1701MA101	ENGINEERING MATHEMATICS I (Common to all B.E / B.Tech Degree Programmes)	L 3	T 2	P 0	C 4

COURSE OBJECTIVES:

1. To educate Matrix Algebra Technique and curvature Theory
2. To impart knowledge of Techniques in solving Ordinary Differential Equations and to apply in solving Modern Engineering Problems
3. To acquaint the students about functions of several variables and also to familiarize the students in infinite series and their convergence

UNIT I EIGEN VALUE PROBLEMS **9 Hours**

Characteristic equation - Eigen values and Eigen vectors of a real matrix – Properties - Cayley– Hamilton theorem- Diagonalization of Matrices - Reduction of a quadratic form to a canonical form by orthogonal transformation – Application of Matrices in Structural Engineering and image processing

UNIT II ORDINARY DIFFERENTIAL EQUATIONS **9 Hours**

Higher order linear differential equations with constant coefficients – Cauchy"s and Legendre"s linear equations – Method of variation of parameters in solution of ordinary differential equations.

UNIT III DIFFERENTIATION AND GEOMETRICAL APPLICATIONS **9 Hours**

Derivative of special functions (Trigonometry, Exponential, Logarithmic), Derivative by rule (Product, Quotient, Chain rule), Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature- Evolutes and involutes.

UNIT IV MULTIVARIABLE CALCULUS **9 Hours**

Functions of two variables and solutions(Partial derivatives and Euler"s theorem)– Taylor"s series - Maxima and Minima – Application of Partial Derivatives to find the optimum requirement using Lagrangian multipliers.

UNIT V SEQUENCES AND SERIES **9 Hours**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D"Alembert"s ratio test – Alternating series – Leibnitz"s test – Application of Sequences in real life.

TOTAL: 45 + 15 HOURS

FURTHER READING:

1. Modeling and solutions using Newton"s Law of Cooling of Bodies
2. Differentiation of implicit Functions, Jacobians and Properties

COURSE OUTCOMES: Employability

On the Successful completion of the course, Students will be able to

CO1: Analyze the characteristics of a linear system with Eigen value and Eigen Vectors
CO2: Recognize and solve Higher order Ordinary Differential Equations
CO3: Solve Derivative of special functions and apply it in solving Geometrical problems
CO4: Apply Partial Derivatives in finding Maxima and Minima of a function
CO5: Test the convergence of any series

REFERENCES:

1. Veerarajan R., "Engineering Mathematics", updated second edition for semester I and II,(2017)
2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, (2014).
3. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Sixth edition, Laxmi Publications(p) Ltd.,(2014).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, (2012).
5. P.Kandasamy, K. Gunavathy and K. Thilagavathy, Engineering Mathematics ,Volume II, S. Chand & Co ., New Delhi, (2009)
6. Erwin Kreyszig, Advanced Engineering Mathematics,9th Edition, Wiley International edition, (2006)
7. Ramana B.V, "Higher Engineering Mathematics",Tata McGrawHill Publishing, New Delhi, (2007).
8. M K Venkataraman, Engineering mathematics, Volume I, 2nd ed., National Publishing Co.(2003)
9. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html
10. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.htm

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1701PH101	APPLIED PHYSICS FOR ENGINEERS (Common to all B.E. / B.Tech Degree Programmes)	L 3	T 0	P 0	C 3

COURSE OBJECTIVES:

1. To impart knowledge in properties of matter, crystallography and ultrasonics.
2. To understand the applications of lasers and fiber optics.
3. To implement the principles of quantum physics in the respective engineering fields.

UNIT I PROPERTIES OF MATTER **9 Hours**

Elasticity: elastic and plastic materials – Hooke"s law – elastic behavior of a material – stress – strain diagram – factors affecting elasticity. Three moduli of elasticity – Poisson"s ratio – torsional pendulum – twisting couple on a cylinder. Young"s modulus – uniform bending – non-uniform bending. Viscosity: coefficient of viscosity – streamline and turbulent flow – experimental determination of viscosity of a liquid – Poiseuille"s method.

UNIT II APPLIED OPTICS **9 Hours**

Interference: air wedge – theory – uses – testing of flat surfaces – thickness of a thin wire. Laser: introduction – principle of laser – characteristics of laser light– types: CO2 laser – semiconductor laser (homojunction). Fiber optics: principle of light transmission through fiber – expression for acceptance angle and numerical aperture – types of optical fibers (refractive index profile and modes) – fiber optic communication system (block diagram & description).

UNIT III ULTRASONICS **9 Hours**

Ultrasonics: introduction – properties of ultrasonic waves – generation of ultrasonic waves – magnetostriction - piezo electric methods – detection of ultrasonic waves – Determination of velocity of ultrasonic waves (acoustic grating). Applications of ultrasonic waves: pulse echo method, SONAR – measurement of velocity of blood flow – modes of operation (A scan, B Scan & C Scan).

UNIT IV SOLID STATE PHYSICS **9 Hours**

Crystal Physics: lattice – unit cell – crystal systems – Bravais lattices – Miller indices – „d" spacing in cubic lattice – calculation of number of atoms per unit cell, atomic radius, coordination number and determination of packing density for SC, BCC, FCC and HCP structures – X-ray diffraction: Laue"s method – powder crystal method.

UNIT V QUANTUM MECHANICS **9 Hours**

Quantum Physics: development of quantum theory – de Broglie wavelength – Schrodinger"s wave equation – time dependent and time independent wave equations – physical significance. Application: particle in a box (1D) – degenerate and non-degenerate states. Electron Microscopy-SEM, TEM - principle and working – problem solving.

TOTAL: 45 HOURS

FURTHER READING:

Neutrino"s – expanding universe

COURSE OUTCOMES: Employability | Entrepreneurship.

On the successful completion of the course, students will be able to

CO1: Realize the concept of properties of matter and apply the same for practical applications.
CO2: Identify the suitable laser source for fiber optic communication applications.
CO3: Determine the velocity of ultrasonic waves and apply the same for day today applications.
CO4: Classify the different types of crystal structures and analyze their properties.
CO5: Comprehend the efficacy of quantum equations in modern areas.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012
3. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. http://nptel.ac.in/

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1701EN101	TECHNICAL ENGLISH	L	T	P	C
	(Common to all B.E / B.Tech Degree Programmes)	3	0	0	3

COURSE OBJECTIVES:

1. To develop the ability to read and comprehend technical texts in the field of Engineering
2. To develop vocabulary building through the study of word construction
3. To develop ability to write formal definitions of technical terms and expression.
4. To recognize various grammatical structures that will aid the student improve his/her theoretical knowledge.

UNIT I **9 Hours**

Articles-Preposition-Subject-Verb-Object-Adjective-Adverb-Conjunction-Nouns- Usages of Have, has, had-Simple Present-Simple Past-Simple Future-Self introduction-Framing Questions

UNIT II **9 Hours**

Present Continuous-Past Continuous-Future Continuous-Describing a place, person or thing-Framing negative questions-Gerund-Listening to Articles, speeches and audios

UNIT III **9 Hours**

Present perfect-past perfect-future perfect-writing short paragraph-sentence pattern- Infinitive-Tag questions-Reading newspaper cutting

UNIT IV **9 Hours**

Present perfect continuous –Past perfect continuous-Future perfect continuous-writing an Essay in 100 words-Types of sentences-Prefix-suffix-word formation-Dialogue writing.

UNIT V **9 Hours**

Active voice-passive voice-impersonal passive voice –Synonyms and Antonyms-phrasal verbs- Punctuation-Common Errors-Letter writing.

TOTAL: 45 HOURS

FURTHER READING:

Letters from a Father to His Daughter- Jawaharlal Nehru

COURSE OUTCOMES: Skill Development

On the successful completion of the course, Students will be able to

CO1: Read and comprehend technical texts in the field of Engineering

CO2: Acquire vocabulary building and write effectively in technical writing

CO3: Write formal definitions of technical terms and expression in both verbal and written form.

CO4: Understand grammatical structures and use flawless English in the professional documents

REFERENCES:

1. Meenakshi Raman, Sangeetha Sharma, "***Technical Communication : English Skills for Engineers***" Oxford University Press: New Delhi, 2016.
2. Rizvi Ashrav.M, "***Effective Technical Communication***" Tata McGraw Hill: New Delhi, 2017
3. Herbert, A.J, "***Structure of Technical English***", London English Language Society. https://archive.org/details/in.ernet.dli.2015.136456
4. J.D. O'Connor Better ***English Pronunciation*** Paperback, 2nd edition, 162 pages, Published September 16th 2013 by Cambridge University Press,October 23rd 1967
5. Nehru, Jawaharlal. ***Letters from a Father to His Daughter***, Puffin Books, 2004
6. ***Technical English*** by faculty of English –published by EGS Pillay press 2017

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1701EN101	TECHNICAL ENGLISH	L	T	P	C
	(Common to all B.E / B.Tech Degree Programmes)	3	0	0	3

COURSE OBJECTIVES:

1. To develop the ability to read and comprehend technical texts in the field of Engineering
2. To develop vocabulary building through the study of word construction
3. To develop ability to write formal definitions of technical terms and expression.
4. To recognize various grammatical structures that will aid the student improve his/her theoretical knowledge.

UNIT I **9 Hours**

Articles-Preposition-Subject-Verb-Object-Adjective-Adverb-Conjunction-Nouns- Usages of Have, has, had-Simple Present-Simple Past-Simple Future-Self introduction-Framing Questions

UNIT II **9 Hours**

Present Continuous-Past Continuous-Future Continuous-Describing a place, person or thing-Framing negative questions-Gerund-Listening to Articles, speeches and audios

UNIT III **9 Hours**

Present perfect-past perfect-future perfect-writing short paragraph-sentence pattern- Infinitive-Tag questions-Reading newspaper cutting

UNIT IV **9 Hours**

Present perfect continuous –Past perfect continuous-Future perfect continuous-writing an Essay in 100 words-Types of sentences-Prefix-suffix-word formation-Dialogue writing.

UNIT V **9 Hours**

Active voice-passive voice-impersonal passive voice –Synonyms and Antonyms-phrasal verbs- Punctuation-Common Errors-Letter writing.

TOTAL: 45 HOURS

FURTHER READING:

Letters from a Father to His Daughter- Jawaharlal Nehru

COURSE OUTCOMES: Skill Development

On the successful completion of the course, Students will be able to

CO1: Read and comprehend technical texts in the field of Engineering

CO2: Acquire vocabulary building and write effectively in technical writing

CO3: Write formal definitions of technical terms and expression in both verbal and written form.

CO4: Understand grammatical structures and use flawless English in the professional documents

REFERENCES:

1. Meenakshi Raman, Sangeetha Sharma, "***Technical Communication : English Skills for Engineers***" Oxford University Press: New Delhi, 2016.
2. Rizvi Ashrav.M, "***Effective Technical Communication***" Tata McGraw Hill: New Delhi, 2017
3. Herbert, A.J, "***Structure of Technical English***", London English Language Society. https://archive.org/details/in.ernet.dli.2015.136456
4. J.D. O'Connor, Better ***English Pronunciation*** Paperback, 2nd edition, 162 pages, Published September 16th 2013 by Cambridge University Press,October 23rd 1967
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1701CH102	MATERIALS CHEMISTRY (B.E. Mechanical Engineering)	L 3	T 0	P 0	C 3

COURSE OBJECTIVES:

1. Imparting knowledge on the principles of water characterization, treatment methods and industrial applications. Employability | Entrepreneurship.
2. Understanding the principles and application of electrochemistry and corrosion science.
3. Basic information and application of polymer chemistry, nanotechnology and analytical techniques.

UNIT I WATER TECHNOLOGY **9 Hours**

Sources, hard & soft water-Degree of hardness and its estimation (EDTA method)– Water Quality Parameters - boiler feed water-requirements - softening of hard water -external treatment –demineralization, internal treatment- boiler compounds - boiler troubles- desalination of sea water –reverse osmosis- Domestic water treatment –disinfection of water – Basic principle of green chemistry (12 guiding principles)-detergents.

UNIT II CORROSION AND PROTECTIVE COATING **9 Hours**

Corrosion – types-chemical, electrochemical corrosion (galvanic, differential aeration) - Factors influencing corrosion -corrosion control – material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: Electroplating of gold and electroless plating of nickel. Paints - Constituents and Functions.

UNIT III POLYMER AND NANO TECHNOLOGY **12 Hours**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Addition (Free Radical Mechanism) condensation and copolymerization. Fabrication of Plastics. Application -Nylon 66, Teflon and Epoxy resin.

Unique properties of nano material- introduction to quantum materials, quantum dots, supramolecular materials and molecular crystal engineering – molecular machines and devices- Logic gate using electronics material for molecular electronic- nano cluster, nano rod, nanotube (CNT) and nanowire. - Synthesis- precipitation, thermolysis, chemical vapour deposition, laser ablation; Nano polymers- Properties and applications.

UNIT IV FUELS AND ENGINEERING MATERIALS **9 Hours**

Fuel-Introduction- classification of fuels - coal analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - Refining of petroleum- manufacture of synthetic petrol (Bergius process)- natural gas- compressed natural gas(CNG)- producer gas- water gas. Combustion- calorific value - Flue gas analysis (ORSAT Method).

Abrasives: definition, classification -grinding wheel, Application. Refractories: definition, properties – Manufacture of alumina, magnesite and silicon carbide bricks.

UNIT V INSTRUMENTAL TECHNIQUES OF CHEMICAL ANALYSIS **6 Hours**

Laws of photochemistry - Grotthus–Draper law, Stark–Einstein law and Lambert-Beer Law. Electromagnetic spectrum - UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only)- Applications. Colorimetry- principles, instrumentation (Block diagram only) estimation of iron. Flame photometry – principles, instrumentation (Block diagram only) estimation of sodium.

TOTAL: 45 HOURS

FURTHER READING:

1. Batteries-Battery recycling process -Lithium battery
2. Cambridge structural database (protein data bank)-noting data bank

COURSE OUTCOMES: Employability

On the successful completion of the course, students will be able to

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CO1: Understand the chemistry of water and its industrial & domestic application
CO2: Utilization of electrochemistry principle in corrosion control and industrial application
CO3: Understanding the various types of polymers, material and its industrial application
CO4: Applications of nanotechnology and analytical techniques in day to day life

REFERENCES:

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age
3. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
4. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New delhi 2010
5. https://en.wikipedia.org/wiki/Ramachandran_plot
6. https://www.ccdc.cam.ac.uk/solutions/csd-system/components/csd/
7. https://link.springer.com/chapter/10.1007/978-3-642-28030-6_2
8. www. santarosa.edu/~yataiiya/4D/QuantumDotsMk2.ppt
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10. https://en.wikipedia.org/wiki/Molecular_electronics
11. https://books.google.co.in/books?isbn=008053239X
12. https://www.ccdc.cam.ac.uk/solutions/csd-system/components/csd/
13. Jain and Jain, "Engineering Chemistry", Sixteenth edition, Dhanpatrai publications, 2012

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1701GE104	FUNDAMENTALS OF MECHANICAL ENGINEERING	L	T	P	C
	(Common to B.E - Mech. & Civil Programmes)	2	0	2	3

COURSE OBJECTIVES:

1. To make the students practice various fundamental and derived units to manipulate length, time, mass, temperature and derived concepts from the fundamental quantities.
2. To make the students familiar with various forces and its conversions, material properties and geometric properties through demonstrations.
3. To make the students capable for understanding the energy in various forms (except nuclear energy) and make them capable of converting energy in one form to another form.
4. To familiarize students with all commonly used mechanical elements along with its applications.
5. To expose students with all conventional and unconventional manufacturing techniques along with their application for enabling them to start doing mechanical projects from the second semester.

