Vision and Mission of the Institute

Vision:

To emerge as a comprehensive Institute that provides quality technical education and research thereby building up a precious human resource for the industry and society.

Mission:

- To provide a learner-centered environment that challenges individuals to actively participate in the education process.
- To empower the faculty to excel in teaching while engaging in research, creativity and public service.
- To develop effective learning skills enabling students pick up critical thinking thus crafting them professionally fit and ethically strong.
- To reach out industries, schools and public agencies to partner and share human and academic resources.

Vision and Mission of the Department

Vision:

To become an excellent centre for technical education and research in the field of mechanical engineering to meet the societal, regional, national and global challenges.

Mission:

- To impart quality technical education and transform bud engineers into an effective and responsible engineers to work with the current technologies in multi-cultural and multi-discipline environment.
- To encourage the students to develop their creativity in the field of mechanical engineering by providing modern laboratory facilities with hands on training and contemporary curriculum.
- To develop the interaction with the Industry, experts in order to technical mastery.
- To provide best teaching & learning practices as well as creating opportunities for Research, maximise student results and placements
- To inculcate and promote lifelong learning skills, problem solving skills, leadership qualities and team work.

PROGRAM EDUCATIONAL OBJECTIVES

- **PEO1:** A strong foundation to access, analyze, plan and implement their knowledge in basic sciences & mathematics, core and interdisciplinary courses.
- **PEO2:** Graduate will be in a position to work with the members of multi-disciplinary teams and can play a leading role in handling the technical issues.
- **PEO3:** Graduates will have capability to work with modern engineering tools, software and equipment under the realistic constraints.
- **PEO 4:** Graduates will engage in lifelong learning skills with research attitude and social responsibility.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO1. **Engineering knowledge:** The Graduate will be able to solve mechanical engineering related problems through the application of knowledge in mathematics, science and engineering.

PO2.Problem analysis: The graduate will be able to identify, formulate and solve complex engineering problems through literature reviews/surveys and fundamentals of mathematics, sciences and engineering.

PO3.Design/development of solutions: The graduate will be able to design and develop solution for complex engineering problems and systems or processes for specific needs within the realistic constraints of the civil society..

PO4.Conduct investigations of complex problems: The graduate will be able to investigate the complex engineering problems through research methodologies.

PO5.Modern tool usage: The graduate will be able to use modern engineering tools, techniques and skills necessary for engineering practice to obtain solution to the problems

PO6.The engineer and society: The graduate will be able to work as responsible professional engineer with contextual knowledge of the civil society.

PO7.Environment and sustainability: The graduate will be able to develop sustainable engineering solutions with environmental and societal context.

PO8.Ethics: The graduates will be able to work with professional ethics and commitment

PO9.Individual and team work: The graduate will be able to associate with the multi-disciplinary teams or lead the people associated with.

PO10.Communication: The graduates will be able to communicate effectively with appropriate representation of their views or ideas.

PO11.Project management and finance: The graduate able to execute the project effectively in multidisciplinary environments as a member or leader through knowledge acquired in engineering.

PO12.Life-long learning: Graduate will have an ability to engage in life-long learning of knowledge on contemporary issues.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR:NELLORE)
SPSR NELLORE DIST

I B.TECH(yearly pattern) Scheme of Instruction and Evaluation
(Common to all branches)
(With effect from the Academic Year 2013-2014)

Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									Maximum Total Marks
						Sessional Test-I		Sessional Test-II		Sessional Test-III		Total Sessional Marks (Max. 40)	End Semester Examination		
		L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks	Duration In Hours	Max. Marks		Duration In Hours	Max. Marks	100
13SH1001	English	2	-	-	4	2	40	2	40	2	40	0.4*first Best + 0.4*second best + 0.2*Least	3	60	100
13SH1002	Engineering Mathematics-I	3	1	-	8	2	40	2	40	2	40		3	60	100
13SH1003	Engineering Mathematics-II	3	1	-	8	2	40	2	40	2	40		3	60	100
13SH1004	Engineering Physics	2	-	-	4	2	40	2	40	2	40		3	60	100
13SH1005	Engineering Chemistry	2	-	-	4	2	40	2	40	2	40		3	60	100
13CS1001	Computer Programming & Data Structures	3	1	-	8	2	40	2	40	2	40		3	60	100
13ME1001	Engineering Graphics	1	0	3	6	2	40	2	40	2	40		3	60	100
13SH10P1	English Language Laboratory			3	4	-	-	-	-	-	-	Day to Day Evaluation and a test (40 Marks)	3	60	100
13ME101P	Workshop			3	4	-	-	-	-	-	-		3	60	100
13CS10P1	Programming Laboratory			3	4	-	-	-	-	-	-		3	60	100
	TOTAL	16	3	12	54									600	1000

13SH1001 – ENGLISH

Course Category:	Humanities	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
Pre-requisite:	• Comprehending the basic level of comprehensions • Intermediate level of error analysis • Ability to use appropriate language in informal situations	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To develop their basic communication skills in English 2. To achieve specific linguistic and communicative competence. 3. To acquire relevant skills and function efficiently in a realistic working context 4. To inculcate the habit of reading. 5. To acquire knowledge on writing skills.	
Course Outcomes:	**CO1**	Correct the error of the sentence; improve language proficiency and face competitive exams; GATE, GRE, TOEFL, GMAT etc
	CO2	Comprehend the advanced level of reading comprehensions
	CO3	Write clear and coherent passages for social and professional contexts
	CO4	Write proposals, business letters
	CO5	Acquire considerable flair in using broad range of vocabulary.
Course Content:	**UNIT-I** **'Humour' from 'Using English' Biography –(Homi Jehangir Bhabha) from "New Horizons"** R- Reading Strategies- Skimming and Scanning. G- Parts of Speech- Noun-number, pronoun-personal pronoun, -Subject verb& Pronoun agreement. **UNIT-II** **'Inspiration' from "Using English" 'Biography-(My Struggle for an Education)' form "New Horizons"** R- Note making strategies W- Paragraph-types- topic sentences, unity, coherence, length, linking devices G- Articles-Prepositions-Tenses- Present tense, Past tense and Future tense **UNIT-III** **'Sustainable Development' from 'Using English' Short Story- (The Happy Prince) from "New Horizons"** G .Non-finite verbs, Auxiliary verbs and question tags V- Word formation and One-Word Substitutes **UNIT-IV** W- Writing Strategies- Sentence structures-Letter Writing-Dialogue Writing- Public Speaking G- Transformation of Sentences (Direct and Indirect/ Active and Passive) V- Affixes-prefix and suffix, root words, derivatives	

