K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING

AND

TECHNOLOGY

Bachelor of Technology - Mechanical Engineering
B. Tech (ME)

Programme Code: 02

2018-22

Approved in the 17th Meeting of Academic Council
Held on 29 June 2018

Member Secretary
K.R. Mangalam University

Registrar
K.R. Mangalam University
Sohna Road, Gurugram, (Haryana)

K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING

AND

TECHNOLOGY

Bachelor of Technology - Mechanical Engineering
B. Tech (ME)

Programme Code: 02

2018-22

Approved in the 17th Meeting of Academic Council Held on 29 June 2018

About K.R Mangalam University

The K.R. Mangalam Group has made a name for itself in the field of education. The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education.

K.R. Mangalam University is the fastest-growing higher education institute in Gurugram, India. K. R. Mangalam University was established under the Haryana Private University Act 2006, received the approval of Haryana Legislature vide Amendment Act # 36 of 2013 and consent of the Hon'ble Governor of Haryana on 11th April 2013, which was published in the Gazette notification vide Leg. No.10/2013, dated 3rd May 2013.

Since its inception in 2013, the University has been striving to fulfil its prime objective of transforming young lives through ground-breaking pedagogy, global collaborations, and world-class infrastructure. Resources at K.R Mangalam University have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly interdisciplinary environment where they grow up with integrative skills through interaction with students from engineering, social sciences, management and other study streams.

K.R Mangalam University is unique because of its:

i. Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.

ii. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

Objectives

i. To impart undergraduate, post graduate and doctoral education in identified areas of higher education.

ii. To undertake research programmes with industrial interface.

iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.

iv. To act as a nodal center for transfer of technology to the industry.

v. To provide job oriented professional education to the Indian student community with particular focus on Haryana.

About School of Engineering & Technology (SOET)

School of Engineering and Technology (SOET), K.R. Mangalam University is dedicated to fostering innovation, excellence, and advancement in engineering and technology. Empowering the new generation of change-makers by imparting exceptional understanding and intellect to facilitate the creation of highly sophisticated futuristic solutions. Our well-qualified academicians, accomplished researchers and industry insiders are focused on imparting their extensive knowledge and expertise to students through various lectures, workshops, industrial visits, projects, and competitions throughout the year ensuring that students receive a comprehensive education that blends theory with practical application.

These programs offered at SOET have the distinct objective of equipping the students with knowledge, skills and attitudes in engineering and technology, to make them capable of successfully meeting the present requirements and future challenges in the engineering profession. SOET brings together outstanding academics, industry professionals, and experienced researchers to deliver a unique hands-on and multi-disciplinary learning experience.

The curriculum of programs has been designed to cater to the ever changing needs and demands of the industry. The curriculum is regularly updated. The school has best infrastructure including domain-specific labs. SOET aims to provide exposure to the principles and practices of Design / Developments and Projects in the area of engineering. SOET is offering Ph.D. programs also.

School Vision

To create, disseminate, and apply knowledge in science and technology to meet the higher education needs of India and the global society, To serve as an institutional model of excellence in scientific and technical education characterized by integration of teaching, research and innovation.

School Mission

M1: To create an environment where teaching and learning are prioritized, with all support activities being held accountable for their success.

M2: To strengthen the institution's position as the school of choice for students across the State & Nation.

M3: To promote creative, immersive, and lifelong learning skills while addressing societal concerns.

M4: To promote co- and extra-curricular activities for overall personality development of the students.

M5: To promote and undertake all-inclusive research and development activities.

M6: To instill in learners an entrepreneurial mindset and principles.

M7: Enhance industrial, institutional, national, and international partnerships for symbiotic relationships.

M8: To help students acquire and develop knowledge, skills and leadership qualities of the 21st Century and beyond.

Programs offered by the School

School offers undergraduate B. Tech Program, B.Sc. (Hons) Program, postgraduate M. Tech Program, and Doctoral Program. All these programs are designed to impart scientific knowledge to the students and provide theoretical and practical training in their respective fields.

B. Tech in Mechanical Engineering

B.Tech Mechanical Engineering program prepares the students for conceptualization, design, manufacturing, and testing of a wide range of machines, materials, including automobiles, power plants, structures etc. it also trains the students in the area of Mechatronics, Automation, advanced manufacturing technology, renewable/alternate energy sources, engines for rockets and airplanes, ships, computer integrated manufacturing, CAD/CAM, apart from refrigeration and air conditioning systems, etc.

Eligibility Criteria: The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: Electric vehicle Engineering design, Thermodynamics, Manufacturing Technology, Additive Manufacturing, Refrigeration and Air-conditioning, Theory of Machines, Design of Machines Elements, CAD Mold Wizard Fundamental Process, Fluid Machinery, Robotics and Automation, CAD sheet Metal/Surface Modelling, CAD Advanced Fundamental Process, Power Plant Engineering.

Career Options: Aerospace Industry, Nuclear power plant, Automotive industry, All government psu's, Indian Defense service.

Program Duration: 4 Years

The maximum period for the completion of the B.Tech. (ME) Programme offered by the University shall be four years.

Class Timings

The classes will be held from Monday to Friday from 9.10 am to 4.00 pm.

Scheme of Studies and Syllabi

The scheme of studies and syllabi of B. Tech (ME) is given in the following pages. These are arranged as (a) common courses (b) degree-specific courses, in numeric order of the last three digits of the course code. The first line contains; Course Code and Credits (C) of the course for each course. This is followed by detailed syllabi.

Four Years B. Tech Mechanical Engineering Programme At A Glance

Semester	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Courses	11	10	10	9	11	9	9	4	**73**
Credits	28	29	28	26	29	27	24	21	**212**

Scheme of Studies

SEMESTER I							
S. No.		**Subject Code**	**Title**	**L**	**T**	**P**	**C**
1	SE	ETMA105	APPLIED MATHEMATICS-I	3	1	0	4
2	SE	ETPH109	APPLIED PHYSICS-I	3	1	0	4
3	SE	ETEC119	ELECTRICAL SCIENCE	3	1	0	4
4	CC	ETME106	ENGINEERING MECHANICS	3	0	0	3
5	SE	ETCS103	INTRODUCTION TO COMPUTER SYSTEM AND PROGRAMMING	3	1	0	4
6	SE	ETEL101	COMMUNICATION SKILLS	4	0	0	4
7	SE	ETPH151	APPLIED PHYSICS-I LAB	0	0	2	1
8	SE	ETEL171	COMMUNICATION SKILLS LAB	0	0	2	1
9	SE	ETEC161	ELECTRICAL SCIENCE LAB	0	0	2	1
10	SE	ETCS153	PROGRAMMING LAB	0	0	2	1
11	CC	ETME154	ENGINEERING MECHANICS LAB	0	0	2	1
				19	**4**	**10**	**28**

SEMESTER II							
S. No.		**Subject Code**	**Title**	**L**	**T**	**P**	**C**
1	SE	ETMA104	APPLIED MATHEMATICS-II	3	1	0	4
2	SE	ETPH108	APPLIED PHYSICS-II	3	1	0	4
3	SE		OPEN ELECTIVE	-	-	-	6
4	CC	ETME107	MANUFACTURING PROCESSES	3	0	0	3
5	SE	ETCS112	OBJECT ORIENTED PROGRAMMING	3	1	0	4
6	SE	ETCH125	ENVIRONMENTAL STUDIES	3	0	0	3
7	SE	ETPH152	APPLIED PHYSICS-II LAB	0	0	2	1
8	CC	ETME157	WORKSHOP PRACTICE	0	0	3	1.5
9	SE	ETCS166	OBJECT ORIENTED PROGRAMMING LAB	0	0	2	1
10	CC	ETME155	ENGINEERING GRAPHICS LAB	0	0	3	1.5
				15	**3**	**10**	**29**

SEMESTER III							
1	SE	ETMA201	APPLIED MATHEMATICS - III	3	1	-	4
2	SE	ETEC 203	BASICS OF ELECTRONICS	3	1	-	4
3	CC	ETME 205	THERMODYNAMICS	3	1	-	4
4	CC	ETME 207	STRENGTH OF MATERIALS	3	1	-	4
5	CC	ETME 209	FLUID MECHANICS	3	1	-	4
6	CC	ETME 211	MATERIAL SCIENCE & METALLURGY	4	-	-	4
7	CC	ETEC 259	BASICS OF ELECTRONICS LAB	-	-	2	1
8	CC	ETME 253	STRENGTH OF MATERIALS LAB	-	-	2	1
9	CC	ETME 255	FLUID MECHANICS LAB	-	-	2	1

10	CC	ETME 257	COMPUTER AIDED MACHINE DRAWING LAB	-	-	2	1
				19	**5**	**8**	**28**

SEMESTER IV							
1	CC	ETME 210	FLUID MACHINES	3	1	-	4
2	CC	ETME 204	KINEMATICS OF MACHINES	3	1	-	4
3	CC	ETME 214	TURBOMACHINES	3	1	-	4
4	CC	ETMA 210	APPLIED NUMERICAL TECHNIQUES & COMPUTING	3	1	-	4
5	SE	ETMC226	FUNDAMENTALS OF MANAGEMENT	3	-	-	3
6	DE		DEPARTMENTAL ELECTIVE	4	-	-	4
7	CC	ETME 252	FLUID MACHINES LAB	-	-	2	1
8	CC	ETME 254	KINEMATICS OF MACHINE LAB	-	-	2	1
9	SE	ETMA 256	APPLIED NUMERICAL TECHNIQUES& COMPUTING LAB	-	-	2	1
				19	**4**	**6**	**26**

SEMESTER V							
1	CC	ETME 301	DYNAMICS OF MACHINES	3	1	-	4
2	CC	ETME 303	MACHINE DESIGN-I	3	1	-	4
3	SE	ETEC 308	CONTROL SYSTEMS	3	1	-	4
4	CC	ETME 307	COMPUTER AIDED DESIGN	4	-	-	4
5	CC	ETME 309	MANUFACTURING TECHNOLOGY	4	-	-	4
6	CC	ETME 311	INTERNAL COMBUSTION ENGINE & GAS TURBINES	4	-	-	4
7	CC	ETME 351	DYNAMICS OF MACHINE LAB	-	-	2	1
8	CC	ETME 353	COMPUTER AIDED DESIGN LAB	-	-	2	1
9	CC	ETME 355	INTERNAL COMBUSTION ENGINE & GAS TURBINES LAB	-	-	2	1
10	CC	ETME 357	MANUFACTURING TECHNOLOGY LAB	-	-	2	1
11	CC	ETME 381	PRACTICAL TRAINING I	-	-	-	1
				23	**3**	**8**	**29**

SEMESTER VI							
1	CC	ETME 302	HEAT TRANSFER	3	1	-	4
2	CC	ETME 304	MACHINE DESIGN-II	3	1	-	4
3	CC	ETME 306	ROBOTICS & AUTOMATION	4	-	-	4
4	CC	ETME 320	AUTOMOBILE ENGINEERING	4	-	-	4
5	CC	ETME 314	PRODUCTION AND OPERATIONS MANAGEMENT	4	-	-	4
6	CC	ETME 312	NON-CONVENTIONAL ENERGY RESOURCES	4	-	-	4
7	CC	ETME 352	HEAT TRANSFER LAB	-	-	2	1
8	CC	ETME 354	ROBOTICS & AUTOMATION LAB	-	-	2	1
9	CC	ETME 356	AUTOMOBILE ENGINEERING LAB	-	-	2	1
				22	**2**	**6**	**27**

SEMESTER VII							
1	CC	ETME 401	REFRIGERATION AND AIR-CONDITIONING	3	1	-	4
2	SE	ETMA 403	OPERATIONS RESEARCH	3	1	-	4
3	CC	ETME 405	POWER PLANT ENGINEERING	4	-	-	4
4	DE		DEPARTMENTAL ELECTIVE	4	-	-	4
5	CC	ETME 409	MEASUREMENT & METROLOGY	3	-	-	3
6	CC	ETME 451	REFRIGERATION AND AIR-CONDITIONING LAB	-	-	2	1
7	CC	ETME 453	MEASUREMENT &METROLOGY LAB	-	-	2	1
8	CC	ETME 481	PRACTICAL TRAINING II	-	-	-	1
9	CC	ETME 457	MINOR PROJECT	-	-	-	2
				17	**2**	**4**	**24**

SEMESTER VIII							
1	CC	ETME 402	MECHANICAL VIBRATIONS	3	1	-	4
2	CC	ETME 406	MECHATRONICS	4	-	-	4
3	DE		DEPARTMENTAL ELECTIVE	4	-	-	4
4	CC	ETME 454	MAJOR PROJECT	-	-	-	6

	OE		DISASTER MANAGEMENT	3			3
				15	**1**	**0**	**21**

Abbreviations:

CC: Core Course

SE: Skill Enhancement

DE: Department Elective

OE: Open Elective

SEMESTER– I

ETMA105	APPLIED MATHEMATICS - I	L	T	P	C
		3	1	-	4

Course Objective: Knowledge of Mathematics is essential for proper understanding of all the engineering and Science subjects. Through this course it is intended to make the students in various disciplines get acquainted with basic concepts of different topics from Mathematics, which is needed to pursue their engineering degree in different disciplines.