UNIT I ENGINEERING MEASUREMENTS I **7 Hours**

Basic Concepts : Length using scale, sine rule and cosine rule, radians, calculation of surface area and volume of standard objects, time zones, period and frequency, linear velocity, linear acceleration, volume flow rate, angular velocity, angular acceleration, mass, density, specific volume, specific gravity, mass flow rate, momentum, conservation of mass and energy, temperature, heat, conduction, convection, radiation, insulation, thermal expansion, specific heat, calorific value, self-ignition temperature, cryogenic temperature, latent heat, evaporation, condensation. Demonstration, measurement and experiments: Length, surface area and volume of standard objects, periods and frequency, linear velocity, linear acceleration, volume flow rate, angular velocity, mass, density, momentum, conservation of mass and energy, temperature, heat, conduction, convection, radiation, insulation, thermal expansion, specific heat, calorific value, self-ignition temperature, latent heat.

UNIT II ENGINEERING MEASUREMENTS II **7 Hours**

Basic Concepts: Newton's Laws, Force, Centripetal Force, Work, Energy, Power, Pressure load area relation, Stress and its types, Atmospheric Pressure, Types of fluids, Elasticity, Plasticity, Fluid Pressure Head Velocity head relation, Surface tension, Archimedes, Principle, Pascal's Law, Force Displacement Relations, Speed and Torque relations, Siphon, Compressibility, Hardness, Brittleness, Toughness, Ductility, Moment, First moment of Area, Second moment of Area. Demonstration, measurement and experiments: Newton's laws, force, centripetal force, power, pressure, pressure load area relation, stress and its types (tension, compression and shear), atmospheric pressure, fluid pressure head and velocity head relation, elasticity, plasticity, types of fluid, surface tension, viscosity, Archimedes principle, Pascal law, siphon, compressibility, hardness, brittleness, toughness, ductility, moment, first moment of area, second moment of area.

1701GEX53	WORKSHOP PRACTICE	L	T	P	C
	(Common to all B.E. / B.Tech Degree Programmes)	0	0	2	1

COURSE OBJECTIVES:

1. To provide hands on training for fabrication of components using sheet metal and welding equipment / tools.
2. To develop skill for using carpentry and fitting tools to make simple components and metal joints.
3. To provide hands on training for preparing the green sand mould using foundry tools.
4. To provide training for making simple house hold electrical & pipe line connections using suitable tools.
5. To develop the skill to make / operate/utilize the simple engineering components.

LIST OF EXPERIMENTS

1. Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box) (or) making simple object using Metal Spinning Machine. (Example: Aluminum Cup).	**4 Hours**
2. Prepare V (or) Half round (or) Square (or) Dovetail joint from the given mild Steel flat.	**4 Hours**
3. Fabrication of a simple component using thin and thick plates. (Example: Book rack)	**2 Hours**
4. Making a simple component using carpentry power tools. (Example: Electrical switch Box/Tool box/ Letter box.	**2 Hours**
5. Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend, Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes, bend, gate valve, flanges and foot valve.	**4 Hours**
6. Prepare a green sand mould using solid pattern/split pattern.	**4 Hours**
7. Study of gas welding equipment and its demonstration	**2 Hours**
8. Soldering Practice for simple printed circuit board.	**4 Hours**
9. Construct a domestic electrical wire connections using indicator, one way switch with calling bell, two way switch with lamp, one way switch with fan regulator and one way switch with socket.	**4 Hours**

TOTAL: 30 HOURS

COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

CO1: Fabricate simple components using sheet metal & welding equipment/tools.
CO2: Make simple components / joints using carpentry and fitting tools.
CO3: Prepare green sand mould using suitable tools.
CO4: Make simple house hold electrical & pipe line connections using suitable tools.
CO5: Make / operate / utilize the simple engineering components.

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1701GEX51	PROGRAMMING IN C LABORATARY (Common to all B.E. / B.Tech. Degree Programmes)	L 0	T 0	P 2	C 1

COURSE OBJECTIVES:

1. To prepare students to comprehend the fundamental concepts
2. To demonstrate fine grained operations in number system
3. To gain exposure in programming language using C
4. To develop programming skills using the fundamentals and basics of C Language.

LIST OF EXPERIMENTS:

1. Working with word and style sheets
2. Write a C program to implement basic concepts
3. Write a C program to implement Decision Making and Branching statements
4. Write a C program to implement looping statements
5. Write a C program to implement Arrays
6. Write a C program to implement Strings
7. Write a C program to implement pointers
8. Write a C program to implement Structures
9. Write a C program to work with files in C

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS:

1. Write a c program to remove the occurrence of "the" word from entered string.
2. Create two files test1.txt and test2.txt and write a C program to read the file text1.txt character by character on the screen and paste it at the end of test2.txt

COURSE OUTCOMES: Employabilty

On the successful completion of the course, students will be able to

CO1: Understand basic concepts of computers
CO2: Implement basic concepts of c-language
CO3: Implement arrays, strings and pointers.
CO4: Implement the basics of structures, unions, file management and preprocessor in C language

REFERENCES:

1. E. Balagurusamy,"Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh Edition, 2017.
2. Pradip Dey, Manas Ghosh , "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
3. Ashok N. Kamthane, "Programming in C", Pearson Education India, 3rd Edition, 2015.
4. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 15th Revised and Updated Edition, 2016.
5. http://nptel.ac.in/

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1701HS151	PHYSICS AND CHEMISTRY LABORATORY-I (Common to all B.E. / B.Tech Degree Programmes)	L 0	T 0	P 2	C 1

COURSE OBJECTIVES:

1. The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies
2. To achieve perfectness in experimental skills
3. To bring confidence and ability to develop and fabricate engineering and technical equipments.
4. To train the students to analyses the water sample
5. To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

PHYSICS

LIST OF EXPERIMENTS:

1. Determine the moment of inertia of the disc and calculate the rigidity modulus of a given wire using torsion pendulum (symmetrical masses method).
2. Find the elevation of the given wooden beam at the midpoint by loading at the ends and hence calculate the Young"s modulus of the material by uniform bending.
3. Determine the coefficient of viscosity of the given liquid by Poiseulle"s method.
4. From the interference fringes from the air wedge setup and calculate the thickness of the given wire.
5. By applying the principle of diffraction, determine the wavelength of given laser light and the average particle size of lycopodium powder using laser source.
6. Determine the
   (i) Wavelength of ultrasonic in a liquid medium
   (ii) Velocity of ultrasonic waves in the given liquid
   (iii) Compressibility of the given liquid using ultrasonic interferometer.

CHEMISTRY

LIST OF EXPERIMENTS:

1. Determination of total, temporary & permanent hardness of water by EDTA method
2. Determination of strength of given hydrochloric acid using pH meter
3. Estimation of iron content of the given solution using potentiometer
4. Estimation of sodium present in water using flame photometer
5. Corrosion experiment – weight loss method
6. Determination of molecular weight of a polymer by viscometry method
7. Conductometric titration of strong acid Vs strong Base

TOTAL: 45 HOURS

COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

CO1: Realize the concept of properties of matter and apply the same for practical applications.
CO2: Identify the suitable laser source for fiber optic communication applications.
CO3: Determine the velocity of ultrasonic waves and apply the same for day today applications.
CO4: Classify the different types of crystal structures and analyze their properties.
CO5: Comprehend the efficacy of quantum equations in modern areas.
CO6: Identify the pH of the solution.
CO7: Find the iron content of the water sample using potentiometer.
CO8: Explain and demonstrate the conductance of the solution.
CO9: Interpret the hardness and metal ions present in the water.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
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principle.

CO5: Identify any conventional manufacturing process and understand their limits and capabilities.

REFERENCES:

1. David Halliday, Robert Resnick, Jearl Walker, Principles of Physics, 10th Edition International Student Version, John Wiley & Sons, 2014.
2. Moaveni, Saeed, Engineering fundamentals: an introduction to engineering, Cengage Learning, 2015.
3. Wickert, Jonathan, and Kemper Lewis, An introduction to mechanical engineering, Cengage learning, 2012.
4. Serway, Raymond, and John Jewett. Physics for scientists and engineers with modern physics, Cengage learning, 2013.
5. Roger Timing, Engineering Fundamentals, Newnes, 2002.
6. C. F. Geraldand P. O. Wheatley, Applied Numerical Analysis, Pearson Education 2003.

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1701GEX03	PROGRAMMING IN C	L	T	P	C
	(Common to all B.E. / B.Tech Degree Programmes)	3	0	0	3

COURSE OBJECTIVES:

1. To prepare students to comprehend the fundamental concepts
2. To demonstrate fine grained operations in number system
3. To gain exposure in programming language using C
4. To develop programming skills using the fundamentals and basics of C Language

UNIT I BASIC CONCEPTS **8 Hours**

Organization and Classifications of Computer- Generations of Computers- Number System- Problem Solving Techniques – Algorithm Design- Flowchart–Pseudocode

UNIT II INTRODUCTION TO C LANGUAGE **10 Hours**

Overview of C - Constants, Variables and Data Types- Compilation and Linking - Operators and Expressions- Decision Making and Branching – Looping statements

UNIT III ARRAYS AND STRINGS **9 Hours**

Arrays-One Dimensional Array- Declaration and Initialization-Two Dimensional Array-Declaration and Initialization- Programs using Arrays- Strings- String Handling Functions, Programs using Strings- Managing I/O Operations

UNIT IV FUNCTIONS & STRUCTURES **10 Hours**

Functions-Function Prototypes-Declaring, Defining and Calling Functions-Call by value and Call by Reference-Recursive Functions-Structures- Declaration and Definition -Accessing Structure Members-Arrays of Structures-Unions- Programs using Structures and Unions

UNIT V POINTERS & FILES **8 Hours**

Pointers-Dynamic Memory Allocation-Arithmetic Operations using Pointers, Files – File Manipulation-I/O Operations, Preprocessor Directives, Storage Classes

TOTAL: 45 HOURS

FURTHER READING:

Object Oriented Programming Approach.

COURSE OUTCOMES: Employability

On the successful completion of the course, students will be able to

CO1: Describe basic concepts of computers
CO2: Paraphrase the operations of number system
CO3: Describe about basic concepts of C-Language
CO4: Understand the code reusability with the help of user defined functions
CO5: Analyze the structure concept, union, file management and preprocessor in C language

REFERENCES:

1. E. Balagurusamy,"Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh Edition, 2017.
2. Pradip Dey, Manas Ghosh , "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
3. Ashok N. Kamthane, "Programming in C", Pearson Education India, 3rd Edition, 2015.
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1701MA201	ENGINEERING MATHEMATICS II	L	T	P	C
	(Common to all B.E / B.Tech Degree Programmes)	3	2	0	4

COURSE OBJECTIVES:

1. To develop an understanding of the standard techniques of Complex variable theory to apply in areas such as heat conduction, elasticity, fluid Dynamics and flow of electric current
2. To train the students with the concepts of Vector calculus needed for problems in all Engineering Disciplines
3. To make the Students apply Laplace Transform to create a new domain in which it is easier to handle the problem that is being investigated

UNIT I ANALYTIC FUNCTIONS **9 Hours**

Analytic functions – Cauchy Riemann Equations – Properties – Determination of Analytic function using Milne Thomson"s method, Conformal Mappings – Mappings of w= z + a, az, 1/z – Bilinear Transformation – Application of Analytic Functions.

UNIT II COMPLEX INTEGRATION **9 Hours**

Cauchy"s fundamental theorem (statement only) – Application of Cauchy"s Integral formula – Laurent"s series – Classification of singularities – Cauchy"s Residue theorem (statement only) – Contour integration.

UNIT III MULTIPLE INTEGRAL **9 Hours**

Double integration – Cartesian and polar coordinates – Change the order of Integration – Applications: Area of a curved surface using double integral – Triple integration in Cartesian co-ordinates – Volume as triple integral.

UNIT IV VECTOR CALCULUS **9 Hours**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration: Green"s theorem in a plane, Gauss divergence theorem and Stokes" theorem (excluding proofs) – Applications of the above theorems to find surface area of a closed region and volume of cube and parallel piped.

UNIT V LAPLACE TRANSFORM **9 Hours**

Laplace Transform – Conditions for existence – Transform of Elementary Functions – Basic Properties – Transform of Unit step function and Impulse function – Transform of Periodic function – Inverse Laplace Transform – Convolution Theorem (excluding Proof) – Initial and Final value Theorems – Solution of Linear ODE of Second order with constant coefficient using Laplace Transform techniques.

TOTAL: 45 + 15 HOURS

FURTHER READING:

1. Volume of Cylindrical and spherical polar co ordinates.
2. Application of Integral theorems in finding Volume/Area of Hemispheres, cylinders etc.

COURSE OUTCOMES: Employability.

On the Successful completion of the course, Students will be able to

CO1: Construct Analytic functions and trace the image of a region using transformation.
CO2: Solve complex integrals.
CO3: Apply multiple integral technique to find area and volume.
CO4: Compute surface and volume integral in vector field.
CO5: Apply Laplace Transform in solving Boundary value problems of second order ODE.

REFERENCES:

1. Veerarajan R., "Engineering Mathematics", updated second edition for Semester I and II, 2017.
2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2014.
3. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Sixth edition, Laxmi Publications Pvt. Ltd., 2014.
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
5. P.Kandasamy, K. Gunavathy and K. Thilagavathy, Engineering Mathematics, Volume II, S. Chand& Co., New Delhi, 2009.
6. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing, New Delhi, 2007.
7. Veerarajan R., "Engineering Mathematics", fifth Edition, Tata Mc Graw Hill Publishing Company, New Delhi, 2006.
8. M K Venkataraman, Engineering mathematics, Volume I, 2nd ed., National Publishing Co, 2003.
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10. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.htm

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1701PH203	MATERIALS SCIENCE (Common to B.E - Mech. & Civil Programmes)	L 3	T 0	P 0	C 3

COURSE OBJECTIVES:

1. To explain the properties of conducting, semiconducting and dielectric materials.
2. To impart fundamental knowledge in optical materials.
3. To understand the nature and application of different magnetic materials.

UNIT I ELECTRICAL PROPERTIES OF METALS **9 Hours**

Quantum free electron theory – Fermi – Dirac distribution function – Fermi energy and its variation with temperature – density of energy states – calculation of density of electrons and Fermi energy at 0 K – mean energy of electrons at 0 K – problem solving.

UNIT II SEMICONDUCTING PROPERTIES OF MATERIALS **9 Hours**

Introduction – elemental and compound semiconductors – intrinsic semiconductors: expression for number of electrons and holes – determination of carrier concentration and position of Fermi energy – electrical conductivity – band gap energy determination – carrier concentration in extrinsic semiconductors. Hall Effect theory and experimental determination – uses – problem solving.

UNIT III DIELECTRIC PROPERTIES OF MATERIALS **9 Hours**

Introduction – fundamental definitions in dielectrics – expression for electronic and ionic polarizations- orientation polarization – space charge polarization – Langevin – Debye equation – frequency and temperature effects on polarization – internal field – expression for internal field (cubic structure) – Clausius – Mosotti equation and its importance – applications of dielectric materials – problems solving.

UNIT IV OPTICAL PROPERTIES OF MATERIALS **9 Hours**

Introduction – optical absorption in metals, semiconductors and insulators. Fluorescence and phosphorescence. Light emitting diode: principle, construction, working and applications. Liquid crystal display: general properties – dynamic scattering display – twisted pneumatic display – applications – comparison between LED and LCD. Blue ray disc – principle – working.