	UNIT-V W- Technical Report writing-strategies, formats-types-technical report writing G- Conditional clauses, Transformation of Sentences (Degrees of Comparison/Connectives) V- Collocations and Technical Vocabulary and using words appropriately- Synonyms- antonyms, homonyms, homophones, homographs, words often confused.
Text Books & Reference Books:	**Text Books:** 1.Using English published by Orient Black Swan 2.New Horizons published by Pearson **Reference Books:** 1. Raymond Murphy's English Grammar with CD, Murphy, Cambridge University Press, 2012. 2. English Conversation Practice- Grant Taylor, Tata McGraw Hill, 2009. 3. Communication skills, Sanjay Kumar & Pushpalatha Oxford University Press, 2012. 4. Techniques of Teaching English: A.L. Kohli 5. A Textbook of English Phonetics: For Indian Students: T Balasubramanian., MacMillan India Limited
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

13SH1002 – ENGINEERING MATHEMATICS-I

Course Category:	Mathematics	**Credits:**	8
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
Pre-requisite:	• Trigonometric, Differentiation and integrationFormulas • Equation Simplifications	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To develop the basic mathematical knowledge and computational skills of the students in the areas of applied mathematics. 2. To develop the skills of the students in the areas of Differential calculus Integral calculus, Vector calculus, Curvature and Matrices. 3. To serve as a pre-requisite mathematics course for post graduate courses, specialized studies and research. 4. To acquire knowledge on integral calculations 5. To acquire knowledge on vector calculations	
Course Outcomes:	**CO1**	Understand the concepts of rank of the matrices, linear and non-linear system of equations, eigen-values and eigen-vectors, apply Caley-Hamilton theorem, diagonalizable of symmetric matrices and demonstrate the nature of quadratic forms.
	CO2	Understanding effectively the mean value theorems and Maxima and Minima of a function of two variables – Lagrange's method of multipliers.
	CO3	Understanding effectively the geometrical aspects of curvature, involutes and evolutes of plane curves, essential concepts for an engineer, as elegant applications of differential calculus.
	CO4	Demonstrate knowledge and understanding the evaluate of double integration and triple integration using Cartesian, polar co-ordinates and also understand effectively areas and volumes.
	CO5	Apply Green's theorem, Gauss' theorem and Stokes' theorem.
Course Content:	**UNIT- I** **MATRICES:**Rank of Matrix**:-**Echelon Form and Normal Form - Consistency of system of linear equations- Eigen values and Eigen vectors- Cayley – Hamilton's theorem- Diagonalization of matrix- Quadratic forms. **UNIT- II** **DIFFERENTIAL CALCULUS:** Rolle's, Lagranges and Cauchy's mean value theorems (without proofs) - Taylor's and Maclaurin's series (only one variable) - Maxima and Minima of a function of two variables – Lagrange's method of multipliers. **UNIT- III** Radius of curvature, involutes and evolutes. Beta and Gamma functions. Curve tracing (only Cartesian form) **UNIT- IV** **INTEGRAL CALCULUS**:Double and Triple Integrals- Change of order of integration- Change of variables- Simple applications to areas and volumes.	

	UNIT- V **VECTOR CALCULUS**:Gradient, Divergence, Curl - Laplacian and Second Order Operators- Line, Surface and Volume integrals- Potential function- Green's theorem, Stoke's theorem and Gauss Divergence theorem (without proof)- Verification of Green's , Stoke's and Gauss Divergence theorem.
Text Books & Reference Books:	**Text Books:** 1. Higher Engineering Mathematics – B S Grewal 2. Engineering Mathematics- B V Ramana 3. Elementary Engineering Mathematics – B S Grewal **Reference Books:** 1. Higher Engineering Mathematics- H K Das et al 2. Advanced Engineering Mathematics- N P Bali & M Goya 3. Engineering Mathematics-I S. Chand & Co.
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

13SH1003 – ENGINEERING MATHEMATICS-II

Course Category:	Mathematics	**Credits:**	8
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
Pre-requisite:	• Trigonometric, Differentiation and integration Formulas • Equation Simplifications • Roots finding and partial fractions	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To develop the basic mathematical knowledge and computational skills of the students in the areas of applied mathematics. 2. To develop the skills of the students in the areas of Differential Equations, Laplace Transform, Fourier series and Fourier Transfers. 3. To serve as a pre-requisite mathematics course for post graduate courses, specialized studies and research. 4. To understanding effectively Fourier series analysis 5. To understand Fourier transform and how to compute it for standard examples	
Course Outcomes:	**CO1**	Students will be able to understand the basic theories and methods of differential equations, and to apply the fundamental techniques of differential equations to perform analysis and computation of solutions to various differential equations.
	CO2	Understanding effectively the Laplace Transformations of standard functions and their properties.
	CO3	Understanding effectively the unit step function, Dirac's delta function, convolution theorem and also the applications of Laplace transforms to differential equations.
	CO4	Understanding effectively Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
	CO5	Understand Fourier transform and how to compute it for standard examples and also understand effectively the Fourier integral in complex form, finite and infinite Fourier transforms, Fourier sine and cosine transforms.
Course Content:	**UNIT – I** **Ordinary Differential Equations:** Linear Differential Equations of second and higher order with constant coefficients- Method of variation of parameters- Equations reducible to linear equations with constant Coefficients- Cauchy's linear equations –Legendre's linear equation. **UNIT – II** **Laplace Transformation:** Laplace Transformations of standard functions- Properties of Laplace Transformation- Transformation of derivatives and integrals- Initial and Final value theorems-Transforms of unit step function and impulse function – Transform of periodic functions. **UNIT – III** **Inverse Laplace Transformation:** Inverse transforms- Unit step function- Dirac's delta function-Convolution theorem- Transforms of periodic functions- Application to solutions of Ordinary Differential Equations. **UNIT-1V**	

	Fourier series: Determination of Fourier coefficients- Fourier series- Even and Odd functions-Change of intervals- Half Range Sine and Cosine Series- Complex form of Fourier series- Parseval's formula. **UNIT-V** **Fourier Transforms:** Fourier Integral Theorem- Fourier Sine and Cosine integral- Fourier integral in complex form – Finite and Infinite Fourier Transforms- Fourier Sine and Cosine transforms properties- Inverse transforms.
Text Books & Reference Books:	**Text Books** 1.Higher Engineering Mathematics –B S Grewal 2.Engineering Mathematics- B V Ramana **Reference Books** 1. Higher Engineering Mathematics- H K Das et al 2. Advanced Engineering Mathematics- N P Bali and M Goyal.
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