UNIT I

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

UNIT II

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

UNIT III

Matrices and its application : Elementary transformation**,** Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

UNIT IV

Ordinary Differential Equations : Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

TEXT BOOKS:

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETPH109	APPLIED PHYSICS - I	L	T	P	C
		3	1	-	4

Course Objective: To objective of the course is to acquaint students with fundamental of graduate level physics which is the very basics of applied Science and Engineering

UNIT I

Interference of Light: Wave theory, Huygen wave theory, Superposition theorem, Interference, types of interference, Young`s double slit experiment, Fresnel Biprism, Interference due to thin films, Wedge shaped film, Newton`s ring, Michelson Interferometer.

Diffraction: Diffraction, Types of diffraction, Fraunhoffer diffraction due to single slit, Diffraction due to N slits, absent spectra, Dispersive power, resolving power, Rayleigh criterion.

UNIT II

Polarization: Polarization, Brewster and Malus law, phenomenon of double refraction, Nicol`s prism, production and detection of polarised light, Specific rotation, Laurent half shade polarimeter, biquartz-polarimeter.

UNIT III

Laser: Spontaneous and stimulated emission, population inversion, principle of LASER action, properties of LASER-coherence, intensity, monochromacity, He-Ne LASER, semiconductor LASER, applications.

Fiber Optics: Introduction, numerical aperture and acceptance angle, types of optical fibre, V-number, attenuation and dispersion (Qualitative only), applications

UNIT IV

Special Theory Of Relativity: Inertial and non-inertial frames of references, Michelson- Morley experiment, postulates of special theory of relativity, Lorentz transformation, length contraction, time dilation, addition of velocities, mass energy equivalence.

REFERENCE BOOKS:

1. Optics by A. Ghatak
2. Optics by N. Subramanyam and Brij Lal
3. Fundamentals of Optics by Jenkins and White
4. Mechanics: Berkeley Physics Course, vol.1 by C. Kittle
5. Mechanics by D.S. Mathur

ETEC 119	ELECTRICAL SCIENCE	L	T	P	C
		3	1	-	4

Course Objective: The objective of the course is to provide a brief knowledge of Electrical Engineering technology to students of various engineering disciplines. The course module includes basic theorems, basic knowledge of current flow and voltages as well as basic knowledge of electrical network and sources of electrical energy.

UNIT I

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

UNIT II

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

UNIT III

Three Phase Circuits: Introduction, Star and Delta connection, Three – phase power, three phase power measurement.

Magnetic Circuits: Introduction to magnetic circuits, Magnetic materials and B-H relationship, Electromagnetic Induction and Force, Inductance: Self and Mutual , Energy stored in Magnetic Systems (Linear) , AC operation of Magnetic Circuits , Hysteresis and Eddy current losses.

UNIT IV

Transformers: Construction, Working principle and phasor diagrams of Single-phase Transformer, E.M.F equation and Auto transformer.

Electrical Machines Construction and working, principles of dc motor and generator , Applications of DC machines, Construction and working principles of 3 phase-Induction motor and Industrial applications.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath , Basic Electrical Engineering , Tata McGraw Hill , New Delhi.
2. B L Thareja – A text book of Electrical Technology.

REFERENCE BOOKS:

1. V.Del Toro ,"Electrical Engineering Fundamentals".
Parker Smith.S.," Problems in Electrical Engineering ".

ETME 106	ENGINEERING MECHANICS	L	T	P	C
		3	-	-	3

Course Objective: Engineering Mechanics is one of the core subjects that introduces the student to analysis of forces and motion and prepares the student for further studies and better understanding of engineering subjects like strength of materials and theory of machines.

UNIT I

Force system: Free body diagram, Equilibrium equations and applications.

Friction: Static and Kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, friction lock, friction of flat pivot and collared thrust bearings, Belt drive- derivation of equation. $T1/T_2 = e\mu^{\theta}$ and its application

UNIT II

Structure: Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section.

Distributed Force: Determination of center of gravity, center of mass and centroid by direct integration and by the method of composite bodies, mass moment of inertia and area moment of inertia by direct integration and composite bodies method, radius of gyration, parallel axis theorem, Pappus theorems, polar moment of inertia.

UNIT III

Kinematics of Particles: Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component.

Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.

UNIT IV

Kinematics of Rigid Bodies: Concept of rigid body, type of rigid body motion, absolute motion, introduction to relative velocity, relative acceleration (Corioli's component excluded) and instantaneous center of velocity, Velocity and acceleration polygons for four bar mechanism and single slider mechanism.

Kinetics of Rigid Bodies: Equation of motion, translatory motion and fixed axis rotation, application of work energy principles to rigid bodies conservation of energy.

TEXT BOOKS:

1. Engineering Mechanics by A.K.Tayal (Umesh Publications).

2. Engineering Mechanics by Sadhu Singh (Khanna Publishers).
3. Engineering Mechanics by Merriam, J L by John Wiley & Sons.

REFERENCE BOOKS:

1. Engineering Mechanics by Irving H. Shames (PHI publications).
2. Engineering Mechanics by U.C.Jindal (Galgotia Publications).
3. Engineering Mechanics by Beer & Johnston, TMH
4. Engineering Mechanics by Subramanyam

ETCS101	INTRODUCTION TO COMPUTER SYSTEMS & PROGRAMMING	L	T	P	C
		2	1	-	3

Course Objective: The objective of the course module is to introduce basics of Computers and its architecture. The course also covers Programming using C.

UNIT I

Introduction to Computer and Programming: Overview of Computer organization and historical perspective computer applications in various fields of science and management. Data representation: Number systems, character representation codes, Binary, hex, octal codes and their inter conversions, ASCII, EBCDIC, Gray code Binary arithmetic, Floating-point arithmetic, signed and unsigned numbers. Concept of algorithms, Flow Charts, Data Flow diagrams etc., Introduction to the Editing tools such as vi or MS-VC editors, Concepts of the finite storage, bits bytes, kilo, mega and gigabytes. Concepts of character representation.

UNIT II

Programming using C: Example of some simple C program. Concept of variables, program statements and function calls from the library (printf for example) C data types, int, char, float etc., C expressions, arithmetic operation, relational and logic operations, C assignment statements, extension of assignment of the operations. C primitive input output using getchar and putchar, exposure to the scanf and printf functions, C Statements, conditional executing using if, else. Optionally switch and break statements may be mentioned.

UNIT III

Iterations and Subprograms: Concept of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned. One dimensional arrays and example of iterative programs using arrays, 2-d arrays Use in matrix computations. Concept of Sub-programming, functions Example of functions. Argument passing mainly for the simple variables.

UNIT IV

Pointers, Strings and Structures: Pointers, relationship between arrays and pointers Argument passing using pointers Array of pointers. Passing arrays as arguments. Strings and C string library. Structure and Unions. Defining C structures, passing strings as arguments Programming examples.

TEXT BOOKS:

1. Yashwant Kanetkar, "Let us C", BPB Publications, 2nd Edition.
2. Herbert Schildt, "C: The complete reference", Osbourne Mcgraw Hill, 4th Edition V Raje Raman : "Computer Programming in C"
3. Rajaraman, "Fundamentals of Computers", Prentice Hall of India, 3rd Edition.

REFERENCE BOOKS:

1. Kernighan & Ritchie, "C Programming Language", the (ANSI C Version), PHI, 2nd Edition.
2. "Fundamental of Computers and Programming in C" by J B Dix.

ETEL 101	COMMUNICATION SKILLS	L	T	P	C
		4	-	-	4

Course Objective: The purpose of this course is to

- Understand the basics of Grammar to improve communication and speak correct form of English
- Improve students' personality and enhance their self-confidence

UNIT I

Introduction to Communication: Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication

UNIT II

Essentials of Grammar: Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection; Using tenses; Articles; Reported Speech; Punctuation

UNIT III

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; Homonyms and Homophones; Antonyms/Synonyms, Phrasal Verbs

UNIT IV

Personality Development: Public Speaking; Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques

Text Book:

1. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press.

References Books:

1. M.L.Tickoo, A. E. Subramanian and P.R. Subramanian, Intermediate Grammar, Usage and Composition, Orient Blackswan.
2. Barun K Mitra, Personality Development and Soft Skills, Oxford University Press.

ETPH151	APPLIED PHYSICS - I LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To plot a graph between the distance of the knife edge from the center of gravity and the time period of the bar pendulum. From the graph, find
   i. The acceleration due to gravity.
   ii. the radius of gyration and the moment of inertia of the bar about an axis
2. To determine the moment of inertia of a flywheel about its own axis of motion.
3. To determine the value of acceleration due to gravity using Kater`s pendulum.
4. To determine the frequency of A.C. mains with sonometer using non-magnetic wire.
5. To determine the frequency of electrically maintained turning fork by Melde`s method.
6. To determine the wavelength of sodium light using Newton`s ring apparatus.
7. To determine the wavelength of prominent lines of mercury by plane diffraction grating.
8. To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer.
9. To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
10. To determine the wavelength of He -Ne LASER using transmission diffraction grating.

11. ETEL 171	COMMUNICATION SKILLS LAB	L	T	P	C
		-	-	2	1

Course

Objective: Communication skills lab focuses on communication activities in functional and situational contexts. It encourages students to speak with fluency and accuracy as well as develop the four skills of reading, writing, listening and speaking.

UNIT I

Situational Conversations : Selling a product, Getting a book published, In a government office ,buying a computer, railway enquiry , Introductions, hiring a taxi , Meetings and Greetings , Making an appointment, Making complaints , Agreeing and disagreeing , Congratulations and good wishes, Expressing ability and certainty.

UNIT II

Personality Development: Handling telephonic calls, Career planning, appearing for personal interview, Public speaking, Presentation skills, Group discussion and Dining etiquettes**.**

UNIT III

Business Writing: Making a CV, Letter writing, Report Writing, Errors in spoken English**.**

UNIT IV

Business Communication: Job Interviews, Teleconferencing, Meetings, Marketing, Sales, Customer Service Negotiations, Human Resource.

Suggested Readings:

O. Scot, Contemporary Business Communication, Biztantra, New Delhi**.**

ETEC 161	ELECTRICAL SCIENCE LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To Verify the Thevenin' s theorem
2. To Verify the Superposition theorem
3. To measure voltage, current and power in an A.C. circuit by LCR impedance method
4. To study the frequency response curve in series R-L-C circuit
5. To study the frequency response curve in parallel R-L-C circuit
6. Measurement of power in three phase circuit by two wattmeter method
7. To determine the parameters and losses in single phase transformer by open and short circuit test
8. Speed control of D.C. shunt motor by armature and field control method
9. Speed control of three phase induction motor by applying voltage variation
10. Measurement of power and power factor in single phase circuit
11. Speed control of DC shunt motor by voltage control method
12. Calibration of energy meter/wattmeter/voltmeter/ammeter

NOTE: At least 10 experiments must be done.

ETCS 166	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIENTS

1. Write a program which accept principle, rate and time from user and print the simple interest. Solution.
2. Write a program which input principal, rate and time from user and calculate compound interest. You can use library function.
   CI = P(1+R/100)T.
3. Write a program to display the following output using a single count statement.
   Subject Marks
   Mathematics 90
   Computer 77
   Chemistry 69 solution
4. Write a program which accepts a character and display its ASCII value. Solution.
5. Write a program to swap the values of two variables. Solution.
6. Write a program to calculate area of circle. Solution
7. Write a program to check whether the given number is positive or negative (using ? : ternary operator) solution
8. Write a program which accepts days as integer and display total number of years, months and days in it.
9. Any year is input by the user. Write a program to determine whether the year is a leap year or not.
10. Write a program to find the roots of and quadratic equation of type ax2+bx+c where a is not equal to zero.
11. The marks obtained by a student in 5 different subjects are input by the user.
    The student gets a division as per the following rules:
    Percentage above or equal to 60 - First division
    Percentage between 50 and 59 - Second division
    Percentage between 40 and 49 - Third division
    Percentage less than 40 - Fail
12. Write a program to calculate the division obtained by the student.
13. Write a program which displays a number between 10 to 100 randomly.
14. Write a program using function which accept two integers as an argument and return its sum. Call this function from main ( ) and print the results in main( ).
15. Write a function that receives two numbers as an argument and display all prime numbers between these two numbers. Call this function from main ( ).
16. Write a C++ program to find the sum and average of one dimensional integer array.
17. Write a C++ program to write number 1 to 100 in a data file NOTES.TXT.
18. Write a user-defined function in C++ to read the content from a text file OUT.TXT, count and display the number of alphabets present in it.
19. Declare a structure to represent a complex number (a number having a real part and imaginary part).
    Write C++ functions to add, subtract, multiply and divide two complex numbers.
20. An array stores details of 25 students (roll no, name, and marks in three subjects).
    Write a program to create such an array and print out a list of students who have failed in more than one subject.
21. Write a program to find the length of string.