UNIT V MAGNETIC PROPERTIES OF MATERIALS **9 Hours**

Introduction – orbital and spin magnetic moments – Bohr magneton – basic definitions – classification of magnetic materials – domain theory of ferromagnetism – process of domain magnetization – explanation of hysteresis curve based on domain theory – hard and soft magnetic materials, ferrites and spinels- applications.

TOTAL: 45 HOURS

FURTHER READING:

1. Giant magnetoresistance.

COURSE OUTCOMES: Employability | Entrepreneurship

On the Successful completion of the course, Students will be able to

CO1: Distinguish electrical properties of different kinds of conducting materials.
CO2: Identify the different types of semiconductors and its applications.
CO3: Categorize the various polarization mechanisms in dielectrics.
CO4: Choose the suitable material for the construction of display devices.
CO5: Select appropriate magnetic materials for magnetic storage devices.

REFERENCES:

1. William D. Callister, "Materials Science and Engineering an Introduction", John Wiley and Sons, Inc, 2010.
2. S.O. Pillai, "Solid State Physics", New Age International Publications, New Delhi, 2014.
3. M.N. Avadhanulu and P.G. Kshirsagar, "A Text Book of Engineering Physics", S. Chand & Company Ltd, New Delhi, 2011.
4. P.K. Palanisamy, "Physics for Engineers", Scitech Publications (India) Pvt. Ltd, Chennai, 2010.
5. V. Raghavan, "Materials Science and Engineering", Prentice Hall of India, New Delhi, 2010.
6. R.K.Gaur and S.L.Gupta, "Engineering Physics", Dhanpet Rai publications, New Delhi, 2010.

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1701CH201	ENVIRONMENTAL STUDIES	L	T	P	C
	(Common to all B.E. / B.Tech Degree Programmes)	3	0	0	3

COURSE OBJECTIVES:

1. Realize the interdisciplinary and holistic nature of the environment.
2. Understand how natural resources and environment affect the quality of life and stimulate the quest for sustainable development.
3. Recognize the socio-economic, political and ethical issues in environmental science.

UNIT I ECOSYSTEMS AND BIODIVERSITY **10 Hours**

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot – spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Documentation of the medicinal plants in your native place.

UNIT II NATURAL RESOURCES **10 Hours**

Forest resources: Use and over – exploitation, deforestation, case studies – timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Documentation of the effect of modern Agriculture in your nearby Village.

UNIT III ENVIRONMENTAL POLLUTION **9 Hours**

Definition – Source, causes, effects and control measures of: (a) Air pollution – Mitigation procedures – Control of particulate and gaseous emission, Control of SO_X, NO_x, CO and HC) – Technology for capturing CO_2 (metallo- organic frame works) (b) Water pollution – Waste water treatment processes. (c) Soil pollution – soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – role of an individual in prevention of pollution – pollution case studies. Documentation study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **8 Hours**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – environmental ethics: Issues and possible solutions – 12 Principles of green chemistry – consumerism and waste products – environment protection act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments – scheme of labeling of environmentally friendly products (Ecomark) central and state pollution control boards – disaster management: floods, earthquake – Public awareness. Analyze the recent steps taken by government of India to prevent pollution (Green India and Clean India).

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **8 Hours**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA) – GIS – remote sensing – role of information technology in environment and human health – Case studies. Documentation study of the Human health and the environment in nearby Hospital (Statistical report).

TOTAL: 45 HOURS

FURTHER READING:

Human rights: E – waste and biomedical waste – Identification of adulterants in food materials

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COURSE OUTCOMES: Employability.

On the Successful completion of the course, Students will be able to

CO1: Describe the importance of ecosystem and its conservation.
CO2: Differentiate various natural resources and the urgent need to conserve the natural resources.
CO3: Explain the different types of pollution and its effects.
CO4: Describe the various environmental protection acts.
CO5: Explain the major diseases, women, child development and the impacts of population explosion.

REFERENCES:

1. Trivedi. R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.
2. Cunningham, W.P.Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan. R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
5. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
6. https://en.wikipedia.org/wiki/Carbon_capture_and_storage
7. Ravikrishnan. A., "Environmental Science and Engineering", Sri Krishna Hi-tech Publishing Company Pvt. Ltd.

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1701GEX01	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to B.E. / B.Tech. – CSE, IT, CIVIL & MECH)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce basic electrical terminologies and laws
2. To impart knowledge on solving series and parallel circuits
3. To introduce about the three phase system
4. To explain the working principle of dc and ac machines, power plants
5. To familiarize about basic electronic components, circuits, transducers, digital logic and communication systems

UNIT I DC AND AC CIRCUIT FUNDAMENTALS **9 Hours**

Definition of terms - voltage, current, power, energy, active and passive elements; Ohm"s law and Kirchhoff"s laws; Series and parallel circuits; source transformation; equivalent resistance; star/delta conversion; Concepts of AC circuits - RMS and average values, form and peak factors, real and reactive power, power factor.

UNIT II THREE PHASE SYSTEM **9 Hours**

Introduction to three phase circuits; balanced and unbalanced system; phase and line parameters - relations; power measurement -voltmeter and ammeter method, two and three watt meter methods; Components of AC transmission and distributions systems (single line diagram approach).

UNIT III ELECTRICAL MACHINES AND POWER PLANTS **9 Hours**

Operating principle, classification and applications of DC generator, DC motor, transformer and induction motor (single phase); Power plants - Thermal power plant, hydroelectric power plant and nuclear power plant (Block diagram approach only).

UNIT IV SEMICONDUCTOR DEVICES AND TRANSDUCERS **9 Hours**

Characteristics of PN junction diode and zener diode; Rectifiers- Half wave and full wave rectifiers (qualitative treatment only); BJT – configurations; Amplifiers & Oscillators - definition, classification and applications; Transducers – classification, resistance temperature detector (RTD), linear variable differential transformer (LVDT).

UNIT V DIGITAL ELECTRONICS AND COMMUNICATION SYSTEMS **9 Hours**

Boolean algebra - Reduction of Boolean expressions; De-Morgan"s theorem; Logic gates - Implementation of Boolean expressions; Model of communication system - Analog and digital, Wired and wireless channel; Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system.

TOTAL: 45 HOURS

FURTHER READING:

1. Working principle and operation of Fax and ISDN
2. LED lightings

COURSE OUTCOMES: Employability / Entrepreneurship.

On the successful completion of the course, students will be able to

CO1: Remember the basic laws and fundamental concepts related to electrical, electronics and communication engineering
CO2: Apply basic concepts to solve problems in DC and AC circuits
CO3: Recall the principle of operation of DC & AC machines and power plants
CO4: Summarize the Boolean algebra and digital logic gates
CO5: Elucidate the characteristics of diode, BJT and applications of amplifiers and oscillators
CO6: Explain the operation of functional blocks of various communication systems

REFERENCES:

1. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, PHI Learning, 2010.
2. R.Muthusubramaniam, S.Salaivahanan and K.A.Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2004.
3. D.P.Kothari and I.J.Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI learning, New Delhi, 2004.
4. J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics", S K Kataria and Sons, Reprint 2012 Edition.
5. R.L.Boylestad and L.Nashelsky, "Electronic Devices and Circuit Theory", Pearson, 11th Edition, 2013.
6. George Kennedy and Bernard Davis, "Kennedy"s Electronic communication Systems", McGraw Hill Education, 5th Edition, 2011.
7. Donald P.Leach, Albert Paul Malvino and GoutamSaha, "Digital Principles and Applications", McGraw-Hill Education, 8th Edition, 2014.
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1701GEX02	ENGINEERING GRAPHICS (Common to all B.E. / B.Tech Degree Programmes)	L 2	T 2	P 0	C 3

COURSE OBJECTIVES:

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

CONCEPTS AND CONVENTIONS (Not for Examination) **2 Hours**

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING **10 Hours**

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

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of Objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **10 Hours**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **10 Hours**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **10 Hours**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **10 Hours**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only) **8 Hours**

Basics commands of AutoCAD- two dimensional drawing, editing, layering and dimensioning - coordinate Systems-Drawing practice - orthographic views of simple solids using AutoCAD.

FURTHER READING:

Applications of engineering graphics in students" discipline

TOTAL: 60 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

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CO1: Perform free hand sketching of basic geometrical constructions and multiple views of objects.
CO2: Do orthographic projection of lines and plane surfaces.
CO3: Draw projections and solids and development of surfaces.
CO4: Prepare isometric and perspective sections of simple solids.
CO5: Demonstrate computer aided drafting.

REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore,2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.

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1701GEX04	ENGINEERING MECHANICS (Common to B.E - Mech. & Civil Programmes)	L 2	T 2	P 0	C 3

COURSE OBJECTIVES:

1. To familiarize on various methods of adding and resolving various force systems in a real world environment.
2. To provide knowledge on understanding the effects of forces on a point and at a distance and to arrive at equivalent systems from the given force system.
3. To provide knowledge on various support conditions of a rigid body and deciding a support system for given condition.
4. To expose students with impact of geometries of load bearing systems and make them calculate moment of inertia of various cross sections.
5. To make students understand concepts of friction under various applications and make them calculate frictional forces induced.

UNIT I BASIC CONCEPTS AND FORCE SYSTEM **5 Hours**

Introduction to mechanics - idealization of mechanics - laws of mechanics - principle of transmissibility - vector - addition, subtraction and product. Force- types - system of forces - resultant forces - composition of forces - resolution of force-free body diagram for real world systems.

UNIT II STATICS OF PARTICLES AND FORCE SYSTEM **6 Hours**

Equilibrium of particle in space, moment of couple-equilibrant Moment about point and specific axis-moment at couple- simplification of force and couple systems.

UNIT III STATICS OF RIGID BODIES **7 Hours**

Equilibrium of rigid bodies in two and three dimensions - beams - types of loads, supports and their reactions Two and three force Members-Static determinacy.

UNIT IV PROPERTIES OF SURFACES AND SOLIDS **7 Hours**

Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas Parallel axis theorem radius of gyration of area- product of inertia- mass moment of inertia.

UNIT V FRICTION **5 Hours**

Introduction - mechanism of friction-types -laws of friction - friction on horizontal and inclined planes, ladder and wedge friction - rolling resistance.

FURTHER READING:

Moment of Inertia of flywheel - Internal force of a member - Equilibrium of rigid bodies in three dimensions: Ball and socket joint.

TOTAL: 30 + 15 HOURS

COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

CO1: Draw a free body diagram from the given real world system and add or subtract or resolve the forces involved in the system.

CO2: Calculate the moment created by the applied force with reference to any reference in a three dimensional space.

CO3: Determine the appropriate support system for the given real world system by calculating the reactions generated.

CO4: Suggest suitable cross section or geometry for a load bearing support to prevent it from collapsing due to bending.

CO5: Calculate the frictional force involved in various real world systems.

REFERENCES:

1. F.P. Beer, and Jr. E.R Johnston, Vector Mechanics for Engineers - Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2007.
2. N.H. Dubey, Engineering Mechanics- Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2013.
3. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt. Ltd., 2006.
4. R.C. Hibbeller, Engineering Mechanics: Combined Statics & Dynamics, Prentice Hall, 2009.
5. D. P. Sharma, Engineering Mechanics, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2010.
6. S. Rajasekaran and G. Sankara subramanian, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.

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1701GEX52	COMMUNICATION SKILLS LAB (Common to all B.E. / B.Tech Degree Programmes)	L 0	T 0	P 2	C 1

COURSE OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. To improve the students" fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts
2. Further, they would be required to communicate their ideas relevantly and coherently in writing.
3. To prepare all the students for their placements.

LIST OF EXPERIMENTS: The following course content to conduct the activities is prescribed for the Communication Skills Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary –** Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** - General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** - Structure and presentation of different types of writing - letter writing/ Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing - planning for writing - improving one's writing.
4. **Activities on Presentation Skills** - Oral presentations (individual and group) through JAM sessions / seminars / PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.
5. **Activities on Group Discussion and Interview Skills** - Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS:

Phonetics

COURSE OUTCOMES: Skill Development

On the successful completion of the course, students will be able to

CO1: Accomplishment of sound vocabulary and its proper use contextually.
CO2: Flair in Writing and felicity in written expression
CO3: Enhanced job prospects.
CO4: Effective Speaking Abilities.

REFERENCES:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson, 2007. Cengage Learning pvt. Ltd. New Delhi
4. English Vocabulary in Use series, Cambridge University Press 2008.
5. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw Hill 2009.
7. Books on TOFEL/ GRE/ GMAT/ CAT/ IELTS by Barron's/ DELTA/ Cambridge University Press.

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1701HS251 **PHYSICS AND CHEMISTRY LABORATORY-II**
(Common to all B.E. / B.Tech Degree Programmes)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills.
3. To bring confidence and ability to develop and fabricate engineering and technical equipments.
4. To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

PHYSICS

LIST OF EXPERIMENTS:

1. Using lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.
2. Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.
3. With the aid of spectrometer, find the angle of Prism and refractive index of the medium.
4. Determine the wavelengths of polychromatic source in the visible region using spectrometer grating.
5. Find the depression at the midpoint of the given wooden beam subjected to non-uniform bending and determines the Young"s modulus of the material of the beam.
6. Find the given unknown resistance using Carey-Foster"s Bridge.

CHEMISTRY

LIST OF EXPERIMENTS:

1. Conductometric Precipitation titration of $BaCl_2$ Vs Na_2SO_4
2. Estimation of dissolved oxygen in a water sample/sewage by Winklers method.
3. Estimation of chloride content in water by argentometric method.
4. Conductometric titration of mixture of acids.
5. Comparison of alkalinities of the given water samples.

Additional Experiments:

1. Estimation of heavy metals in the given solution by EDTA method.
2. Determination of concentration of unknown colored solution using spectrophotometer.

COURSE OUTCOMES: Employabilim.

On the successful completion of the course, students will be able to

TOTAL: 30 HOURS

CO1 : Realize the concept of properties of matter and apply the same for practical applications. CO2 : Identify the suitable laser source for fiber optic communication applications.
CO3 : Determine the velocity of ultrasonic waves and apply the same for day today applications. CO4 : Classify the different types of crystal structures and analyze their properties.
CO5 : Comprehend the efficacy of quantum equations in modern areas. CO6 : Illustrate the EMF of the Redox reaction.
CO7 : Compare the Alkalinity of given water Sample with their standards. CO8 : Identify the Concentration of metal ion present in water sample.
CO9 : Outline the precipitation titration using Conductivity meter.
CO10: Interpret the dissolved oxygen present in the water.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New

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1701MA301	ENGINEERING MATHEMATICS III (Common to B.E - Civil, CSE, EEE, Mech	L 3	T 2	P 0	C 4

PREREQUISITE :

1. Engineering Mathematics I
2. Engineering Mathematics II

COURSE OBJECTIVES:

1. To introduce Fourier series analysis and applications in Engineering, apart from its use in solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I FOURIER SERIES **12 Hours**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis – Simple Applications

UNIT II FOURIER TRANSFORMS **12 Hours**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Formation of partial differential equations – Singular integrals — Solutions of standard types of first order partial differential equations – Lagrange's linear equation — Linear partial differential equations of second order with constant coefficients of homogeneous type- Applications

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT V Z – TRANSFORMS AND DIFFERENCE EQUATIONS **12 Hours**

Z - transforms – Elementary properties – Inverse Z – transform (using partial fraction and residues) – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Linear Algebra
2. Numerical Solution of non-homogeneous partial differential equations

COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

CO1 Use Fourier series analysis which is central to many applications in engineering
CO2 Apply Fourier transform techniques used in wide variety of situations
CO3 Compute the solution of partial differential equations
CO4 Solve boundary value problem using partial differential equation
CO5 Apply Z transform techniques for discrete time systems

REFERENCES:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007
4. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, New Delhi, 2008.
5. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
6. www.nptelvideos.in/2012/11/mathematics-iii.html

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1701ME301 **ENGINEERING THERMODYNAMICS** **L T P C**
3 2 0 4

UNIT I INTRODUCTION AND ZEROTH LAW OF THERMODYNAMICS **12 Hours**

Macroscopic and Microscopic approaches, Definitions and concepts- heat, work, thermodynamic equilibrium, system and types, surroundings, Properties- intensive and extensive properties, Path and point functions, Energy- macroscopic and microscopic modes of energy, Thermodynamic processes and cycle, State postulate, Zeroth law of thermodynamics- temperature scale, perfect gas scale.