13SH1004– ENGINEERING PHYSICS

Course Category:	Sciences	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
Pre-requisite:	• Electromagnetism and optics • Electromagnetic field and Waves	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. Describe the concept of wave particle duality , Schrodinger wave equation and behavior of electrons in metals. 2. Explain and provide the knowledge about semiconductors and their use in electronic devices. 3. Basic properties of magnetic Materials and the uses in Science &Technology. 4. Describe the characteristics of lasers , their construction and applications in Science & Technology 5. Describe basic idea about optical fibers, their construction and uses in communication field.	
Course Outcomes:	**CO1**	Understanding the wave particle behaviour of matter Schrodinger wave equation and electronic behaviour in metals.
	CO2	Understand the structure of crystalline solids and their applications in X-ray diffraction
	CO3	Know the properties of semiconductor materials by projecting the view of energy bands and know the concept of magnetization and applications of magnets in various disciplines.
	CO4	Understand the utilization of laser technology in various disciplines. Basic Understands of Acoustics.
	CO5	Understand the concept of optical fiber and its applications. Basic ideas about super conductor and their uses in different fields.
Course Content:	**UNIT – I** **QUANTUM MECHANICS AND FREE ELECTRON THEORY :** **Quantum Mechanics** : Wave – Particle duality - de'Broglie hypothesis of Matter waves –Properties of matter waves Heisenberg's uncertainty principle and its applications–Schrodinger's time independent and time dependent wave equation – Significance of wave function –Particle in a one dimensional infinite potential well. **Free Electron Theory**: Classical free electron theory- Sources of electrical resistance –Equation for electrical conductivity – Quantum free electron theory- Fermi level and Fermi –Dirac distribution– Bloch theorem -Kronig – Penny model (qualitative) Origin of bands in solids –Classification of solids into conductors, semiconductors and insulators. **UNIT – II** **SEMI CONDUCTORS AND MAGNETIC MATERIALS :** **Semiconductor Physics**: Introduction – Intrinsic and extrinsic semiconductors carrier concentration in intrinsic and extrinsic semi conductors - Drift and diffusion currents Einstein's equation–Continuity equation-Hall effect-direct and indirect bandgap semiconductors. **Magnetic Materials** : Introduction and basic definitions –Origin of magnetic moments –Bohr magneton –Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials –Hysteresis –Soft and hard magnetic materials and applications	

	UNIT – III **CRYSTALLOGRAPHY AND X-RAY DIFFRACTION AND DEFECTS IN CRYSTALS:** **Crystallography** : Introduction–Space lattice–Unit cell–Lattice parameters–Bravias lattice crystal systems–Packing fractions of SC,BCC and FCC structures–Structures of NaCl and Diamond –Directions and planes in crystals–Miller indices – interplanar spacing in cubic crystals **X-ray diffraction and defects in crystals** : X-ray diffraction–Bragg's law–Laue and Powder methods –Defects in solids : point defects, line defects (qualitative)-screw and edge dislocation, burgers vector. **UNIT – IV** **LASERS AND ULTRASONICS** **Lasers** : Introduction – Characteristics of laser –Spontaneous and simulated emission of radiation-Einstein's coefficients–Population inversion–Excitation mechanisms and optical resonator–Ruby laser –He Ne laser–Semi conductor laser-Applications of lasers. **Ultrasonics** : Introduction Production of ultrasonics by piezoelectric method and magneto striction method – Detection and Applications of Ultrasonics. **UNIT – V** **FIBER OPTICS AND SUPERCONDUCTIVITY** **Fiber Optics :** Introduction**-**Construction and working principle of optical fiber–Numerical aperture and acceptance angle–Types of optical fibers–Attenuation and losses in fibers–Optical fiber communication system–Applications of optical fibers in communications, sensors and medicine **Superconductivity**: Introduction–Meissner effect–properties of superconductors–Type I and II superconductors–Flux quantization–London penetration depth–ac and dc Josephson effects–BCS theory (qualitative)-–Applications of superconductors
Text Books & Reference Books:	**Text Books:** 1.P. K. Palaniswamy ,Scietech Publications 2.V.Rajendran and K.Tyagarajan,Tata Mc Graw Hill Publications – III Edition 3.R.K. Gaur and G.L.Guptha,Danapati Rai Publications **Reference Books** 1.A.J.Dekkar ,Mcmillan Publications –Latest Edition 2012 2.M.Arumugam,Anuradha Publications II Edition 3.Rama Chandra B & Subramanyam SV ,Hitech Publications 4.S.O.Pillai ,New age International Publications 5.Puri RK and Babbar VK ,Chand & Co Publications 6.M.N.Aaravindhanulu and P.G.Krishi sagar, Chand & CO Publications Revised Edition 2013
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

13SH1005 – ENGINEERING CHEMISTRY

Course Category:	Sciences	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
Pre-requisite:	fundamentals chemistry	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To strengthen the fundamentals of Chemistry and then build an interface of theoretical concepts with their industrial/engineering applications. 2. The extension of fundamentals Electrochemistry to energy storage devices such as batteries and fuel cells is one such example. 3. To design engineering materials and solve problems related to them. 4. To understand the chemistry involved in the fuels. 5. To understand water chemistry and polymers and their application	
Course Outcomes:	**CO1**	Understand the electrochemical sources of energy
	CO2	Understand industrially based engineering materials
	CO3	Differentiate between soft and hard water
	CO4	Understand the disadvantages of using hard water and apply suitable treatments
	CO5	Understand the basics of polymers and their uses in engineering field
Course Content:	**UNIT – I** **ELECTRO CHEMISTRY** Single electrode potential – explanation and measurement-Reference electrodes: Hydrogen gas electrode-calomel electrode-glass electrode Electrochemical cells-Numerical calculations-Batteries: Rechargeable cells and batteries (Lead-Acid storage cells, Al-Air Batteries)-Fuel Cells : Hydrogen - Oxygen fuel cell Corrosion: Definition-classification-Factors affecting the corrosion-Prevention methods of corrosion – metallic coatings (Electroplating) and cathodic protection. **UNIT-II** **CHEMISTRY OF ENGINEERING MATERIALS** Electrical insulators: Definition-classification-Characteristics-Application of electrical insulating materials (solid, liquid and gaseous insulators) Refractories: Classification-properties and applications Lubricants: Lubricant -Lubrication-Theory of lubrication-Properties and applications of lubricants. **UNIT – III** **FUEL TECHNOLOGY** Classifications of Fuels -Characteristics of fuels -Calorific value – determination – Bomb calorimeter - Boys gas calorimeter - Theoretical calculation of calorific value. Solid fuels-coal-analysis of coal - metallurgical coke Liquid fuels: Petroleum – refining of petroleum - Synthetic petrol – Fischer Tropch's synthesis Gaseous fuel – Flue gas analysis by Orsat's apparatus	