22. Write a program to reverse a string.
23. Write a program to check a string is palindrome or not.
24. Write a program which accept a letter and display it in uppercase letter.
25. Write a user-defined function in C++ to display the multiplication of row element of two-dimensional array A [4][6] containing integer.

ETME 154	ENGINEERING MECHANICS LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To verify the law of Force Polygon
2. To verify the law of Moments using Parallel Force apparatus. (simply supported type)
3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
4. To find the forces in the members of Jib Crane.
5. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.
6. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle
7. To determine the MA, VR, η of Worm Wheel (2-start)
8. Verification of force transmitted by members of given truss.
9. To verify the law of moments using Bell crank lever
10. To find CG and moment of Inertia of an irregular body using Computation method.

SEMESTER - II

ETMA 104	APPLIED MATHEMATICS - II	L	T	P	C
		3	1	-	4

Course Objective: Mathematics being mother of all sciences, knowledge of Mathematics is essential for a better understanding of almost all Engineering and Science subjects. Through this course module it is intended to make students well versed with the concept of basic topics from Mathematics to enable them pursue their Engineering degree in different disciplines.

UNIT I

Calculus of several Variables: Partial differentiation, Euler's theorem on homogeneous functions, Composite functions, Jacobians, Taylor's theorem of two variables and its application to approximate errors, Maxima-Minima for two variables, Lagrange's method of undermined multipliers.

UNIT II

Functions of Complex Variables: Limit, Continuity and Derivatives of complex functions, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Conformal mapping, Standard mappings (linear, square, inverse and bilinear), Complex line integral, Cauchy's integral theorem, Cauchy's integral formula, Zeroes and Singularities, Taylor series, Laurent's series, Calculation of residues, Residue theorem, Application of residue theorem to solve real integrals.

UNIT III

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

UNIT IV

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

TEXT BOOKS:

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETPH 108	APPLIED PHYSICS -II	L	T	P	C
		3	1	-	4

Course Objective: Objective of this course to acquaint engineering students with advanced mathematical concepts applicable to Electromagnetic wave propagation, solid state physics and quantum mechanics, which is very relevant for students pursuing various engineering disciplines.

UNIT I

Crystal structure: Bravais lattice, inter planer distance, Miller indices, packing in solids, Point defects in crystal-Frankel and Schottky defects, chemical bonding in solids.Experimental X-ray diffraction methods: production and properties of X-rays, X-ray diffraction, Bragg`s law, determination of crystal structure- powder method and rotating crystal method

UNIT II

Quantum Mechanics & Statistical Physics: De-Broglie Hypothesis, Davisson Germer experiment, wave function and its properties, Wave Packet, group and phase velocity, Uncertainty principle. Time Dependent and independent Schrodinger Equation, Particle in a box (1-D), Qualitative Features of Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics distribution, functions & their comparison (no derivation)

UNIT III

Electromagnetic theory: Maxwell`s equations in integral and differential form, simple plane wave equation, Maxwell`s equations in different media, Poynting theorem and Poynting vector, physical significance of Maxwell`s equations.

Magnetism: Atomic magnetic moments, types of magnetism, Classical theory of diamagnetism, Classical theory of para magnetism, ferromagnetism, hysteresis, domain theory

UNIT IV

Free electron theory: Classical free electron theory, Drude Model for electrical conduction, Weidman- Franz law, drawbacks of classical free electron theory and quantum free electron theory, Fermi level, density of states, thermionic emission, Richardson`s equation

Superconductivity: Meissen Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), London's equation, properties of superconductors & applications.

TEXT BOOKS:

1. Materials Science and Engineering: An Introduction, VII Ed by William D. Callister, Jr.
2. Solid State Physics: S.O. Pallai.
3. Introduction to Quantum Physics: David J. Griffith
4. Modern Quantum Physics: J.J Sakurai
5. Atomic Physics : Raj am
6. Introduction to Electrodynamics: David J. Griffith
7. Greiner : Quantum Physics

REFERENCE BOOKS:

1. Electromagnetic waves and Radiating Systems :Jordan & Bal main
2. Concept of Modern Physics : A. BEISER
3. Solid State Physics : Kittle

ETME107	MANUFACTURING PROCESSESS	L	T	P	C
		3	-	-	3

Course Objective: The course module is designed to acquaint the engineering student perusing various disciplines, with basic manufacturing process like casting, forging, metal joining and sheet metal used in industries.

UNIT I

Introduction: Manufacturing process, common Engineering materials, their properties and application.

Casting Processes: Principles of metal casting, Pattern materials, types and allowance, composition and properties of molding sand, foundry tools, concept of cores and core print, elements of gating system, description and operation of cupola, special casting processes e.g. die-casting; permanent mould casting; centrifugal casting; investment casting; casting defects.

UNIT II

Smithy and Forging: Forging tool, Basic operations e.g. upsetting; fullering; flattening; drawing; swaging; drop forging; press forging.

Bench Work and Fitting: Fitting shop tools, operation: Fitting; sawing; chipping; thread cutting (with taps and dies); Marking and marking tools

UNIT III

Metal joining: Welding principles, classification of welding techniques, Oxyacetylene Gas welding, equipment And field of application, Arc-welding, metal arc, Carbon arc welding, submerged arc welding and Atomic hydrogen welding, TIG and MIG welding, electric resistance welding: spot; seam; flash; Butt and percussion welding, Flux: composition; properties and function, Electrodes, Types of Joints and edge preparation, Brazing and soldering, welding defects.

UNIT IV

Sheet Metal Work: Tools and equipments, metals used for sheets, standard specification for sheets, Common Processes**:** blanking, punching, drawing, rolling; spinning; bending; embossing and coining.

Modern Trends In Manufacturing: Introduction to numerical control (NC) and computerized numerical control (CNC) machines.

TEXT BOOKS:

1. Element of Manufacturing Processes by B. S. Nagendra Parashar, R. K. Mittal (PHI)
2. Workshop Technology (Manufacturing Process) by S. K. Garg (Laxmi Publication)
3. Manufacturing Process by Raghuvanshi.
4. Manufacturing Technology by P.N.Rao (TMH publications)

REFERENCE BOOKS:

1. Workshop Technology by Hazra-Chowdhary
2. Production Engineering by R.K.Jain
3. Workshop Technology by Chapman

ETCS 110	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		2	1	-	3

Course Objective: The objective of the course module is to acquaint students with object-oriented programming using Programming C++.

UNIT I

Introduction: Introducing Object-Oriented Approach related to other paradigms (functional, data decomposition), Characteristics of Object-Oriented Languages.

Basic terms and ideas: Abstraction, Encapsulation, Information hiding, Inheritance, Polymorphism, Review of C, Difference between C and C++, Cin, Cout, new, delete operators.

UNIT II

Classes and Objects: Abstract data types, Object & classes, attributes, methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, instantiation of objects, Default parameter value, Copy Constructor, Static Class Data, Constant and Classes, C++ garbage collection, dynamic memory allocation.

UNIT III

Inheritance and Polymorphism: Inheritance, Types of Inheritance, Class hierarchy, derivation – public, private & protected, Agrégations, composition vs classification hiérarchies, Polymorphism, Type of Polymorphism – Compile time and runtime, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric polymorphism, Generic function – template function, function name overloading, Overriding inheritance methods

UNIT IV

Files and Exception Handling: Persistent objects, Streams and files, Namespaces, Exception handling, Generic Classes

Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterates, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

TEXT BOOKS:

1. A.R. Venugopal, Ra jkumar, T. Ravishanker “Mastering C++”, TMH

2. R. Lafore, "Object Oriented Programming using C++", BPB Publications
3. Schildt Herbert, "C++ Programming", 2nd Edition, Wiley DreamTech.

REFERENCE BOOKS:

1. D. Parasons, "Object Oriented Programming with C++", BPB Publication
2. Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication
3. Yashwant Kanethkar, "Object Oriented Programming using C++", BPB

ETCH 125	ENVIRONMENTAL STUDIES	L	T	P	C
		3	-	-	3

Course

Objectives: This course in environmental studies will develop the:

- Basic understanding about the concept related to environment such as eco system and biodiversity.
- Insight about the various concerns regarding environment such as population and social issues.

UNIT I

Introduction of Environmental Studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.
Natural Resources: Renewable and Non-renewable Resources
Land resources: land use change; Land degradation, soil erosion and desertification**.**
Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II

Ecosystems: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:
a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological Diversity: Levels of biological diversity; genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and

Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III

Environmental Pollution: Types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.
Environmental Policies and practices: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.
Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. International agreements: Montreal & Koyoto protocol and convention on biological diversity. Nature reserves, tribal population and rights, human wild life conflicts in Indian context.

UNIT IV

Human Communities and the Environment: Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g. CNG vehicles in Delhi).
Field work:
Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds and basic principles of identification.
Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books:

1. Erach Bharucha, Textbook of Environmental Studies, Universities Press (P) Ltd., Hyderabad, India.
2. Anubha Kaushik and C. P. Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books:

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
2. P. H. Raven, D. M. Hassenzahl & L. R. Berg, Environment, John Wiley & Sons, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta, Ecology, Environmental Science and Conservation, S. Chand Publication, New Delhi.

ETPH 152	APPLIED PHYSICS - II LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To determine the value of e/m of electron by J.J. Thomson method.
2. To determine unknown resistance of a wire by Carey Foster's Bridge.
3. To determine the internal resistance of Leclanche cell using potentiometer.
4. To study the charging and discharging of a capacitor and to find out the time constant.
5. To find the thermal conductivity of a poor conductor by Lee's disk method.
6. To study the thermo EMF using thermocouple and resistance using Pt. Resistance thermometer.
7. To determine the velocity of ultrasound waves using an ultrasonic spectrometer in a given liquid (Kerosene Oil)
8. To measure the frequency of a sine-wave voltage obtains from signal generator and to obtain lissajous pattern on the CRO screen by feeding two sine wave voltages from two signal generator.
9. To determine the temp. Co-efficient of resistance of platinum by Callender & Griffith's Bridge.
10. To study Hall Effect.
11. To determine plank's constant.

ETME157	WORKSHOP PRACTICE	L	T	P	C
		-	-	3	1.5

UNIT I

Materials: Spectrography method for finding composition of materials.

Wood Working Shop: Making of various joints, Pattern making.

UNIT II

Foundary Shop: Bench moulding with single piece pattern and two piece pattern. Floor moulding - Making of bend pipe mould etc. Machine moulding - Making of mould using Match-plate pattern. Core making- Making and baking of dry sand cores for placing in horizontal, vertical and hanging positions in the mould cavity.

Fitting Shop: Learning use of fitting hand tools, marking tools, marking gauge. Exercises: Jobs made out of MS Flats, making saw - cut filling V-cut taper at the corners, circular cut, fitting square in square, triangle in square.

UNIT III

Welding Shop: Electric arc welding, Edge preparations, Exercises making of various joints. Bead formation in horizontal, vertical and overhead positions.

Gas Welding: Oxy-Acetylene welding and cutting of ferrous metals.

Soldering: Dip soldering.

Brazing: With Oxy-Acetylene gas.

UNIT IV

Sheet Metal Shop: Learning use of sheet-metal tools, Exercises: Making jobs out of GI sheet metal. Cylindrical, Conical and Prismatic shapes. Project Shop: Extrusion of soft metals, Plastic coating of copper wires, Plastic.

ETME 155	ENGINEERING GRAPHICS LAB	L	T	P	C
		-	-	3	1.5

Course Objective: The Objective of this course is to acquaint engineering students regarding drawings, projections of planes, projection of solid and isometric projection of various objects.

UNIT I

Introduction: Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing,

AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.

Orthographic Projections:

Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.

UNIT II

Orthographic Projections of Plane Surfaces (First Angle Projection Only):

Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only.

UNIT III

Projections of Solids (First Angle Projection Only):

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:

Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.

UNIT IV

Isometric Projection (Using Isometric Scale Only)
Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut
spheres.

TEXT BOOKS:

- Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48th edition, 2005-Charotar Publishing House, Gujarat.

  Computer Aided Engineering Drawing - S. Trymbaka Murthy, - I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition- 2006.

REFERENCE BOOKS:

1. Engineering Graphics - K.R. Gopalakrishna, 32nd edition, 2005- Subash Publishers Bangalore.
2. 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.

SEMESTER - III

ETMA 201	APPLIED MATHEMATICS - III	L	T	P	C
		3	1	-	4

Course Objective: The objective of the course is to provide a brief knowledge of Applied Mathematics to the Engineering students. The students will learn about the Fourier series, Fourier transforms, Special functions, Partial differential equations and its engineering applications.