UNIT II FIRST LAW OF THERMODYNAMICS **12 Hours**

First law of thermodynamics, I law for Closed systems - constant pressure process, constant volume process, constant temperature process, adiabatic process, polytropic process, throttling process. I law for open systems -Steady state flow processes, Steady flow energy equation (SFEE), Application of SFEE-turbines and compressors, nozzles and diffusers, throttling valves, heat exchangers.

UNIT III SECOND LAW OF THERMODYNAMICS **12 Hours**

Limitations of I law of thermodynamics, Second law of thermodynamics- Kelvin - Planck and Clausius statements, Heat Engine, heat pump and refrigerator, Reversibility and irreversibility- irreversible and reversible processes, Carnot's principles, Carnot cycle, Carnot engine, Thermodynamic temperature scale, Clausius inequality, Entropy- principle of entropy increase, Availability & irreversibility – Introduction about third law of thermodynamics.

UNIT IV PROPERTIES OF PURE SUBSTANCES **12 Hours**

Thermodynamic properties of fluids. Pure substance-phases - Phase change processes, Property diagrams - pressure-volume (P-v), pressure-temperature (P-T), temperature volume (T-v), temperature entropy (T-s) and enthalpy-entropy (h-s) diagrams. Steam tables - Problems on flow and non-flow processes.

UNIT V GAS MIXTURES AND PSYCHROMETRIC PROPERTIES **12 Hours**

Thermodynamics of ideal gas mixture- mixture of ideal gas, mixture of perfect gases, Dalton's law ofpartial pressure, Amagat's law, Thermodynamics properties, Ideal gas – equation of state, Van derWaals equation and compressibility chart.Psychrometric properties and processes – Psychrometric chart.

FOR FURTHER READING – SEMINAR – CPS **Total: 60 Hours**

Thermodynamic property relations- Maxwell relations, TDS equations, The Clapeyron equation, Joule- Thompson expansion.

COURSE OUTCOMES: Employability.

	Competency	Cognitive level
CO1	Understand concepts and principles of thermodynamics.	**Understand**
CO2	Utilize first law of thermodynamics for closed and open systems.	**Apply**
CO3	Use second law of thermodynamics for heat Engine, heat pump and refrigerator.	**Apply**
CO4	Explain thermodynamic properties of pure substances and its phase change processes.	**Understand**
CO5	Determine properties of gas mixtures.	**Understand**
CO6	Make use of psychometric properties in Air conditioning process.	**Apply**

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1702ME302 ENGINEERING MATERIALS AND METALLURGY **L T P C**

3 0 0 3

PREREQUISITE :

1. Materials Science

2. Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To provide knowledge on physical metallurgy of metals through the study of phase diagrams.

2. To study the properties and applications of various metals and alloys used in engineering industries.

3. To expose various heat treatment processes of steels.

4. To study the properties and applications of polymers and ceramics.

5. To impart knowledge on mechanical properties evaluation and testing methods of engineering materials.

UNIT I PHASE DIAGRAMS AND CONSTITUTION OF ALLOYS **9 Hours**

Alloys, Solid solutions - Phase diagram, phase rule, lever rule, Binary phase diagram -Isomorphous, eutectic, peritectic, eutectoid reactions - Iron-Carbon phase diagram - Metallography, microstructure.

UNIT II ENGINEERING METALS AND ALLOYS **9 Hours**

Classification of Engineering materials - Ferrous metals -Plain carbon steel (low, medium and high carbon steels), microstructure/composition, properties, applications - Alloy steels, effect of alloying additions on steels - stainless steels, High Strength Low Alloy Steels (HSLA), maraging and tool steels - Cast iron - grey, white, malleable, spheroidal graphite cast iron, microstructure, properties, applications – Non-ferrous metals - Nickel, Copper, Titanium, Aluminium, Magnesium, Zinc alloys, properties and applications - Bearing materials.

UNIT III HEAT TREATMENT OF STEELS **9 Hours**

Purpose of heat treatment - Annealing (stress relief, recrystallization, spheroidizing) -Normalizing - Hardening and Tempering, Isothermal transformation diagrams (T-T-T diagrams), Cooling curves superimposed on T-T-T diagrams (martensite and bainite phase formation) -Hardenability, Jominy end quench test, Case hardening processes, carburizing, nitriding, carbontiriding, cyaniding, flame hardening, induction hardening.

UNIT IV INTRODUCTION TO POLYMERS AND ENGINEERING CERAMICS 9 Hours

Polymers - Plastics and elastomers - Thermoplasts and thermosets, properties and applications (polyethylene, polypropylene, polyurethane, polystyrene, poly vinylchloride, polymethyl methacrylate, polyethylene terapthalate, polycarbonate, polyamide, acrylonitrile butadiene styrene, polyamide, polyamideimide, polypropyleneoxide, polypropylene sulphide, polyetheretherketone, polytetrafluroethylene, urea formaldehyde, phenol formaldehyde, polyester, nylon, epoxy) – Rubber and its types - Types of Ceramics and applications.

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UNIT V MECHANICAL PROPERTIES AND MATERIALS TESTING **9 Hours**

Elastic and plastic deformation, slip and twinning - Tensile test, stress-strain behavior of ductile and brittle materials - Stress-strain behaviour of elastomers – Visco elasticity - Compression test – Hardness and testing methods -Impact test - Fatigue test, Stress vs number of cycles (S-N) curve, endurance limit, factors affecting fatigue - Creep test, creep curves -Types of fracture - Fracture toughness – Three crack propagation modes.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Review on Super alloys, Shape memory alloys, Composite Materials, Case studies in Metallurgical failure analysis.

COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

CO1 Understand phase diagrams of different engineering materials.

CO2 Recognize the properties and applications of various metals and alloys.

CO3 Identify appropriate heat treatment processes for the given applications.

CO4 Awareness on various non metals, its manufacturing techniques and various applications.

CO5 Test the mechanical properties of the given materials for real-time applications.

CO6 Understand phase diagrams of different engineering materials.

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1702ME303 **FLUID MECHANICS AND MACHINERY** **L T P C**
3 0 0 3

Course Objectives

1. To study the fluid laws, properties and measurements.
2. To expose various fluid flow measuring devices and calculate the flow losses in pipes.
3. To learn the concept of dimensional analysis and model analysis.
4. To impart knowledge on various types of hydraulic turbines and performance curves.
5. To gain knowledge on working principles and performance analysis of fluid pumps.

UNIT I INTRODUCTION TO FLUID AND FLUID MOTION **7 Hours**

Fluid- Fluid mechanics -Laws of Fluid Mechanics-Properties of fluid and its Application-Types of fluid Types of fluid Flow-Measurement of Pressure-U-tube and differential manometer- Measurement of velocity using Discharge -Flow characteristics-Momentum -continuity equation.

UNIT II FLUID DYNAMICS AND FLUID FLOW OVER CONDUITS **11 Hours**

Forces acting on a fluid element- Eulers and Bernoulli theorem Application in internal and external flows measuring instruments - Major losses and Minor losses in pipes using standard charts and tables pipes in series and pipes in parallel. - Darcy Weisbach equation. Identification of laminar and turbulent flow in closed conduits, flow in circular pipe.

UNIT III DIMENSIONAL AND MODEL ANALYSIS **9 Hours**

Need for dimensional analysis dimensional analysis using Buckingham pi theorem - Similitude types of similitude - Dimensionless parameters- application of dimensionless parameters Model analysis through Reynolds and Froudes Model law.

UNIT IV HYDRAULIC TURBINES **9 Hours**

Definition of turbine Classification -Types of head and efficiencies of turbine-Impulse turbine - Reaction turbine-Francis turbine, Kaplan turbine - working principles and velocity triangle- Work done by water on the runner Specific speed - unit quantities performance curves.

UNIT V HYDRAULIC PUMPS **9 Hours**

Definition -Centrifugal pump Classification Construction working principle and velocity Triangle Definition of heads-Losses and efficiencies-Multistage Centrifugal pump-Specific speed Priming and cavitation effects of centrifugal pump. Reciprocating pump Classification Working Principle Coefficient of discharge and slip-Indicator diagram (Descriptive treatment only).

FOR FURTHER READING – SEMINAR – CPS **Total: 45 Hours**

Case study simple experiments /analyzing the properties of fluid Analyzing the torcelli equation by a simple experiment

COURSE OUTCOMES: Employability | Entrepreneurship

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

	Competency	Cognitive level
CO1	Explain various properties of fluids and flow measurements.	Understand
CO2	Calculate the energy losses in pipes.	Apply
CO3	Explain the dimensional analysis of fluids.	Understand
CO4	Determine the performance characteristics of hydraulic turbines.	Apply
CO5	Calculate the performance characteristics of hydraulic pumps.	Apply

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1702ME304 **STRENGTH OF MATERIALS** **L T P C**

3 0 2 4

Course Outcomes (COs):

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

Employability / Entrepreneurship

	Competency	Cognitive level
CO1	Calculate various stresses and strain of rigid and deformable bodies.	Understanding
CO2	Determine shear force and bending moments for various beams.	Understanding
CO3	Measure torsional strength of a circular shaft	Applying
CO4	Measure stiffness and modulus of rigidity for helical springs.	Applying
CO5	Measure the slope and deflection of beams.	Applying
CO6	Calculate the strssses of cylinderical and spherical shells.	Understanding

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS **6 Hours**

Introduction to material properties. Stresses and strains due to axial force, shear force, impact force and thermal effect-stepped and composite bars-uniformly varying cross section. Stress-strain curve for ductile and brittle materials Hooke-law - Factor of safety Poisson-ratio. Elastic constants and their relationship.

UNIT II ANALYSIS OF STRESSES IN TWO DIMENSIONS **6 Hours**

State of stresses at a point- Normal and shear stresses on inclined planes - Principal planes and stresses Plane of maximum shear stress - Mohrs -circle for biaxial stress with shear stress. Hoop and longitudinal stresses in thin cylindrical and spherical shells - Changes in dimensions and volume.

UNIT III LOADS AND STRESSES IN BEAMS **6 Hours**

Types of beams- Supports and Loads, Shear force and Bending Moment in beams, Cantilever, simply supported and overhanging beams - Point of contra flexure. Theory of simple bending - bending and shear stress - stress variation along the length and section of the beam, Section modulus.

UNIT IV DEFLECTION OF BEAMS AND COLUMNS **6 Hours**

Slope and Deflection of cantilever, simply supported ,Double integration method and Macaulay's method. Columns- types- Equivalent length Euler and Rankine formulae- Slenderness.

UNIT V TORSION IN SHAFT AND HELICAL SPRING **6 Hours**

Analysis of torsion of circular solid and hollow shafts-stepped shaft-compound shaft- Shear stress distribution, angle of twist and torsional stiffness. Closed coil helical spring- stresses and deflection under axial load-Maximum shear stress in spring section.

FOR FURTHER READING – SEMINAR – CPS **Total 60 Hours**

:

Fatigue, shear flow, shear center, thick wall pressure vessels and bending of curved beams. Open coil spring -stresses and deflection.

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EXPERIMENT 1 **2 Hours**

Find the hardness of the material using Rockwell hardness tester.

EXPERIMENT 2 **2 Hours**

Calculate the hardness of the material using Brinell hardness tester.

EXPERIMENT 3 **2 Hours**

Experimentally calculate the strain energy of a material subjected to impact loading.(Izod testing)

EXPERIMENT 4 **4 Hours**

Experimental analysis of an axial bar under tension to obtain the stress strain curve and the strength.

EXPERIMENT 5 **2 Hours**

Determine the Young-modulus and stiffness of a metal beam through load deflection curve.

EXPERIMENT 6 **4 Hours**

Experimentally calculate the compressive strength of the materials.

EXPERIMENT 7 **2 Hours**

Experimental analysis of a bar under shear stress strain curve and the strength.

EXPERIMENT 8 **4 Hours**

Experimentally calculate the strain energy of a material subjected to impact loading.(Charpy testing)

EXPERIMENT 9 **4 Hours**

Determination of spring constant through load vs deflection curve.

EXPERIMENT 10 **4 Hours**

Experimental analysis of a bar under torsion to obtain stiffness and angle of twist.

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Reference(s)

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning Pvt. Ltd, New Delhi, 2010.
S.S. Rattan, Strength of Materials, Tata McGraw Hill, Delhi, Second Edition, 2011.
3. D. K. Singh, Mechanics of Solids, Pearson Education New Delhi, 2006.
4. F. P. Beer and R. Johnston, Mechanics of Materials, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, Third edition,2002.
5. 5.B. K. Sarkar, Strength of Materials, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, Second Reprint, 2007.
6. http://www.nptel.ac.in/courses/Webcourse-contents/IITROORKEE/strength%20of%20materials/homepage.htm

1702ME305	MANUFACTURING TECHNOLOGY – I	L	T	P	C
		3	0	0	3

PREREQUISITE :

Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To study the sand casting and few special casting processes.
2. To learn various metal joining processes.
3. To provide the knowledge on various bulk deformation processes.
4. To expose knowledge on sheet metal and special forming processes.
5. To learn the various moulding and forming processes of plastics.

UNIT I CASTING PROCESSES **9 Hours**

Introduction to production processes and its classifications - Pattern - Types, Materials and Allowances. Moulding sand - Types, Properties and Testing. Moulding machines and its types. Melting furnaces - Cupola and Induction. Fettling and cleaning. Sand casting defects. Special casting processes - Shell moulding, Die casting, Centrifugal casting and Investment casting.

UNIT II METAL JOINING PROCESSES **9 Hours**

Introduction to welding processes and its classifications - Principle of Gas welding and its flames - Principle of arc welding - Electrodes, Fluxes and filler materials. Principle of Resistance welding - Spot, butt and seam. Principle of Gas metal arc welding, Submerged arc welding, Tungsten Inert Gas welding, Plasma arc welding, Thermit welding, Electron beam welding and Friction welding - Weld defects - Brazing and soldering.

UNIT III BULK DEFORMATION PROCESSES **9 Hours**

Introduction - Hot and cold working of metals - Forging processes - Open and close die forging, Forging equipment and operations. Rolling - Types of Rolling mills, shape rolling operations, Tube piercing and Defects. Principle of Extrusion and its types. Principle of rod and wire drawing.

UNIT IV SHEET METAL FORMING AND SPECIAL FORMING PROCESSES **9 Hours**

Introduction - Shearing, bending and drawing operations - Stretch forming operations - Principle of special forming processes - Hydro forming, Rubber pad forming, Metal spinning, Explosive forming, Magnetic pulse forming, Peen forming and Super plastic forming.

UNIT V MOULDING AND FORMING OF PLASTICS **9 Hours**

Introduction to plastics - Moulding of Thermoplastics - Principle and applications of Injection moulding and its types, Blow moulding, Rotational moulding, Thermoforming and Extrusion. Moulding of Thermosets - Principle and applications of Compression moulding and Transfer moulding Bonding of Thermoplastics - Fusion and solvent methods.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Automation in moulding - Underwater welding - Sequence of operations for producing a fan blade - Production of thermoplastic film, Inspection methods.