	UNIT – IV **WATER TREATMENT** Impurities in water-Hardness of water-disadvantages of water-Estimation of hardness by EDTA method-Estimation of dissolved oxygen-alkalinity-chlorides in water Industrial use of water: For steam generation-troubles of boilers-scale and sludge-priming and foaming-caustic embrittlement-boiler corrosion Softening methods of hard water: Lime-soda process- Zeolite process-Ion exchange method **UNIT - V** **POLYMERS** Introduction to polymers-Polymerization process-types of polymerization Elastomers: natural rubber – volcanization of rubber – compounding of rubber-Synthetic rubbers: preparation, properties and engineering applications of Buna – N, Neoprene, Thiokol and silicon rubbers Plastomers: Thermosetting and thermoplastics-Moulding constituents of plastics-Preparation, properties and engineering applications of PVC, Bakelite, Nylons and Urea-Formaldehyde
Text Books & Reference Books:	**Text Books:** **1.**Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, Foruth Edition, New Delhi 2.A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi **Reference Books**: 1.A Text Book of Enigneering Chemistry, Jain and Jain, DhanapathiRai Publications, New Delhi 2. Engineering Chemistry by K.B.ChandraSekhar, UN.Das and Sujatha Mishra, SCITECH Publications India Pvt Limited. 3.Concepts of Engineering Chemistry- AshimaSrivastavaf and N.N. Janhavi 4.Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu 5.Chemistry of Engineering Materials, C.V.Agarwal ,C.Parameswaramurthy and Andranaidu 6.Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

13CS1001 – C PROGRAMMING & DATA STRUCTURES

Course Category:	Computing	**Credits:**	8
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
Pre-requisite:	• knowledge of computer operation • MS-office • Text editor	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To describe fundamentals of C programming such as variables, conditional and iterative execution, methods, etc. 2. Arrays, Strings, Functions 3. Storage classes, pointers, structures 4. Data structures, stacks and queues 5. Graphics and trees, searching and sorting	
Course Outcomes:	**CO1**	Describe fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
	CO2	Analyze and solve programming problems using a procedural and algorithmic approach with functional decomposition.
	CO3	Apply knowledge of computing and mathematics using simple data structures.
	CO4	Develop skill to use pointers, memory allocation and data handling through files in 'C'.
	CO5	Understand the process of compiling, linking, and running a program using a computing tool.
Course Content:	**UNIT – I** Algorithms, flow charts, Program Development Steps, Introduction To C Language: Basic Structure of C Program, Identifiers, Basic data types, Variables, Operators. Operator Precedence and Associativity, Expression Evaluation, Type conversions. **Selection Statements**: Various forms of if statements, switch statement, **Iteration**: while, do-while, for statements, other control altering statements– break, continue, goto and exit. **UNIT – II** **Arrays**: Declaration, initialization, accessing elements, storing elements, two-dimensional and multi-dimensional arrays, applications of arrays. **Strings**– Declaration, initialization, Built-in and user-defined String handling Functions **Functions**: Basics, call by value and reference, recursive functions, Scope rules. **UNIT – III** **Storage Classes**: auto, register, static, extern. Type qualifiers, Pre-processor Directives. **Pointers**: Initialization of pointers, Address Arithmetic, Dynamic memory allocation functions, array of pointers, pointers to functions, command–line arguments. **Structures**: Declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, pointers to structures, self-referential structures, unions, bitfields.	

	UNIT – IV **Data Structures**: Overview of Data Structures, Linked lists – implementation of Operations in singly linked list, **Stacks & Queues**: Basic Operations, representations of stacks and queues using arrays and linked lists, Applications. **UNIT –V** **Graphs And Trees**: Representation and Traversals. **Searching And Sorting**: Sorting- selection sort, bubble sort, insertion sort, quick sort, merge sort. Searching – linear and binary search methods.
Text Books & Reference Books:	**Text Books:** 1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning. 2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Ed. **Reference Books:** 1. The C programming language: Kernighan B W and Ritchie D M. 2. An Introduction to Data structures with applications: Tremblay J P and Sorenson P G.
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

13ME1001-ENGINEERING GRAPHICS

Course category:	Program core	**Credits:**	6
Course Type:	Theory	**Lecture - Tutorial - Practical:**	1 - 0 - 3
Prerequisite:	Geometrical constructions	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To bring awareness on the standard conventions, notations and methods used in technical drawing 2. To analyse and draw various curves 3. To impart knowledge on orthographic projections of lines, planes and simple solids 4. To draw the development of lateral surfaces of simple solids 5. To impart the knowledge to draw Isometric views and projections.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to create geometric constructions, conics with hand tools to draw lines, polygons, circle, tangencies, conic sections and irregular arcs
	CO2	Ability to draw the solutions to the problems on projection of points, line and planes ,traces and make auxiliary view sketches
	CO3	Ability to draw the solutions to the problems on projection of solids and make sectional view sketches.
	CO4	Ability to draw the solution to the problems on development of solids.
	CO5	Able to draw the isometric views
Course content	**UNIT – I** Conics: General Methods- Ellipse, Parabola and Hyperbola- Ellipse: Special methodsConcentric Circles method, Oblong method and Foci method-Parabola: Tangent method , Rectangle method-Hyperbola. Cycloidal Curves: Cycloids, Epi and Hypo Cycloids- Involute. **UNIT – II** Projections: Principles of Projection- First angle Projection, Projection of points and Lines. Projections of Planes: Projections of Planes, Projection on Auxiliary vertical and inclined planes. **UNIT – III** Projections of Solids: Projections of simple Solids such as Prisms, Pyramids, Cylinders and Cones with varying positions of their Axes. Sections of Solids: Sections of Solids such as Cubes, Prisms, TetraHedron, Pyramids, Cylinders and Cones resting on their bases on H.P only- true shape of Sections.	

	UNIT-1V Development of Surfaces: Development of Laternal Surfaces of Right regular Solids such as Prisms, Pyramids, Cylinders and Cones which are cut by a plane inclined to H.P only. Interpenetration of Solids: Square Prism in a Square Prism and Cylinder in a Cylinder. **UNIT-V** Isometric Projections: Isometric Projections and views of objects. (Treatment to only Isometric Lines). Orthographic Projections: Conversion of Pictorial views into Orthographic views.
Text Books and reference Books:	**Text Books:** 1. P Kannaiah and K L Narayana " A text book on Engineering Drawing" Scitech Publications Pvt Ltd 2. N D Bhatt and V M Panchal "A text book on Engineering Drawing" ,Charotar Publishing house Ltd. **Reference Books:** 1. K Venu Gopal "A text book on Engineering Drawing and Graphics + Auto CAD" .
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13SH10P1 – ENGLISH LANGUAGE LABORATORY