UNIT I

Fourier Series and its applications: Euler's formulae, Dirichlet's conditions, Change of interval, Fourier expansion of even and odd functions, Fourier expansion of square wave, Rectangular wave; Saw-toothed wave; Half & full rectified wave functions, Harmonic analysis.

UNIT II

Fourier integrals and Transforms: Fourier integral theorem, Fourier sine integral, Fourier cosine integral, Fourier sine Transform, Fourier cosine transform, Fourier transform and its

properties, Finite Fourier sine transform, Finite Fourier cosine transform, Fourier transforms of derivatives.

UNIT III

Special Functions: Beta and Gamma functions, Bessel's functions, recurrence relations of Bessel's function, Orthogonality of Bessel function, Ber- Bei functions.

UNIT IV

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

TEXT BOOKS:

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETEC 203	BASICS OF ELECTRONICS	L	T	P	C
		3	1	-	4

Course Objective: The objective of this course to have a basic understanding of various electronic components and electronic instruments which is needed to pursue their engineering degree.

UNIT I

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode : Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes.

UNIT II

Applications of Diodes: Half-Wave Diode Rectifier, Full-Wave Rectifier, Clippers and clampers circuits.

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates, K Maps
Electronics Instruments: Multi-meter, CRO, Function Generator.

UNIT III

Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents.
Application of BJT: CB, CE, CC configurations, transistor as an amplifier and as a switch, RC Coupled Amplifier, Introduction to FETs and MOSFETs.

UNIT IV

Power Supplies: Introduction and Working of Switched Mode Power Supply (SMPS), Voltage Regulator, Introduction to Inverters and UPS.
Operational Amplifiers: Introduction to Op-amps, its characteristics and applications.

TEXT BOOKS:

1. Boylestad & Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10th Edition.
2. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27th Edition.

REFERENCE BOOKS:

1. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
2. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
3. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

ETME 205	THERMODYNAMICS	L	T	P	C
		3	1	-	4

Course Objective: Objective of this course is to impart in depth understanding of the principles of thermodynamics and heat transfer. This course also helps students understand the application of basic fluid mechanics, thermodynamic, and heat transfer principles and techniques, including the use of empirical data, to the analysis of representative fluid and thermal energy components and systems encountered in the practice of electrical, electronic, industrial, and related disciplines of engineering.

UNIT I

Basic Concepts: Macroscopic and Microscopic Approaches, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility, Problems. First Law of Thermodynamics: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, PMMFK, Steady flow energy equation, 1st Law Applied to Non- flow process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Problems.

UNIT II

Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir, Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and their Equivalence, PMMSK. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot Theorem and its Corollaries, Thermodynamic Temperature Scale. Entropy, Clausius Inequality, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics. Problems.

Availability and Irreversibility: High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Dead state of a system, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility, Second law efficiencies of processes & cycles. Problems.

UNIT III

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheat Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam. Problems.

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avogadro's law and Universal Gas Constant, P-V-T surface of an Ideal Gas. Vander Waal's Equation of state, Reduced Co-ordinates, Compressibility factor and law of corresponding states. Mixture of Gases, Mass, Mole and Volume Fraction, Gibson 7 Dalton's law, Gas Constant and Specific Heats, Entropy for a mixture of non-reactive gases. Problems.

UNIT IV

Thermodynamic Relations: Maxwell Relations, Clapeyron Equation, Relations for changes in Enthalpy and Internal Energy & Entropy, Specific Heat Capacity Relations, Joule Thomson coefficient & inversion curve.

Gas power Cycles: Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, and Stirling Cycle, Ericson cycle, Problems.

TEXT BOOKS:

1. Engineering Thermodynamics – Jones and Dugan, PHI, New Delhi.
2. Fundamentals of Engineering Thermodynamics – E. Radhakrishnan, PHI, New Delhi.

REFERENCE BOOKS:

1. Theory and Problems of Thermodynamics – Y. V.C. Rao, Wiley Eastern Ltd., New Delhi.

ETME 207	STRENGTH OF MATERIALS	L	T	P	C
		3	1	-	4

Course Objective: The objective of this course is to make the students understand the concept of stress and strain in different types of structure/machine under different loading conditions. The course also covers the simple and compound stresses due to forces, stresses and deflection in beams due to bending, torsion in circular section, strain energy, different theories of failure, stress in thin cylinder thick cylinder and spheres due to external and internal pressure.

UNIT I

Simple Stresses & Strains: Concept & types of Stresses and strains, Poison's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numerical.

Compound Stresses & Strains: Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principle stresses & strains and principal- planes, Mohr's circle of stresses, Numerical.

UNITII

Shear Force & Bending Moments: Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contra-flexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Problems.

Torsion of Circular Members: Torsion of thin circular tube, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, combined bending and torsion, equivalent torque, effect of end thrust. Numericals.

UNIT III

Bending & Shear Stresses in Beams: Bending stresses in beams with derivation & application to beams of circular, rectangular, I,T and channel sections, composite beams, shear stresses in beams with combined bending, torsion & axial loading of beams Numericals.

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Eulers, Rankine, Gordom's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections,Numerical.

UNIT IV

Slope & Deflection: Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical.

Fixed Beams: Deflections, reactions and fixing moments with SF & BM calculations & diagrams for fixed beams under (i) concentrated loads, (ii) uniformly distributed load and (iii) A combination of concentrated loads & uniformly distributed load.

TEXT BOOKS:

1. Strength of Materials – G.H.Ryder - Macmillan, India 24
2. Strength of Materials– Andrew Pytel and Fredinand L.Singer, Addison –Wesley

REFERENCE BOOKS:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials A Rudimentary Apprach – M.A. Jayaram, Sapna Book House, Bangalore

ETME 209	FLUID MECHANICS	L	T	P	C
		3	1	-	4

Course Objective: The objective of Fluid Mechanics subject is that students should understand the, properties of fluids, pressure measurement devices, hydraulic forces on surfaces, bouncy and flotation in fluids, kinematics and static behaviour of fluids, dimension and model analysis, laminar and turbulent flow, flow through pipes and orifices, boundary layer theory

UNIT I

Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, and properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium, Problems.

Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in

cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net, Problems.

UNIT II

Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation, pitot tube, venturimeter, orifices, orificemeter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications, Problems.

Compressible Fluid Flow: Introduction, continuity momentum and energy equation, sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, stagnation properties, isentropic flow, effect of area variation on flow properties, isentropic flow through nozzles, diffusers, injectors, Problems.

UNIT III

Viscous Flow: Flow regimes and Reynolds's number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings. Problems.

Flow Through Pipes: Major and minor losses in pipes, Hagen-Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes, Problems.

UNIT IV

Boundary Layer Flow: Boundary layer concept, displacement, momentum and energy thickness, von-karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies lift and drag on a cylinder and an airfoil, Problems.

Turbulent Flow: Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes, Problems.

TEXT BOOKS

1. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
2. Mechanics of Fluids – I H Shames, Mc Graw Hill
3. Fluid Mechanics – Frank M White, Tata McGraw Hill.

REFERENCES BOOKS

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi.
4. Fluid Mechanics and Machinery – Dr. R.K.Bansal – Laxmi Publishers.

5. Fluid Mechanics – Dr. R.K. Rajput – Khanna Publications.

ETME 211	MATERIAL SCIENCE & METALLURGY	L	T	P	C
		4	-	-	4

Course Objective: Metallurgy and Materials deal with the structure and properties of all materials, which have engineering applications. Metallurgists and Materials Engineers are responsible for designing, producing, examining and testing materials as diverse as metallic engineering alloys, semiconductors and superconductors, ceramics, plastics and composites. This course will help students understand the properties of different types of materials and their applications.

UNIT I

Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Numerical related to crystallography.

Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects & effects of imperfections on metal properties.

UNIT II

Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.

Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing,normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding,flame and induction hardening. Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite.

UNIT III

Deformation of Metal: Elastic and plastic deformation, mechanism of plastic deformation, twinning, conventional and true stress strain curves for polycrystalline materials, yield point phenomena, strain ageing, work hardening, Bauschinger effect, season cracking. Recovery, re-crystallization and grain growth.

Failures of metals: Failure analysis, fracture, process of fracture, types of fracture, fatigue, characteristics of fatigue, fatigue limit, mechanism of fatigue, factors affecting fatigue.

UNIT IV

Creep & Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism and effect of corrosion, prevention of corrosion. Plastic, Composite and Ceramics: Polymers, formation of polymers, polymer structure and crystallinity, polymers to plastics types, reinforced particles-strengthened and dispersion strengthened composites.

Ceramic materials: Types of ceramics, properties of ceramic, ceramic forming techniques, mechanical behavior of ceramic.

TEXT BOOKS:

1. Elements of Material Science and Engineering: VanVlack, Wesley Pub. Comp.
2. Material Science - Narula, Narula and Gupta. New Age Publishers

REFERENCE BOOKS:

1. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi.
2. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons
3. Material Science and Engineering-An Introduction - Callister; W.D., John Wiley & Sons. Delhi.
4. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi

ETEC 259	BASIC OF ELECTRONICS LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To get familiar with the working knowledge of the following instruments:

a) Cathode ray oscilloscope (CRO)
b) Multimeter (Analog and Digital)
c) Function generator
d) Power supply

2.

a) To measure phase difference between two waveforms using CRO
b) To measure an unknown frequency from Lissajous figures using CRO

3.

a) Plot the forward and reverse V-I characteristics of P-N junction diode
b) Calculation of cut-in voltage
c) Study of Zener diode in breakdown region

4. To plot and study the input and output characteristics of BJT in common-emitter configuration
5. To find frequency response of a given amplifier and calculate its bandwidth
6. To get familiar with pin-configuration of typical op-amp(741) and its use as:

a) Inverting amplifier
b) Non-inverting amplifier
c) Summing amplifier
d) Difference amplifier
7. Use of op-amp as
a) Integrator
b) Differentiator
8. To assemble Wein Bridge oscillator circuit and calculation of oscillation-frequency and its verification from the observed output
9. To assemble and test 5V/9 V DC regulated power supply and find its line-regulation and loand-regulation
10. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR)
11. Verification of truth tables of flip-flops (S-R, J-K)
12. To get familiar with the working and use of seven-segment display.

ETME 253	STRENGTH OF MATERIALS LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To study the Brinell hardness testing machine & perform the Brinell hardness test.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test.
4. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.
5. To study the Impact testing machine and perform the Impact tests (Izod & Charpy).
6. To study the Universal testing machine and perform the tensile test UTM.
7. To perform compression & bending tests on UTM.
8. To perform the shear test on UTM.
9. To study the torsion testing machine and perform the torsion test.
10. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under Point and Distributed Loads.

ETME 255	FLUID MECHANICS LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orificemeter.
3. To determine the coefficient of discharge of Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.

5. To determine the coefficient of discharge of venturimeter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vertex flow.
12. To verify the momentum equation.

ETME 257	COMPUTER AIDED MACHINE DRAWING LAB	L	T	P	C
		-	-	2	1

Introduction: Graphic language classification of drawing, principal of drawing, IS codes for machine drawing, lines, scales, section dimensioning, standard abbreviation, – Limits, fits and Tolerance (Dimensional and Geometrical tolerance) , Surface finish, Gears : Gear terminology, I.S. convention representation of assembly of spur gears, helical gears, bevel gears, worm and worm wheel.

ETME 210	FLUID MACHINES	L	T	P	C
		3	1	-	4

Orthographic projections: Principle of first and third angle projection, orthographic views from isometric views of machine parts / components. Drawing of sectional views: - Coupling, Crankshaft, Pulley, Piston and Connecting rod, Cotter and Knuckle joint. Riveted Joint and Welded Joint.

Free hand sketching: Need for free hand sketching of standard parts and simple machines components.

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies Steam stop valve, Stuffing box, Drill jigs and Milling fixture.

SEMESTER - IV

Course Objective: the objective of this course is to provide a brief knowledge about Pelton turbine, Kaplan turbine, Francis turbine, reciprocating pumps, and centrifugal pumps.

UNIT I

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

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

UNIT II

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

Propeller and Kaplan turbines: Component parts, construction and operation of a Propeller, Kaplan turbine, differences between the Francis and Kaplan turbines, draft tube - its function and different forms, Performance Characteristics, Governing of reaction turbine, Introduction to new types of turbine, Deriaz (Diagonal), Bulb, Tubular turbines, Problems.

UNIT III

Dimensional Analysis and Model Similitude: Dimensional homogeneity, Rayleigh's method and Buckingham's _-theorem, model studies and similitude, dimensionless numbers and their significance. Unit quantities, specific speed and model relationships for turbines, scale effect, cavitations – its causes, harmful effects and prevention, Thomas cavitation factor, permissible installation height, Problems.