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COURSE OUTCOMES: Employability / Entrepreneurship.

On the successful completion of the course, students will be able to

CO1	Produce simple components using sand casting process,moulding machines and melting furnaces.
CO2	Explain the principle of special casting processes and defects in sand casting.
CO3	Use various metal joining processes (Arc welding,Gas welding,Brazing and Soldering).
CO4	Explain the various metal forming processes(forging,rolling,drawing and extrusion).
CO5	Produce simple sheet metal components using sheet metal operations and also describe the principle of advanced sheet metal processes.
CO6	Elaborate concepts of advanced moulding techniques to manufacture plastic components.

REFERENCES

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company rivate Limited, New Delhi, 2010.
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013
3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2013
4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi, 2010
5. S K Hajra Choudhury, Elements of Workshop Technology - Vol. I, Media Promoters & Publishers Private Limited, Mumbai,2013.
6. http://nptel.ac.in/courses/112107144/1.

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1702ME351	MACHINE DRAWING	L	T	P	C
		1	0	2	2

UNIT I LIMITS, FITS AND TOLERANCES **5 Hours**

Limit System- Tolerance, Limits, Deviation, Actual Deviation, Upper Deviation, Lower Deviation, Allowance, Basic Size, Design Size, Actual Size. Fits- Types, Tolerances of Form and Position- Form and Position Variation, Geometrical Tolerance, Tolerance Zone, Indicating Geometrical Tolerances. Indication of Surface Roughness, Standard Abbreviations and Symbols used in industries.

UNIT II SECTIONAL VIEWS **5 Hours**

Sections- Hatching of Sections, Cutting Planes, Revolved or Removed Section, Sectional Views- Full Section, Half Sections and Auxiliary Sections- Conventional Representation-One-view, Two-view and three view Drawings.

UNIT III INTRODUCTION TO MACHINE ELEMENT DRAWINGS **5 Hours**

Drawing standards and Designation of Bolts, nuts, screws, keys, pins, Rivets, Welded Joints Dimensioning of Welds, Belt Driven Pulleys, Chain and Gears Drives

UNIT IV ASSEMBLY DRAWINGS AND SECTIONAL VIEWS **8 Hours**

Preparation of manual parts drawing and assembled sectional views from orthographic part drawings, Automobile components - stuffing box, Machine Tool Parts – plummer block, Joints – knuckle joints, Couplings – Protected type flanged coupling, Bearings – swivel bearing, Preparation of Bill of materials and tolerance data sheet.

UNIT V REAL PRODUCTS TO MACHINE DRAWING CONVERSION **7 Hours**

Preparation of manual parts drawing and assembled sectional views from real time products- Internal combustion engine parts - connecting rod, couplings – universal coupling, machine tool parts – tailstock, Automobile components – screw jack, stuffing box - Commercial products - Preparation of Bill of materials and tolerance data sheet.

TOTAL: 30 HOURS

REFERENCES:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing House Pvt. Ltd., 2014.
2. P.S. Gill, A Textbook of Machine Drawing, Katson books, 2013.
3. R.K. Dhawan, A Textbook of Machine Drawing, S. Chand,2012.
4. K.C. John, Textbook of Machine Drawing, PHI Learning Pvt. Ltd.,2009.
5. http://nptel.ac.in/syllabus/112106075/

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Course Outcomes (COs): Employability.

CO Number	Competency
CO1	Use limits, fits and tolerances in real world problems. (K3)
CO2	Apply different sectional views in drawings. (K3)
CO3	Recognize the drawing notations of standard machine elements. (K2)
CO4	Draw the assembly drawing. (K3)
CO5	Draw the detailed drawing of given components. (K3)
CO6	Prepare Bill of materials and tolerance data sheet for given components. (K3)

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1702ME352 MANUFACTURING TECHNOLOGY LAB - I **L T P C**
0 0 2 1

PREREQUISITE :

Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To provide exposure to the students with hands on experience of centre lathe and Capstan lathe.
2. To provide exposure to the students with hands on experience of various taper, thread cutting and eccentric operations.
3. To provide exposure to the students with hands on experience of various fit, (push, pull, clearance) operations and measurement of cutting forces.

LIST OF EXPERIMENTS:

1. Taper Turning using Tailstock set over method
2. Taper Turning using Compound rest method
3. External Thread cutting
4. Internal Thread Cutting
5. Eccentric Turning
6. Knurling
7. Push fit
8. Clearance fit
9. Force fit
10. Measurement of cutting forces in turning process
11. Simple turning using capstan lathe.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. Drilling and tapping
2. Grooving operation

COURSE OUTCOMES: Employability | Entrepreneurship.

On the successful completion of the course, students will be able to

CO1 Use lathe machine to manufacturing eccentric turning operations.
CO2 Use lathe machine to manufacturing Various tapper turning operations.
CO3 Use various different machine tools for finishing operations of simple step turning in capstan lathe.
CO4 Use lathe machine to manufacturing thread cutting operations.
CO5 Experience on various fits operations in lathe machines.
CO6 Lathe tool dynamometer for measuring the cutting forces.

REFERENCES:

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company rivate Limited, New Delhi, 2010.
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013.
3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2013.
4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi, 2010.
5. S K Hajra Choudhury, Elements of Workshop Technology - Vol. I, Media Promoters & Publishers Private Limited, Mumbai, 2013.
6. http://nptel.ac.in/courses/112107144/1.

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1704ME353-TECHNICAL SEMINAR I

COURSE OBJECTIVES:

1. To develop self-learning skills of utilizing various technical resources to make a technical presentation. 2. To promote the technical presentation and communication skills.

3. To impart the knowledge on intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds.

4. To promote the ability for Interacting and sharing attitude.

5. To encourage the commitment-attitude to complete tasks.

The students are expected to make two presentations on advanced topics (recent trends) related to II year/ III semester subjects. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Students are encouraged to use various teaching aids such as power point presentation and demonstrative models.

TOTAL: 30 HOURS

COURSE OUTCOMES: Skill Development

On the successful completion of the course, students will be able to

CO1	Identify and utilize various technical resources available from multiple fields.
CO2	Improve the technical presentation and communication skills.
CO3	Improve communicative competence.
CO4	Interact and share their technical knowledge.
CO5	Understand and adhere to deadlines and commitment to complete the assignments.

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1702ME354 FLUID MECHANICS AND MACHINERY LAB L T P C

0 0 2 1

PREREQUISITE :

Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To demonstrate the principles of fluid mechanics
2. To measure the energy losses in a pipe flow.
3. To perform characteristic study on impulse, reaction and axial flow turbines.
4. To perform characteristic study on positive displacement pumps.
5. To perform characteristic study on non-positive displacement pumps.

LIST OF EXPERIMENTS:

1. Experimental verification of Bernoulli's theorem in a pipe flow.
2. Measurement of flow rate using venturimeter and calculate the coefficient of discharge
3. Measurement of flow rate using orificemeter and calculate the coefficient of Discharge.
4. Performance test on tangiantial flow impulse (Pelton wheel) turbine against constant head
5. Performance test on Francis turbine against constant head.
6. Performance test on reaction (Kaplan) turbine against constant head.
7. Performance characteristics of a reciprocating pump
8. Performance characteristics of a gear pump
9. Performance test on centrifugal pump
10. Performance test on submersible pump
11. Determination of loss of head in different pipes (major loss) and fittings (minor loss) for various flow rates.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. Measurement of coefficient of friction in flow through pipes

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COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

1. Understand the various basic experience in flow of measurements.
2. Measure the major and minor losses associated in a pipe flow.
3. Experimental verification of Bernoulli's theorem in a pipe flow.
4. Perform the characteristics study on impulse ,reaction and axial turbine.
5. Perform the characteristics study on different types of water pumps.
6. Perform the characteristics study on gear oil pump.

REFERENCES:

1. R.K.Bansal, A Textbook of Fluid Mechanics and Machinery, Laxmi Publications Ltd., New Delhi, Revised Ninth edition, 2014.

2. Bruce R Munson , Donald F Young, Theodore H Okiishi and Wade W. Huebsch, Fundamentals of Fluid Mechanics, John Wiley & Sons, Sixth edition 2009.

3. Pijush K Kundu and Ira M Cohen, Fluid Machines, Academic Press, Burlington, United states of america, 2010.

4. Yunus Cengel and John Cimbala, Fluid Mechanics Fundamentals and Application, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi 2009.

5. Robert and W Fox, Introduction to Fluid Machines, John Wiley Eastern Pvt. Ltd., New Delhi, 6th edition ,2006.

6. http://nptel.ac.in/courses/112105182/

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1704GE351	LIFE SKILLS : SOFT SKILLS (Common to all B.E / B.Tech Degree Programmes)	L	T	P	C
		0	0	2	0

PREREQUISITE :

1. Technical English
2. Communicative English

COURSE OBJECTIVES:

1. To develop the students basic soft skills and enable them to get a job.
2. To develop the students' interpersonal skills and to enable them to respond effectively.
3. To develop the students selling skills and to enable them to apply in their interview process.
4. To develop the students' Corporate Etiquettes and enable them to respond effectively.
5. To develop the students' learning by practice of giving different situations.

UNIT I INTRODUCTION TO SOFT SKILLS **6 Hours**

Soft Skills an Overview - Basics of Communication – Body Language – Positive attitude –Improving Perception and forming values – Communicating with others.

UNIT II TEAM Vs TRUST **6 Hours**

Interpersonal skills – Understanding others – Art of Listening - Group Dynamics – Networking - Individual and group presentations - Group interactions – Improved work Relationship .

UNIT III SELLING ONESELF **6 Hours**

How to brand oneself – social media – job hunting – Resume writing – Group Discussion – Mock G.D - .Interview skills – Mock Interview

UNIT IV CORPORATE ETIQUETTES **6 Hours**

What is Etiquette – Key Factors – Greetings – Meeting etiquettes – Telephone etiquettes – email etiquettes – Dining etiquettes – Dressing etiquettes – Rest room etiquettes – Life etiquettes.

UNIT V LEARNING BY PRACTICE **6 Hours**

1. My family. Myself. 2. Meeting people. Making Contacts. 3. A city. Getting about town. 4. Our flat. Home life.5. Travelling. Going abroad. 6. Going through Customs. 7. At a hotel. 8. Shopping. 9. Eating out. 10. Making a phone call. 11. A modern office.12 Discussing business.

TOTAL: 30 HOURS

ASSSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

COURSE OUTCOMES: Skill Development -

On the successful completion of the course, students will be able to

CO1 Communicate effectively in their business environment.
CO2 Improve their interpersonal skills which are mandatory in a corporate world.
CO3 Brand themselves to acquire a job.
CO4 Involve in corporate etiquettes.
CO5 Survive in the different situations.

REFERENCES:

1. Dr.K.Alex, 'Soft Skills' Third Edition, S.Chand & Publishing Pvt Limited, 2009
2. Aruna Koneru, 'Professional Communication' Second Edition, Tata McGraw-Hill Education, 2008
3. D.K.Sarma, 'You & Your Career' First Edition, Wheeler Publishing & Co Ltd, 1999
4. Shiv Khera 'You Can Win' Third Edition, Mac Millan Publisher India Pvt Limited, 2005

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1702MA403 NUMERICAL METHODS AND STATISTICS L T P C

(Common to B.E - Civil, EEE and Mech.) 3 2 0 4

PREREQUISITE:

1. Engineering Mathematics I 2.Engineering Mathematics II 3.Engineering Mathematics III

COURSE OBJECTIVES:

1.To sole the engineering problem, by use of numerical tools

2.To understand the concept of interpolation

3.To analyze the population and samples using statistics techniques

UNIT I INTERPOLATION AND APPROXIMATION 12 Hours

Interpolation with unequal intervals - Lagrange's interpolation – Newton"s divided difference interpolation – Interpolation with equal intervals – Newton"s forward and backward difference formulae.

UNIT II NUMERICAL DIFFERENTIATION 12 Hours

Approximation of derivatives using interpolation polynomials-Taylor"s series method – Euler"s method - Modified Euler"s method - Fourth order Runge-Kutta method for solving first order equations

Unit III NUMERICAL INTEGRATION 12 Hours

Numerical integration using Trapezoidal, Simpson"s 1/3 rule – Romberg"s method - Two point and three Point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson"s 1/3 rules.

UNIT IV SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 12 Hours

Solution of algebraic and transcendental equations - Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel

UNIT V TESTING OF HYPOTHESIS 12 Hours

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit

TOTAL: 60 HOURS

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FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1.Finding Eigen value using power method 2.Cubic Spline

COURSE OUTCOMES: Skill Development

After completion of the course, Students will be able to

CO1: To find the intermediate values, when huge amounts of experimental data are involved. CO2: To solve first order differential equation using Numerical methods

CO3: To perform Integration using Numerical methods

CO4: To solve algebraic and transcendental Equations numerically CO5: Analyses the statistical data

REFERENCES:

1. Johnson R.A.Gupta C. B, Miller and Freunds Probability and statistics for Engineers, 7th edition ,Pearson Education,2007

2. Grewal B.S and Grewal J.S, Nummerical methods in Engineering and Science, 6th edition, Khanna Puplishers,2004

3. Walpole R.E. Myers S.L ,Ye.K, Probability and statistics for Engg and scientists, 8th edition Pearson education,2007

4. Gerald C.F Wheatley P.O, Applied Numerical Analysis, 6th edition ,Pearson education Asia 2006

5. Nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html

6. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.html

7. www.indiastudychannel.com

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1702ME401 **THERMAL ENGINEERING** **L T P C**
3 2 0 4

UNIT I GAS POWER CYCLES **12 Hours**

Air standard cycles -Otto, Diesel and Dual Calculation of mean effective pressure and air standard efficiency. Gas turbine power plant cycle, Brayton cycle, expression for efficiency, work ratio.

UNIT II INTERNAL COMBUSTION ENGINES **12 Hours**

Internal combustion engines - Classification - Components and functions - Comparison. Valve Timing diagram and port timing diagram - Fuel supply systems - Ignition Systems Lubrication system and cooling system. Performance calculation, Heat balance sheet preparation- Air-fuel ratio calculation- Knocking and detonation.

UNIT III STEAM NOZZLES AND TURBINES **12 Hours**

Flow of steam through Nozzles-Shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles- Compounding of Turbines - velocity diagrams for simple and multistage turbines- Speed regulations- Governors.

UNIT IV AIR COMPRESSOR **12 Hours**

Classification and working Principle-Work of compression with and without clearance, volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling, Work of multistage air compressor. Rotary compressors- Centrifugal, vane and roots blowers

UNIT V REFRIGERATION AND AIR-CONDITIONING **12 Hours**

Vapour compression refrigeration cycle Effect of superheat, sub cooling of refrigerant, performance calculations. Working principle of vapour absorption system- Ammonia, water, Lithium bromide water systems (Elementary treatment only), and comparison between vapour compression and absorption systems. Cooling load calculations, Concept of RSHF, GSHF, ESHF, Air conditioning systems.

Reference(s)

1. Kothandaraman.C.P., Domkundwar.S. and A.V. Domkundwar., A course in Thermal Engineering, Dhanpat Rai & Sons, Fifth edition, 2002.
2. C. P. Kothandaraman, Steam Tables, New Age International Private limited, 2007.
3. R. S. Khurmi & J. K. Gupta, Refrigeration Tables with Chart, S Chand & Company Limited, New Delhi, 2008.
4. Yunus A. Cengel, Michael A. Boles, Thermodynamics An Engineering Approach, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2008.
5. Mahesh M. Rathore, Thermal Engineering, Tata McGraw - Hill Education Private Limited, New Delhi, 2011.
6. http://nptel.ac.in/courses/112106133/

COURSE OUTCOMES: Employability.

