precise dimensions and material consistency, which in some cases, uses only the required amount of raw material (thus minimizing waste), while simultaneously reducing energy consumption.

UNIT-I **(08 Sessions)**
Automation: Introduction to CAM; Automated Manufacturing system; Need of automation, Basic elements of automation, Levels of automation, Automation Strategies, Advantages & disadvantages of automation, Historical development and future trends.
Features of NC Machines: Fundamental of Numerical Control, elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system, Methods for improving Accuracy considering the factors such as tool deflection and chatter and Productivity.

UNIT-II **(08 Sessions)**
Control of NC Systems: Open and closed loops. Control of point to point systems- Incremental open loop control, Incremental close loop, Absolute close loop; Control loop in contouring systems; Adaptive control.
NC Part Programming-: (a) Manual (word address format) programming. Examples Drilling, Turning and Milling; canned cycles, Subroutine, and Macro.
(b) APT programming. Geometry, Motion and Additional statements, Macro- statement.

UNIT-III **(10 Sessions)**
System Devices: Introduction to DC motors, stepping motors, feedback devices such as encoder, counting devices, digital to analog converter and vice versa.
Interpolators: Digital differential Integrator-Principle of operation, exponential decelarion; DDA Hardware Interpolator- Linear, Circular; DDA Software Interpolator.

UNIT-IV **(06 Sessions)**
Computer Integrated manufacturing system: Group Technology, Flexible Manufacturing System, CIM, CAD/CAM, Computer aided process planning-Retrieval and Generative, Concept of Mechatronics, Computer aided Inspection.

UNIT-V **(08 Sessions)**
Robotics: Types and generations of Robots, Structure and operation of Robot, Robot applications. Economics, Robot programming methods, VAL and AML with examples.
Intelligent Manufacturing: Introduction to Artificial Intelligence for Intelligent manufacturing.

Course Outcome: Students completing this course will be able to:

- Ability to create fully constrained solid models that can be quickly modified using standard software tools.
- Ability to use standard software tools to create part assemblies and check for clearances.
- Ability to create the drawings of farm implements and their analysis.
- Ability to write the CNC part programming

Suggested Readings:

- Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover
- Computer Aided Manufacturing by Kundra and Rao
- 3. Computer control of manufacturing systems by Koren
- NC Machine Tools by S.J. Martin.
- NC Machines by Koren
- CAD/CAM by Groover.

Website Sources:

- https://www.youtube.com/watch?v=vO1lc75jtiM
- https://www.youtube.com/watch?v=00TqO1pBEro
- https://www.youtube.com/watch?v=7od3g2Su5RM
- https://www.slideshare.net/AjaySingh718/cad-cam-61993043

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Bachelor of Technology (B.Tech) Mechanical Engineering
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EME - 704: Automobile Engineering **L T P 3 1 0**

OBJECTIVE: Automobile engineering is a branch study of engineering which teaches manufacturing, designing, mechanical mechanisms as well as operations of automobiles. It is an introduction to vehicle engineering which deals with motorcycles, cars, buses, trucks, etc. It includes branch study of mechanical, electronic, software and safety elements. Some of the engineering attributes and disciplines that are of importance to the automotive engineer and many of the other aspects are included in it:

Unit-I **(08 Sessions)**
Introduction to Automobile:
Definition, Classification and application, Components of an automobile Rolling, air and gradient resistance. Tractive effort.
Power Unit and Gear Box:
Principles of Design of main components. Valve mechanism. Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box, Gear ratio determination. Design of Gear box.

Unit-II **(06 Sessions)**
Transmission System:
Requirements, Clutches, Torque converters, Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle, Automatic transmission, **Steering system:** Steering and Front Axle.Castor Angle, wheel camber & Toe-in,Toe-out etc, Steering geometry. Ackerman mechanism, under steer and over steer.

Unit-III **(08 Sessions)**
Braking System:
General requirements, Road, tyre adhesion, weight transfer, braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects.
Chasis and Suspension System:
Loads on the frame. Strength and stiffness, various suspension systems.

Unit-IV **(08 Sessions)**
Electrical System:
Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Battery etc.
Fuel Supply System:
Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburetor etc. MPFI.