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

UNIT IV

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

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

TEXT BOOKS:

1. Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi
2. Hydraulic Machines – Dr R K Bansal -Laxmi Publications New delhi.

REFERENCE BOOKS:

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

ETME 204	KINEMATICS OF MACHINES	L	T	P	C
		3	1	-	4

Course Objective: the objective of this course is to provide a brief knowledge about kinematics mechanism, cams, Gears.

UNIT I

Introduction: mechanism and machines, kinematics links, kinematics pairs, kinematics chains, degree of freedom, Grubler's rule, kinematics inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph, problems.
Kinematics Analysis of Plane Mechanisms: displacement analysis, velocity diagram, velocity determination, relative velocity method, instantaneous center of velocity, Kennedy's theorem, graphical and analytical methods of velocity and acceleration analysis, problems.

UNIT II

Cams: Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods, cams with specified contours, problems.
Gears: fundamental law of gearing, involute spur gears, characteristics of involute and cycloidal action, Interference and undercutting, center distance variation, path of contact, arc of contact, nonstandard gear teeth, helical, spiral bevel and worm gears, problems.

UNIT III

Gear Trains: synthesis of simple, compound and reverted gear trains, analysis of epicylic gear trains, problems.

Kinematics synthesis of Mechanisms: function generation, path generation, Freudenstein's equation, two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, , precision positions, structural error; Chebychev spacing, transmission angle, problems.

UNIT IV

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

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

TEXT BOOKS:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Malik, Third Edition Affiliated East-West Press.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.
3. Theory of Machines- Dr R K Bansal- Laxmi Publication.

REFERENCE BOOKS:

1. Mechanism and Machine Theory : J.S. Rao and R.V. Dukkipati Second Edition New age International.
2. Theory and Machines: S.S. Rattan, Tata McGraw Hill.

ETME 214	TURBOMACHINES	L	T	P	C
		3	1	-	4

Course Objective: the objective of this course is to provide a brief knowledge about introduction of Gas Turbines, Nozzle, and Compressible flow and Steam turbines.

UNIT I

Introduction: Prime Movers, Gas Turbines, Review of Basic principles – Thermodynamics, Fluid Dynamics and Heat Transfer, Fundamentals of Rotating Machines – Energy Equation, Dimensional Analysis, Airfoil Theory.

UNIT II

Centrifugal Compressors: Centrifugal Compressors- Principle of Operation, T-s diagram, Energy equation, velocity triangles, types of blades. Analysis of Flow, Performance Characteristics

Axial Flow Compressors: Axial Flow Compressors – Construction, Principle of Operation, T-s diagram, Energy equation, velocity triangles, Analysis of Flow, Work done factor, Stage efficiency, Degree of reaction, Performance characteristics.

UNIT III

Compressible Flow: Stagnation Properties, Speed of sound and Mach number, one dimensional Isentropic flow, isentropic flow through nozzles, shock waves and expansion waves, Fanno line Rayleigh line flow, air flow and steam flow through nozzles, Area- velocity relationship, Mass flow rate, Choking of Nozzles, Performance characteristics of Nozzles, Super saturated flow.

Gas Turbines: Axial Flow Gas Turbines – Impulse and reaction Turbines, Single Impulse stage, Single Reaction stage, Performance characteristics.

UNIT IV

Steam Turbines: Steam Turbines – Impulse and reaction Turbines, Compounding of steam turbines, multistage reaction Turbines, Reheat factor and Efficiency, Governing of Steam Turbines.

Rankine Cycle: Properties of Pure Substances, Property diagrams, Steam Power plant Layout, Rankine Cycle- Analysis, Modified Rankine Cycle, and Combined Cycle

Text Books:

1. Ganesan, V., Gas Turbines 3/e, Tata McGraw Hill Book Company, New Delhi.

2. Vasandani, V.P. and Kumar, D.S., Treatise on Heat Engineering, Chand and Co Publishers, New Delhi.

3. Saravanmuttoo, H.I.H., Rogers, G.F.C. and Cohen H., Gas Turbine Theory, 6/e. Pearson Prentice Education.

Reference Books

1 Kearton, W. J., Steam Turbine Theory and Practice, CBS Publishers and Distributors, New Delhi.

2 Joel, R., Basic Engineering Thermodynamics, Pearson Education, New Delhi.

3 Yahya, S. M., Turbines, Compressors & Fans, Tata McGraw Hill, New Delhi.

4 Dixon, S. L., Fluid Mechanics and Thermodynamics of Turbomachinery, Butterworth-Heinemann, London.

ETMA 210	APPLIED NUMERICAL TECHNIQUES & COMPUTING	L	T	P	C
		3	1	-	4

Course Objective: The objective of the course is to provide a brief knowledge of Applied Mathematics to the Engineering students. The students will learn about the Fourier series, Fourier transforms, Special functions, Partial differential equations and its engineering applications.

UNIT I

Numerical Techniques: The solution of Linear and Non-Linear Equations: Direct Iteration Method, Regular-Falsi Method, and Newton-Raphson Method. Solution of system of simultaneous equations by Guass Elimination, Gauss-Jacobi and Gauss-Seidal Methods. Finite Differences: Forward, Backward and Central Differences.

UNIT II

Interpolation and Numerical Calculus: Newton's Interpolation for Equi-spaced Values. Divided Differences and Interpolation Formula in terms of Divided Differences. Stirling's Central Difference Interpolation Formula, Lagrange's Interpolation Formula for Unequi-spaced Values. Numerical Differentiation. Numerical Integration: Newton-Cote's Quadrature Formula, Trapezoidal Rule, Simpson's One-third Rule and Simpson's Three-eighth Rule.

UNIT III

Numerical Solution of Ordinary Differential Equations: Picard's Method, Euler's Method, Modified Euler's Method, Runge-Kutta Method of Fouth Order, Milne's Predictor-Corrector Method.

UNIT IV

Computer Programming: Writing Programmes in C/C++ for Solving Numerical Problems. For Example, Programme for Solving Algebraic and Transcendental Equations by Newton-Rapson Method, Solving Simultaneous Equations by Gauss-Seidal Method. Programme for Interpolation by Lagrange's Method. Programme for Estimating the value an Integral by Simpsons's rule. Programme for Solving Differential Equation by Runge-Kutta Method, etc.

TEXT BOOKS:

1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New age International Publisher, India, 5th edition.
2. Kresyzig, Advanced Engineering Mathematics, John Wiley and Sons(Latest edition).
3. Veerarajan & Ramachandran, Numerical Methods: With Programs In C, Tata McGraw-Hill Education.

ETMC 226	FUNDAMENTALS OF MANAGEMENT	L	T	P	C
		3	-	-	3

Course Objective: the objective of this course is to provide a brief knowledge about Management aspects, Production Management, Marketing Management, Marketing Research**.**

UNIT I

Meaning of Management: Definitions of Management, Characteristics of management, Management vs. Administration. Management-Art, Science and Profession. Importance of Management. Development of Management thoughts.

Principles of Management: The Management Functions, Inter-relationship of Managerial functions. Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs Merit. Training - objectives and types of training.

UNIT II

Production Management : Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control.
M**aterial Management:** Brief introduction to the concepts of material management, inventory control; its importance and various methods**.**

UNIT III

Marketing Management: Definition of marketing, marketing concept, objectives & Functions of marketing.
Marketing Research: Meaning; Definition; objectives; Importance; Limitations; Process.
Advertising - meaning of advertising, objectives, functions, criticism.

UNIT IV

Financial Management: Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.

TEXT BOOKS:

1. Principles and Practice of Management - R.S. Gupta, B.D.Sharma, N.S. Bhalla. (Kalyani Publishers)
2. Organisation and Management - R.D. Aggarwal (Tata Mc Graw Hill)

REFERENCE BOOKS:

1. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)
2. Management – Harold, Koontz and Cyrilo Donell (Mc.Graw Hill).
3. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).
4. Financial Management - I.M. Pandey (Vikas Publishing House, New Delhi)

ETME 252	FLUID MACHINES LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the performance characteristics of Pelton turbine-constant head, constantspeed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
9. To study the construction details of a Gear oil pump and its performance curves.
10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies.
11. To study the constructional details of a Centrifugal compressor.
12. To study the model of Hydro power plant and draw its layout.

ETME 254	KINEMATICS OF MACHINES LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To study various types of Kinematic links, pairs, chains and Mechanisms.
2. To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find coefficient of friction between belt and pulley.
5. To study various type of cam and follower arrangements.
6. To plot follower displacement vs cam rotation for various Cam Follower systems.
7. To generate spur gear involute tooth profile using simulated gear shaping process.
8. To study various types of gears – Helical, cross helical worm, bevel gear.
9. To study various types of gear trains – simple, compound, reverted, epicyclic and differential.
10. To find co-efficient of friction between belt and pulley.
11. To study the working of Screw Jack and determine its efficiency.
12. Create various types of linkage mechanism in CAD and simulate for motion outputs and study the relevant effects.
13. Creation of various joints like revolute, planes, spherical, cam follower and study the degree of freedom and motion patterns available.
14. To design a cam profile by using the requirement graph using on-line engineering handbook and verify the same using a 3D mechanism on CAD.

ETMA 256	APPLIED NUMERICAL TECHNIQUES AND COMPUTING LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Solution of Non-linear equation in single variable using the method of successive bisection.
2. Solution of Non-Linear equation in single variable using the Newton Raphson, Secant, Bi –Section and Modified Eualer's, method.
3. Solution of a system of simultaneous algebraic equations using the Gaussian elimination procedure.
4. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method.
5. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method employing the technique of successive relaxation.
6. Numerical solution of an ordinary differential equation using the Euler's method.

ETME 301	DYNAMICS OF MACHINES	L	T	P	C
		3	1	-	4

7. Numerical solution of an ordinary differential equation using the Runge - Kutta 4th order method.
8. Numerical solution of an ordinary differential equation using the Predictor – corrector method.
9. Numerical solution of a system of two ordinary differential equation using Numerical intergration.
10. Numerical solution of an elleptic boundary value problem using the method of Finite Differences.

SEMESTER - V

Course Objective: the objective of this course is to provide a brief knowledge about Balancing of Rotating Component, Governors, Gyroscope.

UNIT I

Static and Dynamic Force Analysis: Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms. Dynamics of **Reciprocating Engines :** engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.

UNIT II

Balancing of Rotating Components :static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing. Balancing of Reciprocating Parts : Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order.

UNIT III

Governors :introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors. Dynamometers : types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

UNIT IV

Gyroscope :gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

TEXT BOOKS:

1. Theory of Mechanisms and Machines: AmitabhaGhosh and Ashok kumarMallik, Third Edition\ Affiliated East-West Press.
2. Theory of Machine: S.S. Rattan, McGraw Hill Higher Education.

REFERENCE BOOKS:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati, New age International.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition McGraw Hill, Inc

ETME 303	MACHINE DESIGN-I	L	T	P	C
		3	1	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Selection of Materials, Mechanical Joints, Belt rope and Chain Drives & Key Coupling.

UNIT I

Design Philosophy: Problem identification- problem statement, specifications, constraints, Feasibility studytechnical feasibility, economic & financial feasibility, societal & environmental feasibility, Generation of solution field (solution variants), Brain storming, Preliminary design, Selection of best possible solution, Detailed design, Selection of Fits and tolerances and analysis of dimensional chains.

Selection of Materials: Classification of Engg. Materials, Mechanical properties of the commonly used engg. Materials, hardness, strength parameters with reference to stress-strain diagram, Factor of safety.

UNIT II

Mechanical Joints: ISO Metric Screw Threads, Bolted joints in tension, Eccentrically loaded bolted joints in shear and under combined stresses, Design of power screws, Design of various types of welding joints under different static load conditions.

Riveted Joints, Cotter & Knuckle Joints: Design of various types of riveted joints under different static loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints.

UNIT III

Belt rope and chain drives: Design of belt drives, Flat & V-belt drives, Condition for Transmission of max. Power, Selection of belt, design of rope drives, design of chain drives with sprockets.

Keys, Couplings & Flywheel: Design of Keys – Flat, Kennedy Keys, Splines, Couplings design – Rigid & Flexible coupling, turning Moment diagram, coefficient of fluctuation of energy and speed, design of flywheel – solid disk & rimmed flywheels.

UNIT IV

Clutches: Various types of clutches in use, Design of friction clutches – Disc. Multidisc, Cone & Centrifugal, Torque transmitting capacity.

Brakes: Various types of Brakes, Self energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes, Thermal Considerations in brake designing.

TEXT BOOKS:

1. Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley-MGH, New York.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.
3. PSG Design Data Book

REFERENCE BOOKS:

1. Engineering design – George Dieter, MGH, New York.
2. Product Design and Manufacturing ,A.K.Chitale and R.C.Gupta, PHI.
3. Machine Design An Integrated Approach: Robert L.Norton, Addison Wesley.
4. Machine Design : S.G. Kulkarini - Tata MacGraw Hill.
5. Design of machine elements-C S Sharma, KamleshPurohit, PHI.