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

Cos	Competency	Cognitive level
CO1	Calculate mean effective pressure and air standard efficiency of various gas power cycles.	Apply
CO2	Determine the performance characteristics of internal combustion engines.	Apply
CO3	Describe the performance characteristics of steam nozzles and steam turbines.	Understand
CO4	Calculate the performance characteristics of air compressors.	Apply
CO5	Calculate the performance characteristics of refrigeration and air conditioning systems.	Apply
CO6	Design a suitable air conditioning system by cooling load calculation.	Apply

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1702ME402	MEASUREMENTS AND METROLOGY	L	T	P	C
		2	0	2	3

PREREQUISITE:

1. Engineering Physics
2. Basic Mathematics

COURSE OBJECTIVES:

1. To study the concepts of measurement and characteristics of instruments.
2. To learn the procedure for various linear and angular measurements.
3. To provide knowledge on measurement of gear and thread terminologies using suitable instruments.
4. To study the use of laser and advances in metrology for linear geometric dimensions.
5. To expose the measuring procedure to measure the mechanical parameters using suitable instruments

UNIT I CONCEPT OF MEASUREMENT **4 Hours**

Introduction: Definition, Objectives, Elements of Measuring System, Accuracy and Precision - Units and Standards - Characteristics of measuring instrument: Sensitivity, Stability, Interchangeability, Range of accuracy, Readability, Reliability, Backlash, Repeatability and Reproducibility – Calibration - Errors in Measurement: Static and dynamic errors - Care of Measuring Instruments.

UNIT II MEASUREMENT OF MECHANICAL PARAMETERS **6 Hours**

Measurement of Force - Principle, analytical balance, platform balance, proving ring. Torque - Prony brake, hydraulic dynamometer. Measurement of Power: Linear and Rotational - Pressure Measurement: Principle, use of elastic members, Bridgeman gauge, Mcleod gauge, Pirani gauge - Temperature Measurement: bimetallic strip, thermocouples, metal resistance thermometer, pyrometers.

UNIT III LINEAR AND ANGULAR MEASUREMENTS **6 Hours**

Linear Measurements: Vernier Caliper, Vernier Height and Depth Gauges, Micrometer and depth micrometer, Slip gauge, limit gauge and its classification - Comparator: Mechanical, Pneumatic and Electrical types - Angular Measurements: Bevel protractor, Sine bar, Angle Decker, Autocollimator.

UNIT IV FORM MEASUREMENT **8 Hours**

Thread Measurement: Terminologies, Errors - External Thread Measurement: Pitch Gauge, Tool Maker's microscope, Floating Carriage micrometer with One, Two and Three wires - Internal Thread Measurement: Taper Parallels and Rollers method.Gear Measurement: Terminologies, Errors, Gear Tooth Vernier caliper, Profile Projector, Base pitch measuring instrument, David Brown Tangent Comparator, Involutes tester, Parkinson Gear Tester - External and Internal Radius measurements - Roundness measurement: Circumferential confining gauge, Assessment using V block and Rotating centres.

UNIT V LASER AND ADVANCES IN METROLOGY **6 Hours**

Interferometer: NPL Flatness, Laser, Michelson - Computer Aided Inspection - Digital Devices - Machine Vision System - Coordinate Measuring Machine: Basic concept, Types, Constructional features, Probes, Accessories - Surface Roughness Measurement - Straightness Measurement - Squareness Measurement - Machine Tool Metrology.

LIST OF EXPERIMENTS: **30 HOURS**

1. Comparing the accuracy of Vernier Caliper, Vernier Height Gauge, Vernier Depth Gauge and Micrometer to check the various dimensions of a given specimen.
2. Checking the dimensional limits of ten similar components using Mechanical Comparator.
3. Measurement of taper angle of a given specimen by using Sinebar.
4. Measurement of screw thread specifications by Floating Carriage Micrometer.
5. Measurement of gear tooth specifications by using Gear Tooth Vernier Calliper.
6. Measurement of gear tooth specifications by using Tool maker microscope.
7. Measurement of gear tooth specifications by using Profile projector.
8. Differentiate the work piece by its Surface Roughness value.
9. Measurement of force using Force Measuring Setup.
10. Measurement of Straightness of a given job by using Autocollimator.
11. Temperature measurement by using Thermocouple.
12. Measurement of Torque using Torque Measuring Setup.
13. Measurement of Displacement using LVDT.
14. Measurement of bore diameter using Telescopic Gauge.

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TOTAL: 30 HOURS

1702ME402 MEASUREMENTS AND METROLOGY LABORATORY

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LIST OF EXPERIMENTS:

1. Comparing the accuracy of Vernier Caliper, Vernier Height Gauge, Vernier Depth Gauge and Micrometer to check the various dimensions of a given specimen.
2. Checking the dimensional limits of ten similar components using Mechanical Comparator.
3. Measurement of taper angle of a given specimen by using Sinebar.
4. Measurement of screw thread specifications by Floating Carriage Micrometer.
5. Measurement of gear tooth specifications by using Gear Tooth Vernier Caliper.
6. Measurement of gear tooth specifications by using Tool Maker's Microscope
7. Differentiate the work piece by its Surface Roughness value
8. Measurement of Straightness of a given job by using Autocollimator
9. Temperature measurement by using Thermocouple.
10. Measurement of force using Force Measuring Setup.
11. Measurement of Torque using Torque Measuring Setup
12. Measurement of Displacement using LVDT.
13. Measurement of bore diameter using Telescopic Gauge
14. Measurement of gear tooth specifications by using Profile projector

Total:30 Hours

REFERENCES:

1. Jain R.K., —Engineering Metrology‖, Khanna Publishers, 2005
2. Alan S. Morris, -The Essence of Measurement‖, Prentice Hall of India, 1997
3. Beckwith, Marangoni, Lienhard, -Mechanical Measurements‖, Pearson Education,2006.
4. Donald Deckman, -Industrial Instrumentation‖, Wiley Eastern, 1985.

COURSE OUTCOMES: Employability.

CO1	Measure the linear dimensions using Vernier calliper, Vernier Height Gauge, Vernier Depth Gauge,
CO2	Make use of a comparator to check the limits of given components.
CO3	Measure the taper angle using Sinebar and Bevel Protractor.
CO4	Make use of Gear tooth Vernier, profile projector, Tool Maker's Microscope and floating Carriage Micrometer to check the gear and threat parameters.
CO5	Perform the surface finish measurement using surface roughness tester.
CO6	Measure the mechanical parameters of using suitable measuring setups.

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1702ME403	KINEMATICS OF MACHINES	L	T	P	C
		2	2	0	3

PREREQUISITE:

1. Engineering Mechanics

2. Engineering Graphics

3. Engineering Mathematics

COURSE OBJECTIVES:

1. To impart the knowledge on the concept of simple mechanisms.

2. To provide knowledge on kinematic analysis of simple mechanisms.

3. To study and construct the cam profile for the various types of follower motion.

4. To learn the kinematics terminologies of spur gear and calculate speed ratio of various types of gear train.

5. To introduce the concept of friction drives in kinematic of machines.

UNIT I FUNDAMENTALS OF MECHANISMS **12 Hours**

Basic Terminology - Kinematic link, Pair, joints, Structure, Machine, Degree of freedom, Grubler&Kutzbach Criterion - Inversions of four bar mechanism, Mechanical advantage - Transmission Angle, Inversion of single slider and double slider crank mechanisms. Common Mechanisms - Straight line mechanism, Dwell mechanism.

UNIT II KINEMATIC ANALYSIS OF MECHANISMS **12 Hours**

Relative velocity of kinematic link, Rubbing Velocity of kinematic pair, Construction of velocity and acceleration diagram by graphical method (Relative Velocity Method), Four bar mechanism, slider crank mechanisms and complex mechanism.

UNIT III CAM AND FOLLOWER MECHANISMS **12 Hours**

Introduction - Terminology, Classifications, Types of follower motion - Uniform Velocity Motion, Simple Harmonic Motion, Uniform Acceleration and Retardation Motion and Cycloidal Motion- Construction of cam profile - Knife edge follower, Roller and flat faced follower.

UNIT IV GEAR AND GEAR TRAIN **12 Hours**

Gears - Terminology, Law of gearing, Length of path of contact, Length of arc of contact, contact ratio- Interference and undercutting. Gear trains- Speed ratio, train value. Simple gear train, compound gear train, Epicyclic gear train- speed calculation by tabular method.

UNIT V FRICTION DRIVES **12 Hours**

Introduction-Friction clutch, types -single plate, Multi plate and cone clutch. Flat Belt Drives Velocity, slip, creep and Centrifugal effect of belt, length of open and cross belt drives, Maximum power transmitted, ratio of driving tension in flat belt drives - V Belt drives.

TOTAL: 60 HOURS

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FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Intermittent motion mechanisms - calculation of velocity and acceleration of two and four-wheel vehicle.

2. Cam mechanism in milling machine - Automotive transmission gear trains - Gear train in ships and aero planes.

3. Application Ropes and chain drives.

COURSE OUTCOMES: Employability.

After completion of the course, Students will be able to

CO1:	Differentiate the basic machine mechanisms.	K2
CO2:	Calculate velocity and acceleration of machine mechanisms.	K2
CO3:	Construct the cam profile for different types of follower motion.	K3
CO4:	Describe the kinematic terminologies of spur gear and calculate speed ratio of various types of gear train.	K2
CO5:	Solve the amount of power transmitted by friction drives.	K2
CO6:	Utilize mechanism for new machine development.	K3

REFERENCES:

1. S. S. Rattan, Theory of Machines, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, 2014.

2. J. J. Uicker, G. R. Pennock and J. E. Shigley, Theory of Machines and Mechanisms, Oxford University Press, New York,2011.

3. Ballaney P L, Theory of Machines and Mechanisms, Khanna Publishers, New Delhi, 2005.

4. Sadhu Singh, Theory of Machines, Pearson Education, Second Edition, 2012.

5. Rao J S and Dukkipati, Mechanism and Machine Theory, Wiley- Eastern Ltd., New Delhi, 2006.

6. http://nptel.ac.in/courses/112104121/1

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1702ME404	Design of Machine Elements	L	T	P	C
		3	2	0	4

Course Objectives

- To learn the design procedure of machine elements subjected to simple and variable loads.
- To study the design procedure of shafts and couplings.
- To provide knowledge on the design of bolted and welded joints.
- To provide knowledge on the design of helical, leaf and torsional springs subjected to constant and variable loads.
- To study the selection procedure of sliding and rolling contact bearings.

UNIT I	STEADY AND VARIABLE STRESSES	12 Hrs

Introduction to the design process - Design of straight and curved beams – „C" Frame and Crane hook. Stress concentration - Design for variable loading - Soderberg, Goodman, Gerber methods and combined stresses - Theories of failure.

UNITII	DESIGN OF SHAFTS AND COUPLINGS	12 Hrs

Design of shafts based on strength, rigidity and critical speed. Design of rigid flange coupling - Design of flexible coupling.

UNIT III	DESIGN OF JOINTS	12 Hrs

Design of bolted joints - stresses due to static loading, eccentrically loading. Design of welded joints - Butt and Fillet welded Joints - Strength of parallel and traverse fillet welded Joints.

UNIT IV	DESIGN OF SPRINGS	12 Hrs

Types, End connections and design parameters. Design of helical springs - Circular and noncircular wire - Concentric springs. Design of leaf and torsional springs under constant and varying loads.

UNIT V	DESIGN OF BEARINGS	12 Hrs

Types and selection criteria - Design of journal bearings - Design of rolling contact bearing Ball and roller bearing.

	Total:	60 Hrs

Course Outcomes (COs): Employability.

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

	Competency	Cognitive level
CO1	Calculate stress concentration of plate under simple and variable loadings.	Understand
CO2	Design the parameters of different types of couplings.	Apply
CO3	Design the solid and hollow shafts for various engineering applications.	Apply
CO4	Design the bolted and welded joints subjected to static and variable load conditions.	Apply
CO5	Estimate the parameters of helical, leaf and torsional springs subjected to variable loads.	Understand
CO6	Design a suitable bearing for various applications.	Apply

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1702ME405 **MANUFACTURING TECHNOLOGY -II**

L T P C

3 0 0 3

PREREQUISITE:

1. Engineering Physics
2. Engineering Chemistry
3. Fundamentals of Mechanical Engineering
4. Manufacturing Technology-1

COURSE OBJECTIVES:

1. To learn the metal cutting theory and calculate the forces involved in it.
2. To study construction, working and operations of centre, semi-automatic and automatic lathes.
3. To provide the knowledge on construddction, working of milling and gear cutting machines.
4. To impart knowledge on construction, working and operations of reciprocating, drilling and boring machines.
5. To provide knowledge on construction, working of broaching, grinding and few fine finishing proceses.

UNIT I METAL CUTTING THEORY **9 Hours**

Introduction - Orthogonal, Oblique Cutting and types of chip formation. Mechanisms of metal cutting - Shear plane, Stress, Strain and cutting forces. Merchants Circle - Deriving the forces, calculations. Cutting tool - Properties, materials, wear, single point tool nomenclature, tool life and its calculations. cutting fluids - Types and its properties.

UNIT II LATHE, SEMI AUTOMATS AND AUTOMATS **9 Hours**

Introduction - Types- Centre Lathe - Construction, specification, operations. Mechanisms - Head stock driven using all geared type and thread cutting. Work holding devices - Centres, chucks, carrier with catch plate and face plates. Calculation of machining time - Capstan and turret lathes - Introduction, turret indexing and bar feeding mechanism. Automats - single spindle, multi spindle and their types

UNIT III MILLING MACHINE AND GEAR CUTTING MACHINES **9 Hours**

Milling - Introduction, types, up milling, down milling, operations, and nomenclature of plain milling cutter. Indexing - simple and differential indexing methods. Gear cutting-gear milling, gear shaper and gear hobber.

UNIT IV RECIPROCATING MACHINES, DRILLING AND BORING MACHINES **9 Hours**

Shaper, Planer and Slotter - Introduction, types, specification and quick return mechanisms. Drilling - Introduction, types, construction of universal drilling machine, specification, types of drills and nomenclature of twist drill. Introduction to horizontal boring machine.

UNIT V BROACHING AND FINISHING PROCESSES **9 Hours**

Broaching - Introduction, types and tool nomenclature. Finishing processes - Grinding -Introduction, types, grinding wheel- specification, selection, glazing, loading, dressing and truing. Fine finishing processes - Honing, lapping, polishing, buffing and super finishing.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Select proper Machines and list the sequence of operations to produce the components – External threaded shafts with key way, Hexagonal bolt and Hexagonal nut.

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REFERENCES:

1. J. P. Kaushish, Manufacturing Processes, Prentice Hall India Learning Private Limited., NewDelhi, 2013.
2. Serope Kalpakjian and Steven R Schmid, Manufacturing Engineering and Technology,Pearson Education Limited., New Delhi, 2013.
3. P. N. Rao, Manufacturing Technology- Metal Cutting and Machine Tools, Tata McGrawHillPublishing Company Private Limited., New Delhi, 2013
4. S. K. HajraChoudhury, Elements of Workshop Technology. Vol. II, Media Promoters Private Limited., Mumbai, 2013.
5. P.C Sharma, Manufacturing Technology - II, S. Chand & Company Limited. New Delhi, 2012.