Unit-V **(10 Sessions)**
Automobile Air Conditioning:
Requirements, Cooling & heating systems
Cooling & Lubrication System:
Different type of cooling system and lubrication system
Maintenance system:
Preventive maintenance, break down maintenance and over hauling.

Course Outcome: Students completing this course will be able to:

- To compare and select the proper automobile system for the vehicle
- To analyses the performance of the vehicle
- To diagnose the faults of auto mobile vehicle
- To apply knowledge of EVs, HEVs and solar vehicles

Suggested Readings:

- Automotive Engineering- Hietner
- Automobile Engineering - Kripal Singh.
- Automobile Engineering - Narang.
- Automotive Mechanics- Crouse
- Automobile Engineering - Newton and Steeds.

Website Sources:

- https://www.slideshare.net
- https://www.slideshare.net/search/slideshow
- https://www.slideshare.net/divyansh395/automobile-engineering-kirpal-singh-vol-1
- https://www.youtube.com/watch?v=EROmKPAd4Wk
- https://www.youtube.com/watch?v=2JLxRf2cLG0&list=PLOG9l_LGgDfJfqk64KQCznBlE7GU3oKak
- Auto mobile engineering Kirpal Singh Vol 1
- http://kobobooks:com

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EME - 705: UNCONVENTIONAL MANUFACTURING PROCESSES L T P 3 1 0

Objective: The objective of this course is to familiarize the students with the principle, working and applications of unconventional machining, welding and forming processes and develop their skills, conceptual abilities and substantive knowledge in the aforesaid field.

Unit-I (07 Sessions)
Introduction: Limitations of conventional manufacturing processes, need of unconventional manufacturing processes & its classification and its future possibilities.

Unit-II (09 Sessions)
Unconventional Machining Process: Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machining etc.

Unit-III (09 Sessions)
Unconventional Machining Process (continued): Principle and working and application of unconventional machining processes such as Laser beam machining,
Electron beam machining, Ultrasonic machining etc. (these can also be used for welding).

Unit-IV (07 Sessions)
Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metalizing, Plasma are welding/cutting etc.

Unit-V (08 Sessions)
Unconventional Forming processes: 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: Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing.

Course Outcome: Students completing this course will be able to:
- Differentiate between conventional and unconventional machining, welding and forming processes.
- Understand the principle, working and applications of unconventional machining, welding and forming processes.
- Use unconventional techniques effectively to produce quality product.

Suggested Readings:

- Pandey P. C. Modern Machining Processes. McGraw Hills, 2013.
- Jain V. K. Unconventional Machining Processes. Katson Publication. 2011
- Jain R. Unconventional Manufacturing Processes. S. K. Kataria & Sons. 2009
- Adithan M. Unconventional Machining Processes. Atlantic Publishers & Distributors Pvt Ltd.
- Kumar N. S. Unconventional Machining Processes. ARS Publications, 2014.

Website sources:
- onlinecourses.nptel.ac.in
- https://easyengineering.net/advanced-machining-processes-by-jain/
- en.wikipedia.org
- https://www.scribd.com/document/128348651/Unit-4-Unconventional-Manufacturing-Process
- https://www.osti.gov/servlets/purl/4553660/
- https://www.researchgate.net/publication/293183705_Welding_Processes_Handbook_Second_Edition

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DEPARTMENTAL ELECTIVE – II

EME - 021: TOTAL QUALITY MANAGEMENT L T P 3 1 0

Objective: The objective of this course is to familiarize the students with the concept of Total Quality Management and its design structure and develop their skills, conceptual abilities and substantive knowledge in the aforesaid field.

Unit-I **(08 Sessions)**

Quality Concepts
Evolution of Quality control, concept change, TQM Modern concept, Quality Circle, Quality concept in design, Review off design, Evolution of proto type, TQM implementation.

Control on Purchased Product
Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality
Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

Unit-II **(08 Sessions)**

Quality Management
Quality Gurus, Quality function, Organization structure and design, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

Human Factor in Quality
Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

Unit-III **(09 Sessions)**

Control Charts
Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts
Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

Unit-IV **(08 Sessions)**

Defects Diagnosis and Prevention
Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects.

Unit-V **(07 Sessions)**

IS0-9000 and its concept of Quality Management:
ISO 9000 series, Taguchi method, Quality awards, JIT in some details.