ETEE 317	MEASUREMENTS & INSTRUMENTATION	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Static and Dynamic Characteristics of Instruments,Transducer Elements, Motion force and Torque Measuring Device.

UNIT I

Instruments and Their Representation : Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration.

Static and Dynamic characteristics of Instruments : Introduction, Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead Band, Backlash, Drift, Formulation of Differential Equations for Dynamic Performance- Zero Order, First Order and Second order systems, Response of First and Second Order Systems to Step, Ramp, Impulse and Harmonic Functions.

UNIT II

Transducer Elements : Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamic, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, Piezo- Electric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration, Ionisation Transducers, Mechano Electronic Transducers, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Volatic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

UNIT III

Motion, Force and Torque Measurement : Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter.

Intermediate, Indicating and Recording Elements : Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements,

UNIT IV

Pressure and Flow Measurement : Pressure & Flow Measurement, Introduction : Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Temperature Measurement : Introduction, Measurement of Temperature, Non Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

TEXT BOOKS:

1. Measurement systems Application and Design. Ernest O. Doebelin, Tata McGraw Hill Edition (Fourth Edition) 2002.
2. Measurement and Instrumentation in Engineering, Francis S. Tse and Ivan E. Morse, Marcel Dekker.

REFERENCE BOOKS:

1. Principles of Measurement and Instrumentation – Alan S. Morris Prentice Hall of India.
2. Mechanical Measurements : T.G. Beckwith, W.L. Buck and R.D. Marangoni Addison Wesley.
3. Instrumentation, Measurement and Analysis – B.C. Nakra and K.K. Chaudhary, TMH.
4. Mechanical Measurements by D. S. Kumar, Kataria& Sons.

ETME 307	COMPUTER AIDED DESIGN	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Curves, Automation and Numerical Control; Flexible Manufacturing Systems & Computer aided process planning

UNIT I

Introduction: Introduction to CAD, Design Process, Introduction to CAM/ CIMS, Importance and Necessity of CAD, Applications of CAD, Hardware and Software requirement of CAD, Basics of geometric and solid modeling, coordinate systems.

Transformations: Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations.

UNIT II

Curves: Algebraic and geometric forms, tangents and normal, blending functions reparametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves. Surfaces and Solids: Plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, Bezier surface, B-spline surface, Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition.

UNIT III

Automation and Numerical Control: Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming.

Group Technology: Part families, part classification and coding, production flow analysis, Machine cell design, Advantages of GT.

UNIT IV

Flexible Manufacturing Systems & Computer aided process planning: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

Finite Element Method: Introduction, Procedure, Finite Element Analysis, Finite Element Modeling, Analysis of 1D, 2D structural problems.

TEXT BOOKS:

1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao&Tiwari, TMH.

REFERENCE BOOKS:

1. CAD/CAM (Principles, Practice & Manufacturing Management) by ChirsMc Mohan & Jimmie Browne, Published by Addison- Wesley.

ETME 309	MANUFACTURING TECHNOLOGY	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Metal forming Jigs and Fixtures, Unconventional Machining Processes, Numerical Control of Machine Tools.

UNIT I

Metal Cutting & Tool Life: Introduction, basic tool geometry, single point tool nomenclature, chips types and their characters tics, mechanics of chips formation, theoretical and experimental determination of shear angle, orthogonal and oblique metalcutting, metal cutting theories, relationship of velocity, forces, and power consumption, cutting speed, feed and depth of cut, coolant, temperature profile in cutting, tool life relationship, tailor equation of tool life, tool material and mechanism

Economics of Metal Machining: Introduction, elements of machining cost, tooling economics, machining, economics and optimization, geometry of twist, drills and power calculation in drills.

UNIT II

Metal forming Jigs and Fixtures: Introduction, Metal blow condition, theories of plasticity, conditions of plane strains, friction, conditions in metal working, wire drawing, theory of forging, rolling theory, no slip angle, and foreword slip, types of tools, principles of locations, locating and clamping devices, jigs bushes, drilling jigs, milling fixtures, turning fixtures, boring and broaching fixtures, welding fixtures, different materials, for jigs and
fixtures, economics of jigs and fixtures.

UNIT III

Unconventional Machining Processes: Abrasive jet machining: Principles, applications, process parameters. Ultrasonic machining: Principles, applications, analysis of process parameters. Electro-chemical machining and grinding: Principles, classifications, choice of electrolytes, applications.
Electric discharge machining: Principles, selection of tools materials and dielectric fluid. Electron beam machining: Generation of electron beam, relative merits and demerits. Laser beam machining: Principles and applications..

UNIT IV

Numerical Control of Machine Tools: Introduction, Numerical Control & its growth, NC Machines tools, Axes of NC Machines, Classification of NC System, CNC, DNC and Machining Centre. Machine Control unit, NC tools & Tool changer.
Manual Part Programming: coordinate, Feed, Speed & Tool, Preparation & Miscellaneous functions, Examples of two axes part programming for Turning and Milling Operations

TEXT BOOK:

1. Manufacturing Engineering Technology, K. Jain, Pearson Education
2. Manufacturing Technology: Foundry, Forming and Welding by P.N.Rao, TMH.
3. Principles of Manufacturing Materials and Processes, James S.Campbell, TMH.
4. Welding Metallurgy by G.E.Linnert, AWS.
5. Production Engineering Sciences by P.C.Pandey and C.K.Singh, Standard Publishers Ltd.
6. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern
7. Manufacturing Technology – Vol. - 2, P.N. Rao, T.M.H, New Delhi
8.Computer Aided Manufacturing: S Kumar & B Kant Khan, SatyaPrakashan, New Delhi

ETME 311	INTERNAL COMBUSTION ENGINES & GAS TURBINES	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Combustion Engines, Cooling Systems, Engine Testing and Performance, Air pollution from I.C. Engine and Its remedies.

UNIT I

Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle.
Problems.

Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.

UNIT II

Combustion in I.C. Engines: S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

UNIT III

Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems.

Air pollution from I.C. Engine and Its remedies: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front.

UNIT IV

Rotary Compressors: Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl;

Axial flow compressor- Degree of reaction, polytropicefficincy, surging, choking and stalling, performance characteristics, Problems.

Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines.
Problems.

TEXT BOOKS:

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI,India

REFERENCE BOOKS:

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
2. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGra

ETME 351	DYNAMICS OF MACHINES LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To perform experiment on Watt and Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.
2. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
3. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.
4. To study gyroscopic effects through models.
5. To determine gyroscopic couple on Motorized Gyroscope.
6. To perform the experiment for static balancing on static balancing machine.
7. To perform the experiment for dynamic balancing on dynamic balancing machine.
8. Determine the moment of inertial of connecting rod by compound pendulum method and tri-flair suspension pendulum.

ETME 353	COMPUTER AIDED DESIGN LAB	L	T	P	C

		-	**-**	**2**	**1**

LIST OF EXPERIMENTS

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
2. Layout drawing of a building using different layer and line colors indicating all Building details. Name the details using text commands, Make a title Block.
3. To Draw Orthographic projection Drawings (Front, Top and side) of boiler safety valve giving name the various components of the valve.
4. Make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap.
5. Draw quarter sectional isometric view of a cotter joint.
6. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
7. Draw 3D models by extruding simple 2D objects, dimension and name the objects. 8. Draw a spiral by extruding a circle.

ETME 355	**I.C. ENGINES & GAS TURBINES LAB**	**L**	**T**	**P**	**C**
		-	**-**	**2**	**1**

LIST OF EXPERIMENTS

1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp,fhp, vs speed (ii) volumetric efficiency & indicated specific specific fuel consumption vs speed.
7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.
8. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhpvs fuel rate, air rate and A/F and (ii) bhpvsmep, mech efficiency &sfc.
9. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.

11. To draw the scavenging characteristic curves of single cylinder petrol engine.
12. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.

ETME 357	MANUFACTURING TECHNOLOGY LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Study and Practice of Orthogonal & Oblique Cutting on a Lathe.
2. Machining time calculation and comparison with actual machining time while cylindrical turning on a Lathe and finding out cutting efficiency.
3. Study of Tool Life while Milling a component on the Milling Machine.
4. Study of Tool Wear of a cutting tool while Drilling on a Drilling Machine.
5. Study of Speed, Feed, Tool, Preparatory (Geometric) and Miscellaneous functions for N. C part programming.
6. Part Programming and proving on a NC lathe for:-
    a. Outside Turning
    b. Facing and Step Turning
    c. Taper Turning
    d. Drilling
    e. Outside Threading

ETME 302	HEAT TRANSFER	L	T	P	C
		3	1	-	4

7. Part Programming and Proving on a NC Milling Machine:-
    a. Point to Point Programming
    b. Absolute Programming
    c. Incremental Programming
8. Part Programming and Proving for Milling a Rectangular Slot.

SEMESTER - VI

Course Objective: the objective of this course is to provide a brief knowledge about Steady State Conduction with Heat Generation, Thermal Radiation, Heat Exchangers.

UNIT I

Basics and Laws: Definition of Heat Transfer, Reversible and irreversible processes, Modes of heat flow, Combined heat transfer system and law of energy conservation.
Steady State Heat Conduction: Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical co-ordinate systems, Numericals.

UNIT II

Steady State Conduction with Heat Generation: Introduction, 1 – D heat conduction with heat sources, Extended surfaces (fins), Fin effectiveness 2-D heat conduction , Numericals.
Transient Heat Conduction: Systems with negligible internal resistance, Transient heat conduction in plane walls, cylinders, spheres with convective boundary conditions, Chart solution, Relaxation Method, Numericals.

UNIT III

Convection: Forced convection-Thermal and hydro-dynamic boundary layers, Equation of continuity, Momentum and energy equations, Some results for flow over a flat plate and flow through tube, Fluid friction and heat transfer (Colburn analogy), Free convection from a vertical flat plate, Empirical relations for free convection from vertical and horizontal o\planes & cylinders, Numericals.

Thermal Radiation: The Stephen-Boltzmann law, The black body radiation, Shape factors and their relationships, Heat exchange between non black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields, Numericals.

UNIT IV

Heat Exchangers: Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness, Numericals.
Heat Transfer with Change of Phase: Laminar film condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective, Nucleate and film boiling, Numericals.

TEXT BOOKS :

1. Heat Transfer – J.P. Holman, John Wiley & Sons, New York.
2. Fundamentals of Heat & Mass Transfer–Incropera, F.P. & Dewitt, D.P –John Willey New York.
3. Heat Transfer-Principles & Applications-Binay K. Dutta, PHI, New Delhi

REFERENCE BOOKS:

1. Conduction of Heat in Solids – Carslow, H.S. and J.C. Jaeger – Oxford Univ. Press.
2. Conduction Heat Transfer – Arpasi, V.S. – Addison – Wesley.
3. Compact Heat Exchangers – W.M. Keys & A.L. Landon, Mc. Graw Hill.
4. Thermal Radiation Heat Transfer – Siegel, R. and J.R. Howell, Mc. Graw Hill.

5. Heat Transmission – W.M., Mc.Adams , Mc Graw Hill.

ETME 304	MACHINE DESIGN-II	L	T	P	C
		3	1	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Shafts, springs, Bearings & Gears.

UNIT I

Design for Production; Erogonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining. Variable Loading : Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.

UNIT II

Shafts: Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.
Springs: Types of Springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem.

UNIT III

Bearings : design of pivot and collar bearing , Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, types of lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

UNIT IV

Gears : Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth –Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

TEXT BOOKS:

1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

REFERENCE BOOKS:

1. Engineering design – George Dieter, McGraw Hill, New York.

2. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman
4. Machine Design: S.G. Kulkarni, TMH, New Delhi.

ETME 306	ROBOTICS & AUTOMATION	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Robot kinematics, Robot dynamics, Configuration of a robot controller, Applications for manufacturing.

UNIT I

Fundamentals of robot technology : Robot anatomy. Work volume. Drive systems. Control systems and dynamic performance. Accuracy and repeatability. Sensors in robotics. Robot reference frames and coordinates and robot kinematics.Path control.

UNIT II

Robot kinematics: Matrix representation. Homogeneous transformations. Forward and inverse kinematics.
Robot dynamics: Differential motions of a frame. Jacobian, static force analysis.

UNIT III

Configuration of a robot controller: End effectors. Mechanical and other types of grippers. Tools as end effectors. Robot and effector interface. Gripper selection and design. Introduction to robot languages.