Course Category:	Humanities	**Credits:**	4
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	• Ability to understand English language • Ability to use language in informal situations • Minimum ability to perceive things around	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To equip with listening to comprehend the speech of people of different backgrounds 2. To enable to express fluently and appropriately in social and professional contexts 3. To help to overcome inhibitions and self- consciousness while speaking in English and to build confidence 4. Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical and analytical writing. 5. Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation	
Course Outcomes:	**CO1**	Comprehends confidently and respond appropriately to the speech of multiple speakers
	CO2	Express ideas and views without any hesitation
	CO3	Communicate and converse with general clarity using proper pronunciation which allow for overall intelligibility.
	CO4	Narrate with ease logically and gracefully
	CO5	Comprehend information in data and represent in pictorial format and graphs
Course Content:	I. Listening Skills: • Listening for Pleasure • Listening for Details • Listening for Information II. Speaking Skills: • Introducing Themselves • Phonetics 1. Introduction of Sounds- Vowels & Consonants 2. Syllables 3. Inflections 4. Stress & Intonation • Jam • Extempore • Role Plays/ Situational Dialogues & Telephonic Conversations • Presentations • Debates	

	III. Reading Skills: • News Paper Reading IV. Writing Skills: • Story Writing • Description 1. Object 2. Place 3. Person 4. Situation • Information Transfer • Giving Directions & Instructions • Email Writing

13ME101P – WORKSHOP

Course Category:	Engineering Sciences	**Credits:**	4
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	• Physical strength • General knowledge • Knowledge on dimensions	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. Types of carpentry, fitting tools & types of joints. 2. Sheet metal – definition, working tools, operations - forming & bending. 3. Types of foundry tools and their usage in moulding process. 4. Types of welding tools, machine tools, cutting tools (Lathe, Drilling). 5. To impart knowledge in various AC & DC circuit parts.	
Course Outcomes:	**CO1**	Able to explain the different tools of usage in carpentry and fitting sections.
	CO2	Able to gain the basic knowledge in the manufacturing process of metal forming, casting process & usage of tools in their respective sections.
	CO3	Able to make the circuits of household wiring.
	CO4	Able to explain the different tools which are using in machine shop, welding shop and black smithy.
	CO5	Students are able to learn the physical recognition of different electrical components like Resistances, Inductances, Capacitances and their ratings. And, gain the knowledge of computer peripherals working, sharing& power point presentation.

Course Content:

LIST OF EXPERIMENTS

CARPENTRY

1. Planning sawing and grooving
2. Half lap joint
3. Half Lap Dovetail Joint
4. Mitre Faced Bridle Joint
5. Mortise and Tenon Joint

FITTING

Straight fitting

1. V-fitting
2. Square fitting
3. Semi-circular fitting
4. Dovetail fitting

FOUNDRY

1. Stepped block
2. Dumb bell
3. Flanged pipe

TINSMITHY

1. Square tin
2. Circular tin
3. Funnel

	DEMO (a) Metal cutting (b) Welding (c) Black smithy **ELECTRICAL WIRING** 1. (a) One lamp controlled by one switch (b) Two lamps controlled by one switch in Series and Parallel (c) Two lamps controlled by one switch in Series and Parallel combinedly 2. (a) Two lamps controlled by two switches independently (b) One lamp controlled by two two-way switched (staircase connection) **IT WORK SHOP** 1. Assembling a desk top computer 2. Connecting two computers using wire and without wire 3. Preparation of a power point presentation **ELECTRONICS** 1. (a) Identification of components (b) Calculation of values of components like (i) Resistance (ii) Capacitance (iii) Inductance 2. Soldering Practice 3. Operation of CRO (a) measurement of parameters (b) Lijjajous Figure

13CS10P1 – PROGRAMMING LABORATORY

Course Category:	Computing	**Credits:**	4
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	• knowledge of computer operation • MS-office • Text editor	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	1. To describe fundamentals of C programming such as variables, conditional and iterative execution, methods, etc. 2. Arrays, Strings, Functions 3. Storage classes, pointers, structures 4. Data structures, stacks and queues 5. Graphics and trees, searching and sorting	
Course Outcomes:	**CO1**	Plan a solution for a problem by writing a program.
	CO2	Develop searching and sorting algorithms using loop statements.
	CO3	Write telephone directory program using files concepts.
	CO4	Develop stacks and queues programs using structures and pointers concepts.
	CO5	Develop trees programs using structures and pointers concepts.
Course Content:	**LIST OF EXPERIMENTS** 1) Write a C program to implement the following i) Convert Centigrade to Fahrenheit and vice versa (f=(9/5)*c+32) ii) Sum of the n natural numbers ((n(n+1))/2) iii) Sum of the squares of the n natural numbers ((n(n+1)(2n+1))/6) iv) Slope and midpoint of line using its end points (slope = (y2-y1)/(x2-x1),midpoint -> x=x1+x2/2, y=y1+y2/2) v) Quotient and remainder based on two integers i and j. (q = i/j, r = i-q*j) vi) Area and circumference of a circle (πr2& 2πr) 2) Compute all possible roots of a quadratic equation of the form ax2+bx+c=0. 3) Write a C program to arrange three numbers in ascending order using i) Ternary operator ii) if statement . 4) Write a C program to i) Find the grade of a student by reading marks ii) Convert the given digit into word. 5) Write a C program to implement the arithmetic operations (+,-,*, %) using switch case statement. 6) Write a C program to find the i) Factorial of a number ii) G.C.D of two numbers. 7) Write a C program to i) To find the sum of individual digits of a given number ii) Reduce the number to a single digit. 8) Write a C program to print i) Prime numbers from 1 to n ii) Pascal triangle.	

	9) Write a C program to find i) The largest and smallest number in a list of integers ii) Sum of 1! +2! +3! +-----+n! using while loop. 10) Write a C program to evaluate 1-1/2! +1/3!-1/4! +-----+1/n! using for loop. 11) Write a C program to implement Fibonacci series using do while loop. 12) Write a C program to evaluate the sum of series $1+x/1! +x^2/2! +x^3/3!...n!$. 13) Write a C program to implement the following i) Length of the given string ii) Reverse of the given string iii) Copy one string into another iv) Comparison of two strings v) Concatenation of strings vi) String handling functions (any five) 14) Write a C program to check whether the given string is a palindrome or not. 15) Write a C program to implement i) Matrix addition ii) Matrix multiplication. 16) Write a C program to implement factorial of a given number using recursion. 17) Write a C program to implement i) Employ salary calculation ii) Student percentage Calculation. 18) Write a function that returns a union with values of say Basic, DA, HRA etc. at different times based on the argument passed. Compute the salary of the employee in main function after calling the above function repeatedly. 19) Write a C program to implement pointer arithmetic. 20) Write a C program for i) Call by value ii) Call by reference. 21) Write a C program to find minimum and maximum values in a given array using pointers. 22) Write a C program to display i) Five arguments from command line arguments ii) Addition of two numbers using command line arguments. 23) Write a C program to implement stacks using arrays. 24) Write a C program to implement Single Liked List operations. 25) Write a C program to i) Convert infix to postfix expression. ii) Evaluate Postfix expression. 26) Write a C program to implement i) Linear search ii) Binary search. 27) Write a C program to implement i) Bubble sort ii) Selection sort. 28) Write a C program to implement Single Liked List operations.