Course Outcome: Students completing this course will be able to:

- Differentiate between quality management and total quality management.
- Apply concept in developing quality product.
- Develop better relation between producer and consumer by gaining customer satisfaction.
- Use control charts effectively to minimize losses.

Suggested Readings:

- Lt. Gen. H.LaI, "Total Quality Management", Wiley Eastern Limited, 1990. .
- Greg Bounds. “Beyond Total Quality Management”.McGraw Hill, 1994.
- Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992
- Kumar S., “Total Quality Management”, Laxmi Publications (P) Ltd. 2007.
- Evans J. R. and Lindsay W. M., “The Management and Control of Quality” South Western College Pub. 2005.
- Kiran D. R. Total Quality Management. Butterworth Heinemann publications. ISBN 978-0-12811035-5
- Pandian S. M. V. A Key Concept of Total Quality Management. Notion Press Media Pvt Ltd. ISBN: 9781648994777, 2020.

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- www.researchgate.net
- www.academia.edu
- en.wikipedia.org
- www.ddegjust.ac.in
- www.sciencedirect.com
- www.sanfoundry.com

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EME - 752: Computer Aided Design (CAD) Lab **L T P 0 0 2**

Objective: The objective of this lab is to impart practical knowledge on design and mainly used for detailed engineering of 3D models or 2D drawings of physical components, but it is also used throughout the engineering process from conceptual design and layout of products, through strength and dynamic analysis of assemblies to definition of manufacturing methods of components. CAD allows for the easier development of products and product management integration. It also allows for greater modeling and even provides a basis for virtual networking! In the engineering world, CAD is extremely important and widely used to design and develop products to be used by consumers.

List of experiments: (Minimum 8 experiments are required to be performed) **(16 Sessions)**

1. Line drawing or Circle drawing algorithm experiment: writing the program and running it on computer.
2. Transformations algorithm experiment for translation/rotation/scaling: writing program and running it on computer.
3. Design problem experiment: writing the program for design of machine element or other system and running it on computer.
4. Optimization problem experiment: writing a program for optimizing a function and running it on computer.
5. Auto CAD experiment: understanding and use of 2 –D Auto CAD commands.
6. Auto CAD experiment: understanding and use of 3 –D Auto CAD commands.
7. Writing a small program for FEM for 2 spring system and running it or using a FEM package.
8. Use of sketch on Pro/E.
9. Use of Surface on Pro/E.

Course Outcome: Students completing this course will be able to:

- Be able to create a detailed drawing.
- Be able to assemble a manufacturing environment.
- Be able to create basic NC sequences necessary for material removal.
- Be able to use a commercial CAD software package as an engineering tool
- Analyze technical drawings using both CAD and basic manual tools.
- Apply the stages of the design process from scratch using engineering graphics techniques such as sectional projections, dimensioning and computer-generated drawings (2D).

Suggested Readings:

- Computer Graphics by Hearn & Baker (Pearson / Prentice hall)
- Computer Aided Design by R.K.Srivastava.
- CAD/CAM Theory and Practice – Ibrahim Zeid (McGraw Hill International)
- Computer Aided Analysis & Design of Machine Elements (Rao&Dukkipati)
- Computer Oriented Numerical Methods – Rajaraman (Prentice Hall)
- FEM – SS. Rao.
- Grover Mikell P. 2003. Automation, Production Systems and Computer Integrated Manufacturing. Prentice-Hall of India.
- Radhakrishnan P, Subramanyan S &Raju V. 2003. CAD/CAM/CIM. New Age International.
- Rao PN. 2002. CAD/CAM Principles and Applications. Tata McGraw Hill.

Website Sources:

- https://www.slideshare.net/search/slideshow
- https://www.researchgate.net
- https://www.youtube.com/watch?v=QuR-VKis3jU
- https://www.youtube.com/watch?v=WROFrYJ5rGs
- https://www.youtube.com/watch?v=PihEGns8USc

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EME - 753: Computer Aided Manufacturing (CAM) Lab **L T P 0 0 2**

Objective: The objective of the lab is to develop the designs of various mechanical components using 2D and 3D Software. This lab is available to graduate the students in the fields of Computer Aided Design and Computer Aided Manufacturing. The basic knowledge can be used for successful accomplishment of project works.