COURSE OUTCOMES: Employability -

After completion of the course, Students will be able to

CO	Course Outcomes	BL
CO1	Explain the mechanisms of metal cutting, cutting tool materials, tool wear and cutting fluids.	K2
CO2	Discuss about the constructional features of different types of lathe parts and their operations.	K2
CO3	Describe the construction and working of milling and gear cutting machine.	K2
CO4	Illustrate the various types of reciprocating, drilling and boring machines.	K2
CO5	Describe the construction and working of broaching and finishing process.	K2
CO6	Measure the metal removal rate of the work piece in various speeds.	K3

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1702ME451	THERMAL ENGG. LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

1. To learn the port timing and valve timing diagram of two stroke and four stroke internal combustion engines.
2. To study the fuel properties, performance and emission characteristics of IC engines.
3. To study the performance of IC engine on retardation.
4. To study the performance of two stage reciprocating air compressor.
5. To study the performance of refrigeration and air conditioning system

EXPERIMENT 1 **4 Hours**

Experimental study on port timing and valve timing diagram of IC engines.

EXPERIMENT 2 **4 Hours**

Experimental study on flash point, fire point of the given oil sample.

EXPERIMENT 3 **2 Hours**

Detrmination of dynamic viscosity of the given using Red wood viscometer

EXPERIMENT 4 **2 Hours**

Experimental study of performance test on 4-Stroke Petrol engine.

EXPERIMENT 5 **2 Hours**

Experimental study of performance on 4-Stroke diesel engine with mechanical loading.

EXPERIMENT 6 **2 Hours**

Experimental study of performance on 4-Stroke diesel engine with electrical loading

EXPERIMENT 7 **2 Hours**

Experimental study of performance on 4-Stroke diesel engine with hydraulic loading.

EXPERIMENT 8 **2 Hours**

Heat balance test on 4-Stroke diesel engine with mechanical loading.

EXPERIMENT 9 **2 Hours**

Morse test on multi-cylinder petrol engine.

EXPERIMENT 10 **2 Hours**

Retardation test on 4-Stroke diesel engine with mechanical loading

EXPERIMENT 11 **2 Hours**

Experimental study on performance of two stage reciprocating air compressor.

EXPERIMENT12 **2 Hours**

Experimental study on determination of Coefficient of Performance of refrigerationsystem

EXPERIMENT13 **2 Hours**

Experimental study on determination of Coefficient of Performance of Air-conditioning system.

FOR FURTHER READING – SEMINAR – CPS **Total 30Hours**

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Course Outcomes (COs) Employability | Entrepreneurship

After completion of the course, Student will be able to

1. Analyze the valve and port timing diagram .
2. Analyze the characteristic and performance of IC Engines.
3. Analyze the performance of Two Stage Air Compressor.
4. Conduct morse test in petrol engines.
5. Determine flash and fire point of various fuels.
6. Analyze the Performance of refrigeration system.

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1702ME452
MANUFACTURING TECHNOLOGY LABORATORY – II

L T P C
0 0 2 1

PREREQUISITE :

1. Workshop Practice Laboratory
2. Manufacturing Technology I Lab

COURSE OBJECTIVES:

1. To learn the metal cutting theory and calculate the forces involved in it.
2. To study construction, working and operations of centre, semi-automatic and automatic lathes.
3. To provide the knowledge on construction, working of milling and gear cutting machines.
4. To impart knowledge on construction, working and operations of reciprocating, drilling and boring machines.
5. To provide knowledge on construction, working of broaching, grinding and few fine finishing processes.

LIST OF EXPERIMENTS:

1. Contour milling using vertical milling matching.
2. Spur gear cutting in milling machine.
3. Gear generation in hobbing machine.
4. Gear generation in gear shaping machine.
5. Horizontal surface grinding.
6. Cylindrical grinding.
7. Tool angle grinding with tool and Cutter Grinder.
8. Measurement of cutting forces in Milling.
9. Square Head Shaping.
10. Hexagonal Head Shaping.
11. Vertical surface grinding.
12. Make a v-block using planner machine

Total: 60 Hours

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Select proper Machines and list the sequence of operations to produce the components.
2. External threaded shafts with key way, Hexagonal bolt and Hexagonal nut.

COURSE OUTCOMES: Employability

After completion of the course, Student will be able to

CO1	Produce of spur gear by using universal milling machine, gear hobbing machine, gear shaping machine.
CO2	Do the surface grinding operation using horizontal grinding machine, vertical grinding machine, cylindrical grinding machine
CO3	Produce a single point tool using tool and cutter grinder
CO4	Use the planner machine & vertical milling machine to perform contour, key way operation.
CO5	Measure the cutting force using milling tool dynamometer.
CO6	Do the square head shaping and hexagonal head shaping using shaper machine

REFERENCES:

1. J. P. Kaushish, Manufacturing Processes, Prentice Hall India Learning Private Limited., New Delhi, 2013.
2. SeropeKalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013.
3. P. N. Rao, Manufacturing Technology- Metal Cutting and Machine Tools, Tata McGraw Hill Publishing Company Private Limited., New Delhi, 2013
4. S. K. HajraChoudhury, Elements of Workshop Technology. Vol. II, Media Promoters & Publishers Private Limited., Mumbai, 2013.
5. P.C Sharma, Manufacturing Technology - II, S. Chand & Company Limited, New Delhi, 2012.
6. http://nptel.ac.in/courses/112105126

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1704GE451	LIFE SKILLS: VERBAL ABILITY	L	T	P	C
		0	0	2	0

PREREQUISITE:

Technical English – I and II

COURSE OBJECTIVES:

1. To help students comprehend and use vocabulary words in their day to day communication.
2. To apply appropriate reading strategies for interpreting technical and non-technical documents used in job-related settings.
3. To ensure students will be able to use targeted grammatical structures meaningfully and appropriately in oral and written production.
4. To enable the students to arrange the sentences in meaningful unit and to determine whether constructions rely on active or passive voice.
5. To apply the principles of effective business writing to hone communication skills.

UNIT I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.

UNIT II COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages.

UNIT III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence improvement – Error Detection FAQ in Competitive exams.

UNIT IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.

UNIT V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.

Total: 30 Hours

ASSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

COURSE OUTCOMES: SKILL DEVELOPMENT

After completion of the course, Student will be able to

CO1: Use new words in their day to day communication.
CO2: Gather information swiftly while reading passages.
CO3: Students are proficient during their oral and written communication.
CO4: Rearrange the sentences and able to identify the voice of the sentence.
CO5: Students use their knowledge of the best practices to craft effective business documents

REFERENCES:

1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.
2. R S Aggarwal and Vikas Aggarwal, Quick Learning Objective General English, S.Chand Publishing House, 2017.
3. Dr.K.Alex , Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014.
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition, 2007.

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ME6501 **COMPUTER AIDED DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS **9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design - CAD system architecture- Computer graphics - co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing Clipping- viewing transformation

UNIT II GEOMETRIC MODELING **9**

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling - surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III VISUAL REALISM **9**

Hidden - Line-Surface-Solid removal algorithms - shading - colouring - computer animation.

UNIT IV ASSEMBLY OF PARTS **9**

Assembly modelling - interferences of positions and orientation - tolerance analysis-massproperty calculations - mechanism simulation and interference checking.

UNIT V CAD STANDARDS **9**

Standards for computer graphics- **Graphical Kernel System** (GKS) standards for exchangeimages- **Open G**raphics Library **(OpenGL)** - Data exchange standards - IGES, STEP, CALSetc ---- communication standards.

TOTAL : 45 PERIODS

OUTCOMES: Employability:

- Upon completion of this course, the students can able to use computer and CAD software's for modeling of mechanical components

TEXT BOOKS:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007

REFERENCES:

1. Chris McMahon and Jimmie Browne "CAD/CAM Principles", "Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker "Computer Graphics"'. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.
5.

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ME6502 **HEAT AND MASS TRANSFER** **L T P C**
3 0 0 3

OBJECTIVES:

To understand the mechanisms of heat transfer under steady and transient conditions.
To understand the concepts of heat transfer through extended surfaces.
To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.
(Use of standard HMT data book permitted)

UNIT I CONDUCTION 9

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids – Use of Heisler's charts.

UNIT II CONVECTION 9

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes .

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

Nusselt's theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.

UNIT IV RADIATION 9

Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

UNIT V MASS TRANSFER 9

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

TOTAL : 45 PERIODS

OUTCOMES: Employability.

Upon completion of this course, the students can able to understand and apply different heat and mass transfer principles of different applications.

TEXT BOOK:

Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 2010

REFERENCE BOOKS:

Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
Venkateshan. S.P., "Heat Transfer", Ane Books, New Delhi, 2004.
Ghoshdastidar, P.S, "Heat Transfer", Oxford, 2004,
Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
Yadav, R., "Heat and Mass Transfer", Central Publishing House, 1995.
M.Thirumaleshwar : Fundamentals of Heat and Mass Transfer, "Heat and Mass Transfer", First Edition, Dorling Kindersley, 2009

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ME6503 **DESIGN OF MACHINE ELEMENTS** **L T P C 3 0 0 3**

OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

(Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 10

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

UNIT II SHAFTS AND COUPLINGS 8

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

UNIT III TEMPORARY AND PERMANENT JOINTS 9

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

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS 9

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

TOTAL: 45 PERIODS

OUTCOMES: Employability

- Upon completion of this course, the students can able to successfully design machine components

TEXT BOOK:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
4. Bernard Hamrock, Steven Schmid,Bo Jacobson, "Fundamentals of Machine Elements",2nd

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5. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
6. Ansel Ugural, "Mechanical Design - An Integral Approach", 1st Edition, Tata McGraw-Hill Book

ME6504 METROLOGY AND MEASUREMENTS **L T P C**
3 0 0 3

OBJECTIVES:

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

UNIT I BASICS OF METROLOGY **5**

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

UNIT II LINEAR AND ANGULAR MEASUREMENTS **10**

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

UNIT III ADVANCES IN METROLOGY **12**

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

UNIT IV FORM MEASUREMENT **10**

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

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE **8**

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

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the Students can demonstrate different measurement technologies and use of them in Industrial Components

TEXT BOOKS:

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

REFERENCES:

1. Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning EMEA,1990.
2. Backwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2006.

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ME6505 **DYNAMICS OF MACHINES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

UNIT I FORCE ANALYSIS **9**

Dynamic force analysis - Inertia force and Inertia torque- D Alembert's principle -Dynamic Analysis in reciprocating engines - Gas forces - Inertia effect of connecting rod- Bearing loads - Crank shaft torque - Turning moment diagrams -Fly Wheels - Flywheels of punching presses- Dynamics of Cam-follower mechanism.

UNIT II BALANCING **9**

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder engine - Balancing of Multi-cylinder inline, V-engines - Partial balancing in engines - Balancing of linkages - Balancing machines-Field balancing of discs and rotors.

UNIT III SINGLE DEGREE FREE VIBRATION **9**

Basic features of vibratory systems - Degrees of freedom - single degree of freedom - Free vibration - Equations of motion - Natural frequency - Types of Damping - Damped vibration- Torsional vibration of shaft - Critical speeds of shafts - Torsional vibration - Two and three rotor torsional systems.

UNIT IV FORCED VIBRATION **9**

Response of one degree freedom systems to periodic forcing - Harmonic disturbances -Disturbance caused by unbalance - Support motion -transmissibility - Vibration isolation vibration measurement.

UNIT V MECHANISM FOR CONTROL **9**

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling force curves. Gyroscopes -Gyroscopic forces and torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the Students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem

TEXT BOOK:

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

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Benson H. Tongue, "Principles of Vibrations", Oxford University Press, 2nd Edition, 2007

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4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
5. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
6. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
7. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
8. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
9. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996
10. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, "Theory of Vibration with Application", 5th edition, Pearson Education, 2011
11. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
12. Khurmi, R.S.,"Theory of Machines", 14th Edition, S Chand Publications, 2005.

GE6075 PROFESSIONAL ETHICS IN ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES:

To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES **10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES **8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOMES : Employability

Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXTBOOKS:

Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

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ME6511 **DYNAMICS LABORATORY** **L T P C0**
0 3
2

OBJECTIVES:

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

LIST OF EXPERIMENTS

1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillatingc ylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compoundpendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell,
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.
   b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.-Undamped and Damped Natural frequencies.
   b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
    b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
    c) Determination of transmissibility ratio using vibrating table.

TOTAL : 45 PERIODS

OUTCOME Employability

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Ability to use the measuring devices for dynamic testing.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.
8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.

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ME6512 **THERMAL ENGINEERING LABORATORY – II** **L T P C**
0 0 3 2

OBJECTIVES

- To study the heat transfer phenomena predict the relevant coefficient using implementation
- To study the performance of refrigeration cycle / components

LIST OF EXPERIMENTS:

HEAT TRANSFER LAB: **30**

1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus (natural & forced convection modes)
8. Determination of Stefan - Boltzmann constant.
9. Determination of emissivity of a grey surface.
10. Effectiveness of Parallel / counter flow heat exchanger.

REFRIGERATION AND AIR CONDITIONING LAB **15**

1. Determination of COP of a refrigeration system
2. Experiments on Psychrometric processes
3. Performance test on a reciprocating air compressor
4. Performance test in a HC Refrigeration System
5. Performance test in a fluidized Bed Cooling Tower

TOTAL: 45 PERIODS

OUTCOMES Employability

- Ability to demonstrate the fundamentals of heat and predict the coefficient used in that transfer application and also design refrigeration cycle.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Guarded plate apparatus	1 No.
2	Lagged pipe apparatus	1 No.
3	Natural convection-vertical cylinder apparatus	1 No.
4	Forced convection inside tube apparatus	1 No.
5	Composite wall apparatus	1 No.
6	Thermal conductivity of insulating powder apparatus	1 No.
7	Pin-fin apparatus	1 No.
8	Stefan-Boltzmann apparatus	1 No.
9	Emissivity measurement apparatus	1 No.
10	Parallel/counter flow heat exchanger apparatus	1 No.
11	Single/two stage reciprocating air compressor	1 No.
12	Refrigeration test rig	1 No.
13	Air-conditioning test rig	1 No.
14	HC Refrigeration System	1 No.
15.	Fluidized Bed Cooling Tower	1 No.

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ME6513 METROLOGY AND MEASUREMENTS LABORATORY **L T P C**
0 0 3 2

OBJECTIVES

- To familiar with different measurement equipments and use of this industry for quality inspection

LIST OF EXPERIMENTS

1. Tool Maker's Microscope
2. Comparator
3. Sine Bar
4. Gear Tooth Vernier Caliper
5. Floating gauge Micrometer
6. Co ordinate Measuring Machine
7. Surface Finish Measuring Equipment
8. Vernier Height Gauge
9. Bore diameter measurement using telescope gauge
10. Bore diameter measurement using micrometer
11. Force Measurement
12. Torque Measurement
13. Temperature measurement
14. Autocollimator

TOTAL: 45 PERIODS

OUTCOMES Employability.