Vision and Mission of the Institute

Vision:

To emerge as a comprehensive Institute that provides quality technical education and research thereby building up a precious human resource for the industry and society.

Mission:

- To provide a learner-centered environment that challenges individuals to actively participate in the education process.
- To empower the faculty to excel in teaching while engaging in research, creativity and public service.
- To develop effective learning skills enabling students pick up critical thinking thus crafting them professionally fit and ethically strong.
- To reach out industries, schools and public agencies to partner and share human and academic resources.

Vision and Mission of the Department

Vision:

To become an excellent centre for technical education and research in the field of mechanical engineering to meet the societal, regional, national and global challenges.

Mission:

- To impart quality technical education and transform bud engineers into an effective and responsible engineers to work with the current technologies in multi-cultural and multi-discipline environment.
- To encourage the students to develop their creativity in the field of mechanical engineering by providing modern laboratory facilities with hands on training and contemporary curriculum.
- To develop the interaction with the Industry, experts in order to technical mastery.
- To provide best teaching & learning practices as well as creating opportunities for Research, maximise student results and placements
- To inculcate and promote lifelong learning skills, problem solving skills, leadership qualities and team work.

PROGRAM EDUCATIONAL OBJECTIVES

- **PEO1:** A strong foundation to access, analyze, plan and implement their knowledge in basic sciences & mathematics, core and interdisciplinary courses.
- **PEO2:** Graduate will be in a position to work with the members of multi-disciplinary teams and can play a leading role in handling the technical issues.
- **PEO3:** Graduates will have capability to work with modern engineering tools, software and equipment under the realistic constraints.
- **PEO4:** Graduates will engage in lifelong learning skills with research attitude and social responsibility.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO1.Engineering knowledge: The Graduate will be able to solve mechanical engineering related problems through the application of knowledge in mathematics, science and engineering.

PO2.Problem analysis: The graduate will be able to identify, formulate and solve complex engineering problems through literature reviews/surveys and fundamentals of mathematics, sciences and engineering.

PO3.Design/development of solutions: The graduate will be able to design and develop solution for complex engineering problems and systems or processes for specific needs within the realistic constraints of the civil society..

PO4.Conduct investigations of complex problems: The graduate will be able to investigate the complex engineering problems through research methodologies.

PO5.Modern tool usage: The graduate will be able to use modern engineering tools, techniques and skills necessary for engineering practice to obtain solution to the problems

PO6.The engineer and society: The graduate will be able to work as responsible professional engineer with contextual knowledge of the civil society.

PO7.Environment and sustainability: The graduate will be able to develop sustainable engineering solutions with environmental and societal context.

PO8.Ethics: The graduates will be able to work with professional ethics and commitment

PO9.Individual and team work: The graduate will be able to associate with the multi-disciplinary teams or lead the people associated with.

PO10.Communication: The graduates will be able to communicate effectively with appropriate representation of their views or ideas.

PO11.Project management and finance: The graduate able to execute the project effectively in multidisciplinary environments as a member or leader through knowledge acquired in engineering.

PO12.Life-long learning: Graduate will have an ability to engage in life-long learning of knowledge on contemporary issues.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR:NELLORE)
SPSRNELLORE DIST
II YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMISTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2014-2015)
(For the batch admitted in the academic year 2013-2014)

Course Code	Course Title	Instruction			Credits	Evaluation							Max. Total Marks
		Hours/Week				Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		
		L	T	D/P		Duration In Hours	Max Marks	Duration in Hours	Max Marks		Duration in Hours	Max Marks	100
13SH2104	Numerical Methods & Statistics	3	1	-	4	2	40	2	40	0.8(best test) + 0.2(other test)	3	60	100
13EE2121	Electrical & Electronics Engineering	3	1	-	4	2	40	2	40		3	60	100
13CE2101	Engineering Mechanics	3	1	-	4	2	40	2	40		3	60	100
13CE2106	Fluid Mechanics	3	1	-	4	2	40	2	40		3	60	100
13ME2101	Basic Manufacturing Processes	4	-	-	4	2	40	2	40		3	60	100
13ME2102	Basic Thermodynamics	3	1	-	4	2	40	2	40		3	60	100
	LABS		-							Day to day Evaluation and test			
13EC21P2	Electrical & Electronics EngineeringLab		-	3	2	-		-			3	60	100
13ME21P1	Fuels&Lubricants-I Lab		-	3	2	-		-			3	60	100
	TOTAL	19	5	6	24+4								

13SH2104– Numerical Methods & Statistics

Course category:	Basic Sciences	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Engineering Mathematical Concepts.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Apply definition of probability of an event. 2. Learning the decision making procedure about a parameter. 3. Design an experiment to the controllable variables of the system. 4. Display successive measurements of a process with center line and control limits. 5. Able to understand the discrete and continuous Random variables.	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Students will be able to understand the basic theories and methods of solving of nonlinear equations differential equations, and to apply the fundamental techniques of solving iterative methods. Bisection and Newton Rapshon methods. Understanding effectively fitting of a curve by the method of least squares method.And also understand the rank correlation and Regression of lines
	CO2	Understanding effectively Iterative methods: Gauss Jordan, Gauss Elimination with Pivotalcondensation, Triangular factorization methods Gauss- Seidel and also understand Newton – Raphson iterative methods.
	CO3	Understanding effectively Taylor's and Euler's methods of first order differential equations.To obtain more desired accuracy and also understand R-K Grillmethod, Milne's Predictor and corrector methods which plays an important role in engineering subjects.
	CO4	To know the definitions of Newton's forward and backward interpolation formulae. Also to understand Lagrange's interpolation formula. Understand effectively by Romberg method of integration
	CO5	Students will be able to understand the discrete and continuous Random variables .Understand effectively three important theoretical distributions Binomial, Poisson and Normal distribution
Course content	**UNIT-I** **Determination of Roots of Non-linear Equations:** Bisection Method - Iterative methods - False position method – Newton Raphson method. **Curve fitting**: Fitting a straight line – Second degree curve by the method of least Squares – Power Curve by the method of least Squares. Correlation: Coefficient of correlation – Rank correlation Regression of lines.	