UNIT IV

Applications for manufacturing: Flexible automation. Robot cell layouts. Machine interference. Other considerations in work cell design. Work cell control, interlocks. Robot cycle time analysis. GraPrentice Hall Indiacal simulation of robotic work cells.
Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

TEXT BOOKS:

1. Saeed B. Niku, “Introduction to Robotics analysis, Systems & Applications”, Pearson Education Singapore P. Ltd.
2. S.R. Deb, “Robotic Technology and Flexible Automation”, Tata McGraw Hill Publishing Co. Ltd.
3. R.K. Mittal, I.J. Nagrath, “Robotics & Control”, Tata McGraw & Hills,

REFERENCE BOOKS:

1. Robert J. Schilling, "Fundamentals of Robotics, analysis & Control", Prentice Hall of India P.Ltd.,
2. John J.Craig; "Introduction to Robotics Mechanics & Control", Pearson Education.
3. Allison Druin & James Hendler; "Robots Exploring New Technologies for learning for kids", Morgan Kaufmann Publishers.

ETME 320	AUTOMOBILE ENGINEERING	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Power Transmission, Suspension Systems, Automotive Brakes, Tyres & Wheels.

UNIT I

Introduction to Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

Clutches : Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi plate Clutch, Centrifugal Clutches, Electromagnetic Clutch, Over Running Clutch; Clutch Linkages.

UNIT II

Power Transmission: Requirements of transmission system; General Arrangement of Power Transmission
system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases. Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles.

UNIT III

Suspension Systems: Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs.

Steering System : Front Wheel geometry & Wheel alignment viz. Caster, Camber, King pin Inclination, Toein/ Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack & Pinion Power Steering Gear, Electronics steering.

ETME 314	PRODUCTIONAND OPERATIONS MANAGEMENT	L	T	P	C
		4	-	-	4

UNIT IV

Automotive Brakes, Tyres & Wheels : Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes; Tyres of Wheels; Types of Tyre & their constructional details, Wheel Balancing, Tyre Rotation; Types of Tyre wear & their causes.

Emission Control System & Automotive Electrical : Sources of Atmospheric Pollution from the automobile, Emission Control Systems – Construction and Operation of Positive Crank Case Ventilation (PVC) Systems, Evaporative Emission Control, Heated Air Intake System, Exhaust Gas Recirculation (ECR) Systems, Air Injection System and Catalytic Converters; Purpose construction & operation of lead acid Battery, Capacity Rating & Maintenance of Batteries; Purpose and Operation of Charging Systems, Purpose and Operations of the Starting System; Vehicle Lighting System.

TEXT BOOKS:

1. Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2. Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

REFERENCE BOOKS:

1. Automotive Mechanics – Crouse / Anglin, TMH.
2. Automotive Technology – H.M. Sethi, TMH, New Delhi.
3. Automotive Mechanics – S.Srinivasan, TMH, New Delhi.
4. Automotive Mechanics – Joseph Heitner, EWP.
5. Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
6. The Motor Vehicle – Newton steeds Garrett, Butter Worths.

Course Objective: the objective of this course is to provide a brief knowledge about Operations Management, PERT/CPM, Maintenance Management, Inspection, Productivity.

UNIT I

Introduction to Operations Management - Nature, Scope, Importance and Functions - Evolution from manufacturing to operations management - Evolution of the factory System - manufacturing systems –quality – mass customization. Contribution of Henry Ford, Deming, Crossby, Taguchi,

Types of Industries – Variety of Businesses – Integration of Manufacturing & Services – Scale of Operations. Methods of Manufacturing - Project / Jobbing, Batch Production, Flow/Continuous Production, Process Production -Characteristics of each method

UNIT II

Facilities Location & Layout – Strategic importance - Factors affecting location & Layout - Installation of facilities – Single location, multi-location decisions. Principles and Types of Facilities and Layout.

Project Management: Introduction to PERT / CPM - Network Crashing (Numericals expected for PERT/CPM)

UNIT III

Maintenance Management - Importance and types of maintenance – Maintenance Planning - Spare Parts Management – Concept of TPM.

Inspection - Cent percent Inspection, Sample Inspection, Operation Characteristics Curves, Statistical Quality Control – Construction & Interpretation of Control Charts – (X-R, n, p, c, np) Introduction to Six Sigma, (Numericals expected for Control Charts). Gap analysis for service quality assessment.

UNIT IV

Productivity - Work Study - Objectives, Scope and Uses - Methods Study – Flow Process chart, Flow diagram & Process mapping - Work Measurement - Elements - Performance Rating - Allowances - Standard Time - Synthetic Time Standards – Work Sampling (Numericals expected for Standard Time)

Lean Production Systems – TOYOTA system – JIT - KANBAN - Theory of Constraints.

Books Recommended:-

1. Operations Management - Krajewski
2. Operations Management - Mahadevan
3. Production & Operations Management – Chary

Reference Books:

1. Production & Operations Management - Chase
2. Production & Operations Management - Adam & Ebert
3. Manufacturing & Operations Management - L.C.Jhamb
4. The Machine that Changed the World – James Womack (Reference)

ETME 312	NON-CONVENTIONAL ENERGY RESOURCES	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about. Geothermal Energy, Fuel Cells, Thermo-electrical and thermionic Conversions, Wind Energy, Bio-mass & Ocean Thermal Energy Conversion (OTEC).

UNIT I

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.
Solar Cells: Theory of solar cells. solar cell materials, solar cell power plant, limitations.
Solar Thermal Energy: Solar radiation flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT II

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.

UNIT III

Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations.

Wind Energy: Wnd 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 IV

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.

REFERENCES BOOKS:

1. Andra Gabdel, "A Handbook for Engineers and Economists".
2. A. Mani , "Handbook of Solar radiation Data for India".
3. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
4. F.R. the MITTRE, "Wind Machines" by Energy Resources and Environmental Series.
5. Frank Kreith, "Solar Energy Hand Book".

ETME 352	HEAT TRANSFER LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating power.
3. To determine the thermal conductivity of a solid by the guarded hot plate method.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
7. To determine average heat transfer coefficient for a externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
8. To measure the emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity with surface temperature.
9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
10. To verify the Stefen-Boltzmann constant for thermal radiation.
11. To demonstrate the super thermal conducting heat pipe and compare its working with that of the best conductor i.e. copper pipe. Also plot temperature variation along the length with time or three pipes.
12. To study the two phases heat transfer unit.
13. To determine the water side overall heat transfer coefficient on a cross-flow heat exchanger.
14. Design of Heat exchanger using CAD and verification using thermal analysis package eg. I-Deas etc.

ETME 354	ROBOTICS & AUTOMATION LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Demonstration of Cartesian/ cylindrical/ spherical robot.
2. Demonstration of Articulated/ SCARA robot.
3. Virtual modeling for kinematic and dynamic verification any one robotic structure using suitable software.

4. Design, modeling and analysis of two different types of grippers.
5. Study of sensor integration.
6. Two program for linear and non-linear path.
7. Study of robotic system design.
8. Setting robot for any one industrial application after industrial visit.

ETME 356	AUTOMOBILE ENGINEERING LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To study and prepare report on the constructional details, working principles and operation of the following Automotive Engine Systems & Sub Systems.
    a. Multi-cylinder : Diesel and Petrol Engines.
    b. Engine cooling & lubricating Systems.
    c. Engine starting Systems.
    d. Contact Point & Electronic Ignition Systems.
2. To study and prepare report on the constructional details, working principles and operation of the following Fuels supply systems:
    a. Carburetors
    b. Diesel Fuel Injection Systems
    c. Gasoline Fuel Injection Systems.
3. To study and prepare report on the constructional details, working principles and operation of the following Automotive Clutches.
    a. Coil-Spring Clutch
    b. Diaphragm – Spring Clutch.
    c. Double Disk Clutch.
4. To study and prepare report on the constructional details, working principles and operation of the following Automotive Transmission systems.
    a. Synchromesh – Four speed Range.
    b. Transaxle with Dual Speed Range.
    c. Four Wheel Drive and Transfer Case.
    d. Steering Column and Floor – Shift levers.
5. To study and prepare report on the constructional details, working principles and operation of the following Automotive Drive Lines & Differentials.
    a. Rear Wheel Drive Line.
    b. Front Wheel Drive Line.
    c. Differentials, Drive Axles and Four Wheel Drive Line.

6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.

a. Front Suspension System.
b. Rear Suspension System.

ETME 401	REFRIGERATION & AIR-CONDITIONING	L	T	P	C
		3	1	-	4

7. To study and prepare report on the constructional details, working principles and operation of the following Automotive Steering Systems.
   a. Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering.
   b. Power steering Systems, e.g. Rack and Pinion Power Steering System.
   c. Steering Wheels and Columns e.g. Tilt & Telescopic steering Wheels, Collapsible Steering Columns.
8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
   a. Various Types of Bias & Radial Tyres.
   b. Various Types of wheels.
9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
   a. Hydraulic & Pneumatic Brake systems.
   b. Drum Brake System.
   c. Disk Brake System.
   d. Antilock Brake System.
   e. System Packing & Other Brakes.
10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.
11. Modeling of any two automotive systems on 3D CAD using educational softwares (eg. 3D modeling package/Pro Engineering/I-Deas/ Solid edge etc.)
12. Crash worthiness of the designed frame using Hypermesh and LS-Dyna solver or other software.

SEMESTER – VII

Course Objective: the objective of this course is to provide a brief knowledge about Vapour Compression (VC) Refrigeration Systems, Other Refrigeration Systems, Psychrometry of Air & Air Conditioning Processes, & Air Conditioning Systems with Controls & Accessories.

UNIT I

Introduction: Definition of refrigeration & air conditioning; Necessity; Methods of refrigeration; Unit of refrigeration; Coefficient of performance (COP), Fundamentals of air-conditioning system; Refrigerants- Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly Refrigerants; Introduction to Cryogenics.

Air Refrigeration System: Carnot refrigeration cycle. Temperature Limitations; Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero plane; Air craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems, problems.

UNIT II

Vapour Compression (VC) Refrigeration Systems: (A) Simple Vapour Compression (VC) Refrigeration systems-Limitations of Reversed Carnot cycle with vapour as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on p-v, t-s and p-h diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

(B) Multistage Ref. Systems- Necessity of compound compression, Compound VC cycle , Inter-cooling with liquid sub –cooling and / or water inter cooler: Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Individual compression system with individual or multiple expansion valves; Individual compression systems with individual or multiple expansion valves but with and without intercoolers.

Other Refrigeration Systems: (A) Vapour Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Performance, Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration; Problems.
(B) Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications, Problems.
(C) Cascade Refrigerating Systems-Necessity Selection of Pairs of refrigerants for the system, Concept of cascade temperature, Analysis, Multistaging, Comparison with V.C. systems, Applications, Problems.

UNIT III

Psychrometry of Air & Air Conditioning Processes: Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychrometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychrometric processes in air washer, Problems.

Air- Conditioning Load Calculations: Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical

applications, Infiltration and ventilation, Heat generation inside conditioned space; Apparatus selection; Comfort chart, Problems.

UNIT IV

Air Conditioning Systems with Controls & Accessories: Classifications, Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls; Accessories; Problems.

Refrigeration and Air Conditioning Equipments: Type of compressors and their performance curves; Types of Condensers, Heat transfer in condensers; Types of expansion devices; types of evaporators, Cooling and Dehumidifying coils, Problems.

TEXT BOOKS:

1. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India.
2. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi.

REFERENCE BOOKS:

1. A course in Refrigeration & Air Conditioning – Arora & Domkundwar, Dhanpat Rai & Sons.
2. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
3. Refrigeration & Air conditioning- Manohar Prasad Wiley Estern limited, New Delhi.

ETMA 403	OPERATIONS RESEARCH	L	T	P	C
		3	1	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Deterministic Model, Advanced Topic Of LP, Waiting Line Models, Project Line Models, Simulation & Decision Theory.

UNIT I

Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods.

Linear Programming (LP): Programming definition, formulation, solution- graphical, simplex Gauss-Jordan reduction process in simplex methods, BIG-M methods computational, problems.

UNIT II

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepperg stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

Advanced Topic Of LP: Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

UNIT III

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network, resources leveling in project, problems.

UNIT IV

Simulation: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems.
Decision Theory: Decision process, SIMON model types of decision making environment-certainty, risk, uncertainty, decision making with utilities, problems.

TEXT BOOKS:

1. Operation Research – TAHA, PHI, New Delhi.
2. Principle of Operations Research – Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.

REFERENCE BOOKS :

1. Operation Research- Gupta & Sharma, National Publishers, New Delhi.
2.Quantitative Techniques- Vohra, TMH, New Delhi
3. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
4. Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
5.Operation Research – Philips, Revindran, Solgeberg, Wiley ISE.

ETME 405	POWER PLANT ENGINEERING	L	T	P	C
		4	-	-	4

Course Objective: The objective of this course is to provide a brief knowledge about Steam Power Plants, Combined Cycles, Nuclear Power Plants, Hydro Electric Power Plants, Other Power Plant, Control and Economics.