- Ability to handle different measurement tools and perform measurements in quality impulsion

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Micrometer	5
2	Vernier Caliper	5
3	Vernier Height Gauge	2
4	Vernier depth Gauge	2
5	Slip Gauge Set	1
6	Gear Tooth Vernier	1
7	Sine Bar	1
8	Floating Carriage Micrometer	1
9	Profile Projector / Tool Makers Microscope	1
10	Parallel / counter flow heat exchanger apparatus	1
11	Mechanical / Electrical / Pneumatic Comparator	1
12	Autocollimator	1
13	Temperature Measuring Setup	1
14	Force Measuring Setup	1

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15	Torque Measuring Setup	1
16	Coordinate measuring machine	1
17	Surface finish measuring equipment	1
18	Bore gauge	1
19	Telescope gauge	1

ME6601 **DESIGN OF TRANSMISSION SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues

(Use of P S G Design Data Book permitted)

UNIT I DESIGN OF FLEXIBLE ELEMENTS **9**

Design of Flat belts and pulleys Selection of V belts and pulleys - Selection of hoisting wire ropes and pulleys - Design of Transmission chains and Sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS **9**

Speed ratios and number of teeth-Force analysis -Tooth stresses Dynamic effects - Fatigue strength - Factor of safety Gear materials - Design of straight tooth spur & helical gears based on strength and wear considerations - Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS **9**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV GEAR BOXES **9**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT V CAMS, CLUTCHES AND BRAKES **9**

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches -axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes external shoe brakes – Internal expanding shoe brake.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to successfully design transmission

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components used in Engine and machines

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TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications,Chennai, 2003.
2. Gitin Maitra, L. Prasad "Hand book of Mechanical Design", 2nd Edition, Tata McGraw-Hill, 2001.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. C.S.Sharma, Kamlesh Purohit, "Design of Machine Elements", Prentice Hall of India, Pvt. Ltd., 2003.
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2nd Edition, Tata McGraw-Hill Book Co., 2006.
6. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
7. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
8. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
9. Ansel Ugural, "Mechanical Design - An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
10. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003.
11. U.C.Jindal : Machine Design, "Design of Transmission System", Dorling Kindersley, 2010

MG6851 PRINCIPLES OF MANAGEMENT LTPC

3 0 0 3

OBJECTIVES:

To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure

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– types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES: Employability.

Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.
JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.

REFERENCES:

Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

ME6602 AUTOMOBILE ENGINEERING **L T P C 3 0 0 3**

OBJECTIVES:

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

UNIT I VEHICLE STRUCTURE AND ENGINES **9**

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

UNIT II ENGINE AUXILIARY SYSTEMS **9**

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

UNIT III TRANSMISSION SYSTEMS **9**

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

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UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS **9**

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

UNIT V ALTERNATIVE ENERGY SOURCES **9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required -Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels Electric and Hybrid Vehicles, Fuel Cell

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

REFERENCES:

1. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart -Will Cox Company Inc, USA ,1978.
4. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
5. Ganesan V. "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2007.

ME6603 FINITE ELEMENT ANALYSIS **L T P C**
3 0 0 3

OBJECTIVES: To introduce the concepts of Mathematical Modeling of Engineering Problems.

- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION **9**

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

UNIT II ONE-DIMENSIONAL PROBLEMS **9**

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

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS **9**

Second Order 2D Equations involving Scalar Variable Functions - Variational formulation -Finite Element formulation - Triangular elements - Shape functions and element matrices and vectors.

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Application to Field Problems Thermal problems - Torsion of Non circular shafts -Quadrilateral elements - Higher Order Elements.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS **9**

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

UNIT V ISOPARAMETRIC FORMULATION **9**

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

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

TEXT BOOK:

1. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

REFERENCES:

1. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2004
2. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.
4. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall College Div, 1990
5. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)*

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ME6604 **GAS DYNAMICS AND JET PROPULSION** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.

(Use of Standard Gas Tables permitted

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 6

Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone - Effect of Mach number on compressibility - Isentropic flow through variable ducts - Nozzle and Diffusers

UNIT II FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - variation of flow properties.

UNIT III NORMAL AND OBLIQUE SHOCKS 10

Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl - Meyer relations - Applications.

UNIT IV JET PROPULSION 10

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines

UNIT V SPACE PROPULSION 10

Types of rocket engines - Propellants-feeding systems - Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity - Applications - space flights

TOTAL: 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion

TEXT BOOKS:

1. Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2003.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 1996.

REFERENCES:

1. Hill. P. and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison - Wesley Publishing company, 1992.
2. Zucrow. N.J., "Aircraft and Missile Propulsion", Vol.1 & II, John Wiley, 1975.
3. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
4. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York,1986,.
5. Shapiro. A.H.," Dynamics and Thermodynamics of Compressible fluid Flow", John wiley, New York, 1953.
6. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 1999.
7. Somasundaram. PR.S.L., "Gas Dynamics and Jet Propulsions", New Age International Publishers, 1996.
8. Babu. V., "Fundamentals of Gas Dynamics", ANE Books India, 2008.
9. Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd.,

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ME6004 UNCONVENTIONAL MACHINING PROCESSES **L T P C**
3 0 0 3

OBJECTIVES:

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

UNIT I INTRODUCTION **6**

Unconventional machining Process – Need – classification – Brief overview

UNIT II MECHANICAL ENERGY BASED PROCESSES **9**

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES **9**

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES **11**

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

UNIT V THERMAL ENERGY BASED PROCESSES **10**

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL: 45 PERIODS

OUTCOMES: Employability | Entrepreneurship :

Upon completion of this course, the students can able to demonstrate different unconventional machining processes and know the influence of difference process parameters on the performance and their applications.

TEXT BOOKS:

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

REFERENCES:

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

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ME6611 **CAD / CAM LABORATORY** **L T P C**
0 0 3 2

OBJECTIVES:

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

LIST OF EXPERIMENTS

1. 3D GEOMETRIC MODELLING **24 PERIODS**

List of Experiments

1. Introduction of 3D Modelling software

Creation of 3D assembly model of following machine elements using 3D Modelling software

2. Flange Coupling
3. Plummer Block
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Stuffing box
9. Crosshead
10. Safety Valves
11. Non-return valves
12. Connecting rod
13. Piston
14. Crankshaft

* Students may also be trained in manual drawing of some of the above components

2. Manual Part Programming. **21 PERIODS**

(i) Part Programming - CNC Machining Centre

a) Linear Cutting.
b) Circular cutting.
c) Cutter Radius Compensation.
d) Canned Cycle Operations.

(ii) Part Programming - CNC Turning Centre

a) Straight, Taper and Radius Turning.
b) Thread Cutting.
c) Rough and Finish Turning Cycle.
d) Drilling and Tapping Cycle.

3. Computer Aided Part Programming

e) CL Data and Post process generation using CAM packages.
f) Application of CAPP in Machining and Turning Centre.

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TOTAL: 45 PERIODS

OUTCOMES Employability.

- Ability to develop 2D and 3D models using modeling softwares.
- Ability to understand the CNC control in modern manufacturing system.
- Ability to prepare CNC part programming and perform manufacturing.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Qty
HARDWARE		
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
SOFTWARE		
7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	15 licenses
9.	Licensed operating system	Adequate
10.	Support for CAPP	Adequate

ME6612 **DESIGN AND FABRICATION PROJECT** **L T P C**
0 0 4 2

OBJECTIVES:

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

GUIDELINE FOR REVIEW AND EVALUATION

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

TOTAL : 60 PERIODS

OUTCOMES: Employability | Entrepreneurship.

- Use of design principles and develop conceptual and engineering design of any components.
- Ability to fabricate any components using different manufacturing tools.

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GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED **L T P C**
0 0 4 2

OBJECTIVES:

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

UNIT I LISTENING AND SPEAKING SKILLS **12**

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

UNIT II READING AND WRITING SKILLS **12**

Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS **12**

International English Language Testing System (IELTS)-- Test of English as a Foreign Language (TOEFL) Civil Service(Language related)- Verbal Ability.

UNIT IV INTERVIEW SKILLS **12**

Different types of Interview format- answering questions- offering information- mock interviews-body language(paralinguistic features)- articulation of sounds- intonation.

UNIT V SOFT SKILLS **12**

Motivation- emotional intelligence-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning -- intercultural communication- creative and critical thinking

TOTAL: 60 PERIODS

TEACHING METHODS:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

Lab Infrastructure:

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	**Server**	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	

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	• OS: Win 2000 server • Audio card with headphones • JRE 1.3	
2	**Client Systems** • PIII or above • 256 or 512 MB RAM / 40 GB HDD • OS: Win 2000 • Audio card with headphones • JRE 1.3	60 Nos.
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

Evaluation:

Internal: 20 marks

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

Note on Internal and External Evaluation:

1. Interview - mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation - should be extempore on simple topics.
4. Discussion - topics of different kinds; general topics, and case studies.

OUTCOMES: SKILL DEVELOPMENT

At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

REFERENCES:

1. **Business English Certificate Materials,** Cambridge University Press.
2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress.**
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.

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ME6701 **POWER PLANT ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

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

UNIT I COAL BASED THERMAL POWER PLANTS **10**

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

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS **10**

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

UNIT III NUCLEAR POWER PLANTS **7**

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

UNIT IV POWER FROM RENEWABLE ENERGY **10**

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

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS **8**

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

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw - Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw - Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, "Power Plant Engineering", 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw - Hill, 1998.
4. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

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ME6702 **MECHATRONICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION **12**

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

UNIT II 8085 MICROPROCESSOR AND 8051 MICROCONTROLLER **10**

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

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE **8**

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

UNIT IV PROGRAMMABLE LOGIC CONTROLLER **7**

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

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN **8**

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

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

TEXT BOOKS:

1. Bolton, "Mechatronics", Printice Hall, 2008
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.

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5. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

ME6703 COMPUTER INTEGRATED MANUFACTURING SYSTEMS **L T P C 3 0 0 3**

OBJECTIVES:

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION **10**

Brief introduction to CAD and CAM - Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM - Concurrent Engineering-CIM concepts - Computerised elements of CIM system -Types of production Manufacturing models and Metrics - Mathematical models of Production Performance - Simple problems - Manufacturing Control - Simple Problems - Basic Elements of an Automated system - Levels of Automation - Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING **10**

Process planning - Computer Aided Process Planning (CAPP) - Logical steps in Computer Aided Process Planning - Aggregate Production Planning and the Master Production Schedule - Material Requirement planning - Capacity Planning- Control Systems-Shop Floor Control-Inventory Control - Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) Simple Problems.

UNIT III CELLULAR MANUFACTURING **9**

Group Technology(GT), Part Families - Parts Classification and coding - Simple Problems in Opitz Part Coding system - Production flow Analysis - Cellular Manufacturing - Composite part concept - Machine cell design and layout - Quantitative analysis in Cellular Manufacturing - Rank Order Clustering Method - Arranging Machines in a GT cell - Hollier Method - Simple Problems.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) **8**

Types of Flexibility - FMS - FMS Components - FMS Application & Benefits - FMS Planning and Control- Quantitative analysis in FMS - Simple Problems. Automated Guided Vehicle System (AGVS) - AGVS Application - Vehicle Guidance technology - Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS **8**

Robot Anatomy and Related Attributes - Classification of Robots- Robot Control systems - End Effectors - Sensors in Robotics - Robot Accuracy and Repeatability - Industrial Robot Applications - Robot Part Programming - Robot Accuracy and Repeatability - Simple Problems.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the student can able to understand the use of computers in process planning and use of FMS and Robotics in CIM

TEXT BOOK:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age

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International (P) Ltd, New Delhi, 2000.

REFERENCES:

1. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
2. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.
3. Rao. P, N Tewari &T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.

GE6757 TOTAL QUALITY MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality-- Dimensions of product and service quality - Basic concepts of TQM - TQM Framework Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus--Customer orientation, Customer satisfaction, Customer complaints, Customer retention Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) Taguchi quality loss function - TPM - Concepts, improvement needs Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

TOTAL: 45 PERIODS

OUTCOMES: Employability.

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.

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2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

ME6005 PROCESS PLANNING AND COST ESTIMATION

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OBJECTIVES:

- To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING **10**

Introduction- methods of process planning-Drawing interpretation-Material evaluation - steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES **10**

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION **8**

Importance of costing and estimation -methods of costing-elements of cost estimation -Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION **8**

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION **9**

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOMES: Employability

- Upon completion of this course, the students can able to use the concepts of process planning and cost estimation for various products.

TEXT BOOKS:

1. Peter scalon, "Process planning, Design/Manufacture Interface", Elsevier science technology Books, Dec 2002.

REFERENCES:

1. Ostwalal P.F. and Munez J., "Manufacturing Processes and systems", 9th Edition, John Wiley, 1998.
2. Russell R.S and Tailor B.W, "Operations Management", 4th Edition, PHI, 2003.
3. Chitale A.V. and Gupta R.C., "Product Design and Manufacturing", 2nd Edition, PHI, 2002.

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ME6010 **ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT **6**

Robot - Definition - Robot Anatomy Co ordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic GrippersVacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION **12**

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications-Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING **13**

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS **5**

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES: Employability

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.

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ME6711 **SIMULATION AND ANALYSIS LABORATORY** **L T P C 0 0 3 2**

OBJECTIVES:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS

A. SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

B. ANALYSIS

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi - symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL: 45 PERIODS

OUTCOMES: Employability | Entrepreneurship.

- Upon completion of this course, the Students can model, analyse and simulate experiments to meet real world system and evaluate the performance.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Computer Work Station	15
2	Color Desk Jet Printer	01
3	Multibody Dynamic Software Suitable for Mechanism simulation and analysis	15 licenses
4	C / MATLAB	5 licenses

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ME6712 **MECHATRONICS LABORATORY** **L T P C**
0 0 3 2

OBJECTIVES:

- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS:

1. Assembly language programming of 8085 - Addition - Subtraction - Multiplication - Division - Sorting - Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
8. Study of PLC and its applications.
9. Study of image processing technique.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	NAME OF THE EQUIPMENT	Qty.
1	Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each	1 No.
2	Basic Hydraulic Trainer Kit	1 No
3	Hydraulics and Pneumatics Systems Simulation Software	10 No
4	8051 - Microcontroller kit with stepper motor and drive circuit sets	2 No
	Image processing system with hardware & software	1 No.

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ME6713 **COMPREHENSION** **L T P C**
0 0 2 1

OBJECTIVES:

- To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

TOTAL : 30 PERIODS

OUTCOMES: SKILL DEVELOPMENT

- ability to understand and comprehend any given problem related to mechanical engineering field.

MG6863 **ENGINEERING ECONOMICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.

UNIT I INTRODUCTION TO ECONOMICS **8**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics - Engineering efficiency, Economic efficiency, Scope of engineering economics--Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING **10**

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications -Time value of money, Single payment compound amount factor Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW **9**

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS **9**

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

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UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 PERIODS

OUTCOMES : EMPLOYABILITY.

- Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES:

1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

ME6016 ADVANCED I.C ENGINES **L T P C**
3 0 0 3

OBJECTIVES:

To understand the underlying principles of operation of different IC Engines and components.
To provide knowledge on pollutant formation, control, alternate fuel etc.

UNIT I SPARK IGNITION ENGINES 9

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – ... motion - Introduction to Turbocharging.

UNIT III POLLUTANT FORMATION AND CONTROL 9

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS 9

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS 9

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

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TOTAL : 45 PERIODS

OUTCOME: Employability.

Upon completion of this course, the students can able to compare the operations of different IC Engine and components and can evaluate the pollutant formation, control, alternate fuel

TEXT BOOKS:

Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.
Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.

REFERENCES:

1. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons 2007.
2. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987.
3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995

IE6605 PRODUCTION PLANNING AND CONTROL

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OBJECTIVES:

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY 9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development -- Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data -- Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning kanban - Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

ATTESTED
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TOTAL: 45 PERIODS

OUTCOMES: Employability

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

1. Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.
2. James.B.Dilworth,"Operations management - Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.

REFERENCES:

1. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition, John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", 2nd Edition, Oxford university press, 2007.
4. Melynk, Denzler, " Operations management - A value driven approach" Irwin Mcgraw hill.
5. Norman Gaither, G. Frazier, "Operations Management", 9th edition, Thomson learning IE, 2007
6. Jain. K.C & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
7. Chary. S.N. "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
8. Upendra Kachru, "Production and Operations Management - Text and cases", 1st Edition, Excel books 2007.

ME6811 **PROJECT WORK** **L T P C**
0 0 12 6

OBJECTIVES:

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

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

Employability | Entrepreneurship | Skill Development

TOTAL: 180 PERIODS

OUTCOMES:

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

ATTESTED
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