	UNIT-II **Solution of Linear and Non-linear Algebraic Equations:** Iterative methods – Gauss Jordan– Gauss Elimination with Pivotal condensation –Triangular factorization methods – Gauss- Seidel and Newton – Raphson iterative methods. **UNIT-III** **Solution of Ordinary Differential Equations:** Taylor's Series method – Euler's method –Euler's modified method — Runge-Kutta Second and Fourth order methods - Runge-Kutta Grill method – Milne's Predictor and Corrector methods for first order equations **UNIT-IV** **Numerical Interpolation, Differentiation and Integration:** Newton's forward and backward interpolation formula – Lagrange's interpolation formula - Numerical Differentiation by Richardson's extrapolation—Numerical integration by Romberg method. **UNIT-V** **Probability and Statistics:** Introduction – Random variables – Discrete and Continuous distributions – Binomial, Poisson's and Normal distributions.
Text Books and reference Books:	**TEXT BOOKS:** 1. Mathematical Statistics: Ray M. & Sharma H.S; Ram Prasad&Sons.Publishers. 2. Numerical methods : Armugam S. etal.;Scitech Publications, Chennai. 3. Statistics : Schuam's Series**.** **REFERENCES:** 1. Higher Engineering Mathematics :Grewal B.S., Khanna publications. 2. Mathematical Methods : D.V.T.K.V.Iyengar, Dr.B. Krishnaghandhi, S.Chand&Co. Publications
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13EE2121– ELECTRICAL AND ELECTRONICS ENGINEERING

Course category:	Basic Sciences	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Electrical Concepts.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Describe the basic properties of electrical elements and A.C fundamental calculations. 2. Describe the principal of transformer construction, working principle. 3. To provide knowledge on the concepts of single phase induction motor construction. 4. To make the students explain about Junction Diode and Rectifier. 5. Describe the concepts of BJT operations, configurations and characteristics	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Able to understand the basic properties of electrical elements and A.C fundamental calculations.
	CO2	Able to understand the concepts of transformer construction, working principle and efficiency.
	CO3	Able to understand the concepts of single phase induction motor construction, working principle and performance characteristics.
	CO4	Able to understand the operatingcharacteristics and applications of diode.
	CO5	Able to understand the concepts of BJT operations, configurations and characteristics.
Course content	**UNIT-I** **Basic Electrical Circuits:** Active and passive elements, Kirchhoff's laws – Alternating currents,Definitions of peak value, RMS value, Average value and form factor, single phase circuits – Behavior of resistance, Inductance and Capacitance to sinusoidal excitation voltage. Series, Parallel and series-parallel circuits. **UNIT-II** **Transformers:** single phase transformers - Principle of operations – construction, EMF equation, regulation, losses and efficiency, equivalent circuit, OC and SC test. **UNIT-III** **Induction Motors:** Three phase induction motor - Principle of operation. Types slip torque characteristics, principle of operation of single phase induction motors, Types of starting and applications. **UNIT-IV** **Junction diode:** Band structure of P-N Junction – current components – Volt ampere characteristics and its temperature dependence – diode resistance and capacitance – Zener	

	diode and tunnel diode. **Rectifiers:** Diode equivalent circuit, Half – Wave, Full – Wave and Bridge rectifiers, Analysis of filters with full wave rectifier. **UNIT-V** **Bipolar Junction Transistor:** Transistor action – PNP and NPN Transistors. CB,CE,CC configurations and their characteristics, analytical expressions for transistor characteristics – Specifications of BJT – Determination of h- parameters from BJT characteristics
Text Books and reference Books:	**TEXT BOOKS:** 1. A course in basic electrical engineering by J.B. Guptha, Dhanpat Rai publishers 2. Principle of electrical engineering and electronics by Mehta .V.K, S.Chand& Co publishers. **REFERENCES:** 1. Electrical Machines by IJ Nagrath and DP Kothari, TMH publishers 2. Electrical Machines by P.S.Bimhra, Khanna publications. 3. Electronic devices and Circuits by Boylestad, Louis Nashelsky, 9ed..,2008 PE
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13CE2101– ENGINEERING MECHANICS

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 1- 0
Prerequisite:	Engineering Physics, Integral and differential Calculus.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To become science-based engineers, having a thorough knowledge of mathematics and physical science. 2. To have a broad grasp of the principles and methods of mechanics, and an ability to apply those fundamentals in practical situations. 3. To develop as persons and professionals, continually expanding their knowledge and abilities, communicating effectively with others, exercising leadership, contributing as team members, and functioning capably with people from diverse social and cultural backgrounds. 4. To sustain and advance human society by applying analytical skills as well as sound reasoning. 5. To developing novel processes and technologies, integrating the contributions of different disciplines, and creating new knowledge and new engineering techniques.	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Able to apply the basic laws of mechanics and explain the free body diagrams for a rigid body or for a group of rigid bodies.
	CO2	Describe the second moments and products of area for various beam cross sections.
	CO3	Ability to apply the laws of friction to solve the engineering problems
	CO4	Able to derive the basic equations of dynamics and to solve problems related to them on rigid bodies.
	CO5	To know the basics of stress – strain and their relationships
Course content	**UNIT-I** **Statics:** Introduction, units and dimensions, Law of mechanics, vectors, vectorial representation of forces and moments, vector operations. Coplanar and concurrent forces, resolution and composition of forces - Equilibrium of a particle - Equivalent systems of forces - Principle of transmissibility, single equivalent force, free body diagram- Types of supports and their reactions, equilibrium of rigid bodies in two dimension **UNIT-II** **Properties of surfaces & solids:** Determination of areas and volumes - First moment of area and centroid - second and product moments of plane area - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.	

	UNIT-III **Friction:** Types of friction, limiting friction, Laws of friction, Static and dynamic friction, motion of bodies. Belt drives - open, crossed and compound, length of belt, tension, tight side and slack side initial and centrifugal, Power transmitted and conditions for maximum power **UNIT-IV** **Dynamics:** Displacement, velocity and acceleration, their relationship, Relative motion, Curvilinear motion, Newton's law of motion, Impulse and momentum, Impact of elastic bodies, Moment of Momentum Equations, Work energy equation, D' Alembert's Principle and its uses, Impulse and Momentum. **UNIT-V** **Concept of Stress and Strain:** Elasticity and Plasticity, Hooke's law, Stress- Strain diagram - tapered bars, Compound bars. Poison's ratio, Volumetric strain, relation between elastic constants, temperature stress, factor of safety, ductile and brittle materials under compression, endurance limit.
Text Books and reference Books:	**TEXT BOOKS:** 1. Engineering Mechanics : S.S.Bhavakatti, New Age Publishers, 4th edition, 2012 2. Engineering Mechanics : Tayal, Umesh Publications, 13thedition,2006 3. Engineering Mechanics : RK. Bansal, Laxmi Publications, 5th edition, 2008 **REFERENCES:** 1. Engineering Mechanics-Statics and Dynamics : Beer and Johnson, McGraw Hill,2007 2. Strength of Materials and Applied Mechanics : I B Prasad 3. Engineering Mechanics : Timoshenko, Young and J.V. Rao, TMH 4. Engineering Mechanics - Ferdinand LSinger,Harper Collings Publishers, 1975
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13CE2106– FLUID MECHANICS (SI UNITS)