UNIT I

Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.
Steam Generator: Fuel handling systems, Indian coals, combustion of coal in furnaces, Elementary boilers- Cochran, Babcock & Wilcox. High pressure heavy duty boilers, Super critical and once through boilers layout of evaporator, super heater, re-heater and economizer; dust collectors; ash disposal, fans and draft systems, fluidized bed combustion;

UNIT II

Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

UNIT II

Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.
Combined Cycles: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal, using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles. Problems.

UNIT III

Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors- PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, handling of nuclear waste and safety measures, peak load power generation method.

Other Power Plant: General layout of I.C. Engines and turbine power plants, types, gas turbine plants, fields of application, Nuclear power plants, power reactors and nuclear steam turbines;

UNIT IV

Control: Important instruments on steam generator and turbine; drum water level control, combustion control and super heat temperature control; testing of power plants and heat balance.
Economics: Planning for power generation in India, super thermal power plants, estimation of cost of power generation; choice of plant site.

TEXT BOOKS:

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Campany Ltd., New Delhi
2. Power Plant Engineering: P.K. Nag Tata McGraw Hill second Edition.
3. Arora & Domkundwar, “A course in Power Plant Engineering”, Dhanpat Rai & Sons T2]

4. P.L.Balaney "Thermal Engineering", Khanna Publishers.

REFERENCE BOOKS:

1. Power Plant Engg. : M.M. El-Wakil McGraw Hill.
2. R.K.Rajput "Thermal Engineering", Laxmi Publications (P) Ltd.
3. A.S Sarao "Thermal Engineering", Satya Prakshan.
4. Shamsher Gautam "Power Plant Engineering" Vikas Publishing House

ETME 409	MEASUREMENTS & METROLOGY	L	T	P	C
		3	-	-	3

Course Objective: the objective of this course is to provide a brief knowledge about Comparators, Angular Measurement, Straightness and flatness, Gear Measurement & Machine Tool Alignment.

UNIT I

Principles of measurement: Definition of Metrology, difference between precision and accuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, application of Least Square principles, errors in measurement of a quality which is function of other variables.

Length Standards: Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges – its use and care, methods of building different heights using different sets of slip gauges.

Limits, fits and tolerances: Various definitions, IS919-1963, different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919-1963. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor's Principle, wear allowance on gauges. Different methods of giving tolerances on gauges, Numericals.

UNIT II

Comparators: Mechanical Comparators: Johanson Mikrokator and Signma Mechanical Comparator. Mechanical - optical comparator. Principles of Electrical and electronic comparators. Pneumatic comparators – advantages, systems of Penumatic gauging:- Flow type and back pressure type, Principle of working of back pressure gauges, different type of sensitivities and overall magnification, Solex Penumatic gauges and differential comparators. Numericals based on pneumatic comparators.

Angular Measurement: Sine Bar – different types of sine bars, use of sine bars in conjuction with slip gauges, precautions and calibration of sine bars. Use of angle gauges, spirit level, errors in use of sine bars. Numericals. Principle and working of Micro-optic autocollimator. Circular Division: dividing head and circular tables, circular division by precision Polygons. Caliper Principle, Calibration of polygons. Numerical based on circular division

UNIT III

Straightness and flatness: Definition of Straightness and Flatness error. Numericals based on determination of straightness error of straight edge with the help of spirit level and auto collimator. Numericals based on determination of flatness error of a surface plate with the help of spirit level or auto collimator.

Screw Thread Measurement :Errors in threads, Measurement of elements of screw threads – major dia, minor dia, pitch, flank angle and effective diameter (Two and three wire methods). Effect of errors in pitch and flank angles and its mathematical derivation. Numericals.

Gear Measurement: Measurement of tooth thickness – Gear tooth vernier caliper, Constant chord method, base tangent method and derivation of mathematical formulae for each method. Test plug method for checking pitch diameter and tooth spacing. Measurement of Gear Pitch, Parkinson Gear Tester, Numericals.

UNIT IV

Machine Tool Alignment: Machine tool tests and alignment tests on lathe. Alignment tests on milling machine. Alignment tests on a radial drilling machine.

Interferometry: Principle of measurement, Interferometry applied to flatness testing, surface contour tests, optical flats, testing of parallelism of a surface with the help of optical flat. Quantitative estimate of error in parallelism, Flatness Interferometer NPL-Gauge length interferometer for checking the error in slip gauges. Numericals based on Interferometry.

Surface texture: Introduction, different types of irregularities, standard measures for assessment and measurement of surface finish.

TEXT BOOKS:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers, Delhi
2. I.C. Gupta, "Engineering Metrology", Dhanpat Rai Publications, Delhi

REFERENCE BOOKS:

1. F.W. Galyer & C.R. Shotbolt, "Metrology for Engineers", ELBS edition.

ETME 451	REFRIGERATION & AIR-CONDITIONING LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENT

1. To study the vapour compression Refrigeration System and determine its C.O.P. and draw P-H and T-S diagrams.
2. To Study the Mechanical heat pump and find its C.O.P.
3. To study the Air and Water heat pump and find its C.O.P.

4. To study the cut- sectional models of Reciprocating and Rotary Refrigerant compressor.
5. To study the various controls used in Refrigerating & Air Conditioning systems.

ETME 402	MECHANICAL VIBRATIONS	L	T	P	C
		3	1	-	4

6. To study the Ice- plant, its working cycle and determine its C.O.P and capacity.
7. To study the humidification, heating, cooling and dehumidification processes and plot them on Psychrometric charts.
8. To determine the By-pass factor of Heating & Cooling coils and plot them on Psychrometric charts on different inlet conditions.
9. To determine sensible heat factor of Air on re-circulated air-conditioning set up.
10. To study the chilling plant and its working cycle.

ETME 453	MEASUREMENT & METROLOGY LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Use of Comparators (Mechanical, Opto-Mechanical & Electrical (LVDT)),
2. Projectors (Profile & Tool Maker's Microscope),
3. Angular Measurements using Combination Set,
4. Bevel Protactor & Sine Bar,
5. Linear Measurements using Vernier Caliper (Depth Caliper, Height Gauge) and Micrometers (Outside, Inside Rod type, Inside Jaw type & Point / Ball Micrometer), Radius Measurement using Radius Gauge & Profile Projector,
6. Inside Diameter Measurement using Bore Gauge,
7. Measurement of Pitch Diameter of External Threads,
8. Use of Plug & Ring Gauges, Snap Gauge (Fixed & Adjustable both),
9. Working Principle of a Pneumatic Air Gauge,
10. Use of Slip Gauges of various types and their Setup,
11. Gauge Repeatability & Reproducibility Study using the $\overline{X} - R$ Method,
12. Measurement of Surface Roughness parameters such as R_a, R_t and R_z.

SEMESTER - VIII

Course Objective: the objective of this course is to provide a brief knowledge about Harmonically Excited Vibrations, Two Degrees of Freedom Systems & Normal Mode Vibration of Continuous System.

UNIT I

Fundamentals : Importance of Study of Vibrations, Classifications of Vibrations, Free and Forced, Undamped and Damped, Linear and Non-linear, Deterministic and Random, Harmonic Motion, Vector and Complex Number Representations, Definitions and Terminology, Periodic Functions, Harmonic Analysis, Fourier Series Expansion.
Free and Damped Vibrations : Single Degree of Freedom system, D'Alemberts Principal, Energy Methods, Rayleighs Method, Application of these Methods, Damped Free Vibrations, Logarithmic Decrement, Under Damping, Critical and Over Damping, Coulomb Damping.

UNIT II

Harmonically Excited Vibrations : Forced Damped Harmonic Vibration of Single Degree of Freedom Systems, Rotating Unbalance, Rotor Unbalance, Critical Speeds and Whirling of Rotating Shafts, Support Motion, Vibration Isolation, Energy Dissipated by Damping, Equivalent, Viscous Camping, Structural Damping Sharpness of Resonance, Vibration Measuring Instruments.

UNIT III

Transient Vibrations : Impulse Excitation, Arbitrary Excitation, Response to Step Excitions, Base Excitation Solution by Laplace Transforms, Response Spectrum, Runge-Kutta Method.
Two Degrees of Freedom Systems : Introduction to Multi-Degree of Freedom Systems, Normal Mode Vibrations, Coordinate Coupling, Principal Coordinates, Free Vibrations in Terms of Initial Conditions, Forced Harmonic Vibrations, Vibration Absorber, Centrifugal Vibration Absorber, Vibration Damper.

UNIT IV

Multi degrees of Freedom Systems and Numerical Methods Introduction, Influence Coefficients, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes, Orthogonality of Normal Modes, Dunkerley's Equation, Method of Matrix Iteration, The Holzer Type Problem, Geared and Branched Systems, Beams.
Normal Mode Vibration of Continuous System: Vibrating String, Longitudinal Vibrations of Rod, Torsional Vibrations of Rod, Lateral Vibrations of Beam.

TEXT BOOKS:

1. Theory of Vibrations with Applications W.T. Thomson, Prentice Hall of India.
2. Mechanical Vibration : G.K. Grover and S.P. Nigam, Nem Chand and Sons

REFERENCE BOOKS :

1. Theory and Practice of Mechanical Vibrations J.S. Rao and K. Gupta, Wiley Eastern Ltd.
2. Mechanical Vibrations S.S. Rao, Addison – Wesely Publishing Company

ETME 406	MECHATRONICS	L	T	P	C
		4	-	-	4

Course Objective: the objective of this course is to provide a brief knowledge about Pneumatic, Hydraulic, Mechanical and Electrical Actuation Systems, Closed Loop Controllers & Microprocessors and Input/Output Systems.

Introduction and Basics: What is Mechatronics?; A Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers; The Mechatronic Approach.

UNIT I

Hardware of Measurement Systems; A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / alongwith Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Operational Amplifier; Protection; Fitering; Wheat Stone Bridge; Digital Signals; Multiplexers; Data Acqusition; Digital Signal Processing; Pulse Modulation; Data Presentation Systems – Displays; Data Presentation Elements; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems.

UNIT II

Pneumatic, Hydraulic, Mechanical and Electrical Actuation Systems: Pneumatic and Hydraulic Systems; Directional Control Valves; Valve Symbols; Pressure Control Valves; Cylinder Sequencing; Process Control Valves; Rotary Actuators; Mechanical Systems – Types of Motion, Kinematic Chains, Cams, Gear Trains, Ratchet & Pawl, Belt & Chain Drives, Bearings, Mechanical Aspect of Motor Selection; Electrical Systems; Mechanical & Solid State Switches; Solenoids; D.C. & A.C. Motors; Stepper Motors; Problems.

System Modeling and Performance: Engg. Systems; Rotational – Translational Systems; Electro-mechanical Systems; Hydraulic – Mechanical Systems; A review of modeling of First and Second Order Systems and Performance Measures; Transfer Functions for first order System, Second Order System, Systems in series & Systems with Feedback Loops; Frequency Response of First Order and Second Order Systems; Bode Plots: Performance Specifications: Stability; Problems.

UNIT III

Closed Loop Controllers: Continuous and Discrete Processes – Lag, Steady State Error; Control Modes; Two- step Mode; Proportional Mode – Electronic Proportional Controllers; Derivative Control – Proportional plus Derivative Control; Integral Control - Proportional plus Integral Control; PID Controller – Operational Amplifier PID Circuits; Digital Controllers – Implementing Control Modes; Control System Performance; Controller Tuning – Process Reaction Method & Ultimate Cycle Method; Velocity Control; Adaptative Control; Problems.

Digital Logic and Programmable Logic Controllers : A Review of Number Systems & Logic Gates; Boolean Algebra; Kanaugh Maps; Sequential Logic; Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters; Master & Jump Controls; Data Handling; Analogue Input/ Output; Selection of a PLC; Problems.

UNIT IV

Microprocessors and Input/Output Systems: Control; Microcomputer Structure; Micro-controllers; Applications; Programming Languages; Instruction Sets; Assembly Language Programs; Subroutines; Why C Language ? A review of Program Structure, Branches, Loops, Arrays, Pointer; Examples of Programs; Interfacing; Input/ Output; Interface Requirements; Peripheral Interface Adaptors; Serial Communication Interface; Examples of Interfacing; Problems.

Design and Mechatronics: Design Process; Traditional and Mechantronics Design; Possible Mechatronics design solutions for Timed Switch, Wind Screen Wiper Motion, Bath Room Scale, A Pick & Place Robot, Automatic Camera, Engine Management System & Bar Code Recorder.

TEXT BOOKS:

1. Mechatronics by W. Bolton, Published by Addition Wesley.
2. Mechatronics System Design – Devdas Shetty and Richard A. Kolx Brooks/ Cole

REFERENCE BOOKS:

1. Introduction to Mechatronics and Measuring System : david G. Alciation and Michael B. Hist and Tata McGraw Hill
2. Mechtronics – Sensing to Implementation - C.R.Venkataraman, Sapna