List of experiments: (Minimum 6 experiments are required to be performed) **(12 Sessions)**

1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine.
3. Experiment on Robots and it programs.
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motors and feedback devices.
7. Study of Robot structure.
8. Writing a part-programming (in word address format or in APT) for turning operation.
9. Experiment on Mechatronics and controls.

Course Outcome: Students completing this course will be able to:

- Understand the environmental impact of the investigation.
- Work individually and in a team for conducting the experiments.
- Be able to create a detailed drawing.
- Be able to assemble a manufacturing environment.
- Be able to create basic NC sequences necessary for material removal.
- Use modern tools for measurements/modeling and simulation/draw the graphs etc.
- Effectively communicate and explain the experimental analysis.

Suggested Readings:

- Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover
- Computer Aided Manufacturing by Kundra and Rao
- 3. Computer control of manufacturing systems by Koren
- NC Machine Tools by S.J. Martin.
- NC Machines by Koren
- CAD/CAM by Groover.

Website Sources:

- https://www.youtube.com/watch?v=vO1lc75jtiM
- https://www.youtube.com/watch?v=00TqO1pBEro
- https://www.youtube.com/watch?v=7od3g2Su5RM
- https://www.slideshare.net/AjaySingh718/cad-cam-61993043

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B.Tech – IV Year (VII Semester)

EME - 754: Automobile Engineering Lab **L T P 0 0 2**

Objective: Use core competence acquired in various areas of Mechanical Engineering to solve techno-managerial issues for creating innovative products that lead to better livelihoods & economy of resources, to establish themselves as effective collaborators and innovators to address technical, managerial and social challenges, to equip students for their professional development through lifelong learning and career advancement along with organizational growth. Serve as a driving force for proactive change in industry, society and nation.

List of experiments: (Minimum 6 experiments are required to be performed) **(12 Sessions)**

1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine.
3. Experiment on Robots and it programs.
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motors and feedback devices.
7. Study of Robot structure.
8. Writing a part-programming (in word address format or in APT) for turning operation.
9. Experiment on Mechatronics and controls.

Course Outcome: Students completing this course will be able to:

- Understand the environmental impact of the investigation.
- Work individually and in a team for conducting the experiments.
- An ability to work professionally in mechanical systems including design, analysis, production, measurement and quality control.
- An ability to work on diverse disciplinary tasks including manufacturing, materials, thermal, automobile, robotics, Mechatronics, engineering software tools, automation and computational fluid dynamics.
- To enable students for higher studies and competitive examinations.
- To facilitate students and industry professionals for continuous improvement and innovation.

Suggested Readings:

- Automotive Engineering- Hietner
- Automobile Engineering - Kripal Singh.
- Automobile Engineering - Narang.
- Automotive Mechanics- Crouse
- Automobile Engineering - Newton and Steeds.

Website Sources:

- https://sites.google.com/view/autoleengineeringbyrbgupta
- https://www.springer.com/journal/12239
- https://www.youtube.com/watch?v=sYnd6fI-ugo
- https://www.youtube.com/watch?v=SHl0TdnbP1Y
- https://www.slideshare.net/palsons/automobile-engineering-ppt-76816480

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STUDY AND EVALUATION SCHEME (Effective from 2018-19)
YEAR IV, SEMESTER-VIII

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	EME - 801	Maintenance Engineering & Management	3	1	0	20	10	30	70	100	4
2.	EME - 802	Non-Conventional Energy Resources	3	1	0	20	10	30	70	100	4
2.	EHU - 801	Industrial Management	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
3.	EME – 851	Project	0	0	20	-	300	300	400	700	10
4.	GP-801	General Proficiency	-	-	-	-	-	100	-	100	1
		TOTAL	**09**	**03**	**20**	**-**	**-**	**-**	**-**	**1100**	**23**

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EME - 801: MAINTENANCE ENGINEERING & MANAGEMENT L T P 3 1 0

Objective: The objective of this course is to familiarize the students with the maintenance strategies and their management and develop their skills, conceptual abilities and substantive knowledge in the aforesaid field.

Unit-I **(08 Sessions)**
Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models, elements in series, parallel, mix, logic diagrams, improving reliability, redundancy-element, unit, standby, maintainability, availability, reliability and maintainability trade off.

Unit-II **(08 Sessions)**
Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency.

Unit-III **(08 Sessions)**
Condition Based Maintenance: Principles of CBM, Pillars of condition Monitoring, CBM implementation and benefits, condition monitoring techniques – visual monitoring, vibration monitoring, wear debris monitoring, corrosion monitoring, performance monitoring, Replacement planning maintain or replace decision,

Unit-IV **(08 Sessions)**
Maintenance Planning and scheduling, GANTT chart, PERT, CPM and CPA networks, Advantage and Disadvantage of PERT/CPM, Computerized maintenance management system(CMMS), component features of CMMS, Future of CMMS.

Unit-V **(08 Sessions)**
Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management.

Course Outcome: Students completing this course will be able to:

- Understand and select the proper maintenance technique according to the size of organization.
- Apply cost reduction technique keeping in view the economic as well as human aspect.
- Develop better relation between producer and consumer by gaining customer satisfaction.
- Make use of allotted maintenance budget in best possible manner.

Suggested Readings:

- Mishra R. C. & Pathak K. Maintenance Engineering & Management. Prentice Hall India Learning Private Limited, 2012.
- Venkataraman V. Maintenance Engineering & Management. 2007
- Chandra S. Maintenance Engineering & Management. S. K. Kataria & sons.
- Srivastava S. K. 2011. Maintenance Engineering. S. Chand and Company Ltd., ISBN: 81-219-2644-0
- .Nauhria R. N. & Prakash R. Management of systems. 2013
- Niebel B. W. Engineering Maintenance Management. CRC Press, 1994
- Wagner D. H. Operations Research. John Wiley and Sons. 2014

Website sources:

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- https://en.wikipedia.org/wiki/Maintenance_engineering en.wikipedia.org
- www.sciencedirect.com
- https://www.wiley.com/en-us/Introduction+to+Maintenance+Engineering
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EME–802 / EOE-081: Non–Conventional Energy Resources **L T P 3 1 0**

Objective: To understand the various forms of conventional energy resources, also study the present energy scenario and the need for energy conservation. Grab the concept of various forms of renewable energy. To learn Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. To analyze the environmental aspects of renewable energy resources.

UNIT-I **(08 Sessions)**
Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.
Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II **(08 Sessions)**
Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT-III **(08 Sessions)**
Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.
Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations.
Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV **(08 Sessions)**
Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations.
Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

UNIT-V **(08 Sessions)**
Bio-mass: Availability of bio-mass and its conversion theory.
Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations.
Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Course Outcome: Students completing this course will be able to:

- Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
- Know the need of renewable energy resources, historical and latest developments.
- Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.
- Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
- Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
- Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.

Suggested Readings:

- Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
- John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
- M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
- D.S. Chauhan,"Non-conventional Energy Resources" New Age International.

Website Sources:

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- https://nptel.ac.in/courses/121/106/121106014/
- https://www.nationalgeographic.com/environment/energy/reference/renewable-energy/
- http://quiznext.in/study-material/learning_material/CBSE-10-Physics/Sources-of-Energy/alternative-or-non-conventional-sources-of-energy/

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EHU-701 / 801: INDUSTRIAL MANAGEMENT **L T P 3 1 0**

Objective: The objective of this course is to familiarize the students to gain insight about managerial techniques through various assessment tools/models to control and enhance the productivity of the work environment.

Unit-I **(10 Sessions)**
Introduction: Concept, Development, application and scope of Industrial Management.
Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Unit-II **(08 Sessions)**
Management Function: Principles of Management- Management Tools – time and motion study, work simplification- process charts and flow diagrams, Production Planning, Specification of Production requirements.

Unit-III **(08 Sessions)**
Inventory control: Inventory, cost, Deterministic models, Introduction to supply chain management.

Unit-IV **(07 Sessions)**
Quality control: Meaning, process control, SQC control charts, single, double and sequential sampling, Introduction to TQM.

Unit-V **(07 Sessions)**
Environmental Issues: Environmental Pollution – various management techniques to control Environmental pollution – Various control acts for Air, Water, Solid waste and Noise pollution.

Course Outcome: Students completing this course will be able to:
- Understand the scope of Industrial Management.
- To apply various management tools in systems of different industrial configurations.
- To use various control charts to determine the product acceptability as per designed criteria .
- To control environmental pollution by various management techniques.

Suggested Readings:

- Khanna O.P.: Industrial Engineering
- T.R. Banga: Industrial Engineering and Management
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