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Engineering Mechanics And Engineering Mathematics.	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To provide basic knowledge in fluid properties and statics. 2. To provide understanding on the fundamental laws related to the static and dynamic behavior of fluids and also to develop the equations for pressure flow and momentum analysis. 3. To make the students to explain pressure, discharge measurement devices. 4. To analyze and evaluate the fluid flows of laminar and turbulent	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Ability to explain the fluid properties and basics of laws of fluids.
	CO2	Ability to analyze the hydrostatic forces, total pressure and Centre of pressure on plane surfaces
	CO3	Ability to analyze the kinematics and dynamics aspects in fluid flow and to solve problems related to them.
	CO4	Ability to understand and measure: the pressure and discharge of a fluid flow by using various measuring devices.
	CO5	Ability to understand and analyse the laminar and turbulent fluid flow.
Course content	**UNIT-I** **Fluid properties:** Mass density, weight density, specific volume, relative density, viscosity, compressibility and Bulk Modulus, surface tension and capillarity and standard atmosphere pressure, Vapor pressure and Cavitation. **UNIT-II** **Fluid static's:** Fluid pressure, Pascal's law, absolute and gauge pressure, hydrostatic force on surfaces- total pressure and center of pressure on plane surfaces like Vertical, Horizontal and Curved surfaces. **UNIT-III** **Fluid kinematics:** Type of fluid flow, type of flow lines, rate of flow, velocity potential and stream function continuity equation. **Fluid dynamics:** Euler's equation- Bernoulli's equation and its applications momentum equation and moment of momentum equation. **UNIT-IV** **Pressure Measurements**: Piezometer, manometer-differential manometers, micro manometers, velocity measurements- Pitot tube. **Discharge measurement**: Orifice and mouthpiece, venture meter, Orifice meter and Nozzle meter.	

	UNIT-V **Laminar flow:** Relationship between shear stress and pressure gradients, laminar flow through circular pipes, Hagen-Poiseulle law, loss of head due to friction. **Turbulent flow:** Loss of head due to friction in pipe, Darcy- Weisbach equation, Minor head losses, pipes in series and parallel- siphon. .
Text Books and reference Books:	**TEXT BOOKS:** 1. Fluid Mechanics with Engineering. Applications: Daugherty R.L and J.B. Franzini, TMH, 10^{th} ed. 2. Fluid Mechanics and Fluid Machinery : Rajput R.K.;S.Chand Publications 3. Fluid Mechanics and Fluid Machinery : Bhansal R.K.;Laxmi Publications, 9^{th} ed. **REFERENCES:** 1. Hydraulics and Fluid Mechanics : Modi and Seth,Standard Book House, 2002 2. Theory and applications of Fluid Mechanics : SubramanyamK.,Tata McGraw-Hill
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME2101–BASIC MANUFACTURING PROCESSES

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Basics in Engineering Physics and chemistry.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To examine the principles associated with basic operations of casting and interpret its advantages as well as limitations. 2. To expose the students to a variety of welding processes including their typical use in our daily life. 3. To provide a technical understanding of common mechanical working of metals to aid in appropriate process section for the material. 4. To teach the process level dependence of various sheet metal operations as well as other cold working processes. 5. To understand the characteristics of various extrusion and forging processes along with their defects.	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Able to describe different types of casting processes as well as able to select an appropriate casting process which suits for manufacturing of products with given shape and size.
	CO2	Able to describe and choose an appropriate welding process based on the properties of the material and explain the advanced welding methods.
	CO3	Able to explain the hot and cold working process and calculate the forces generated during rolling operation.
	CO4	Able to explain and select an appropriate sheet metal operation for producing desired components.
	CO5	Able to explain and illustrate the types of extrusion and forging process.
Course content	**UNIT-I** **Casting:** Introduction**,** Steps involved in making a casting, Types of patterns, Pattern making, Materials used for patterns, pattern allowances. Moulding methods: sand molding, Centrifugal, die and investment casting methods. **Design of Castings**: Principles of Gating, Gating ratio and design of Gating systems, Risers – Types, functions and design.Casting Defects. **UNIT-II** **Welding:** Classification of welding processes. Types of welds, welded joints and their characteristics.Gas welding, Arc welding, Forge welding, Resistance welding, Thermitwelding, and Plasma Arc welding.Soldering&Brazing,Cutting of Metals – Oxy Acetylene Gas cutting, plasma arc cutting. **Advanced Welding Methods:** Inert Gas welding-TIG & MIG welding, Friction welding, Explosive welding, welding defects – causes and remedies.	

	UNIT-III **Mechanical Working of Metals:** Hot working, Cold working,Warm working, Strain hardening, Recovery, Recrystallisation and grain growth. **Rolling:** Theory of rolling, Types of Rolling mills and products, Forces in rolling. **UNIT – IV** **Sheet Metal and other Cold Working Processes:** Blanking and piercing, Bending and forming, Drawing and its types, wire drawing and tube drawing, coining, hot and cold spinning.HERF(High Energy Rate Forming) Methods-Explosive forming,Electro-Magnetic pulse forming. **UNIT-V** **Extrusion of Metals:**Basic extrusion process and its characteristics, Hot extrusion and cold extrusion, Forward extrusion, Backward extrusion, Impact extrusion, Hydrostatic extrusion. **Forging Processes:** Principles of forging, Tools and Dies, Types Forging, Drop Forging, Roll forging, forging defects.
Text Books and reference Books:	**TEXT BOOKS:** 1. Manufacturing Technology : P.N. Rao, Tata McGraw Hill,2nd ed., 2008. 2. Manufacturing Technology : Kalpakjian, Pearson edition, 4th ed., 2002. 3. Elements of Workshop Technology, Vol. 1 : S.K.HajraChoudary,A.K.HajraChoudary, Media Promoters Publishers, 15th ed., 2012. **REFERENCES:** 1. Production Technology: R.K. Jain, 2nd ed., Khanna Publishers, 2001. 2. Principles of Metal Castings : Rosenthal,1st ed., Tata McGraw Hill, 1955. 3. Welding Process &Technology :R.S.Parmar, New Delhi, 4th ed., Khanna Publishers, 1997. 4. Manufacturing Technology : R.K. Rajput,1sted.,Laxmi Publications, 2007.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME2102– BASIC THERMODYNAMICS (SI UNITS)

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 1 - 0
Prerequisite:	Engineering physics, chemistry and Mathematics.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To provide understanding on the concepts of thermodynamics 2. To understand and apply the first law of thermodynamics 3. To understand and apply the second law of thermodynamics 4. To understand and explain the concepts of entropy, availability 5. To explain and analyze various gas power cycles and testing of IC Engines	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Ability to explain the fundamental aspects of thermodynamics, discuss the First Law of Thermodynamics and to solve problems related to First law of Thermodynamics.
	CO2	Ability to explain gas laws, discuss the Second Law of Thermodynamics and to solve problems related to Second Law of Thermodynamics.
	CO3	Ability to explain and discuss:Claussius theorem, principle of Increase of Entropy, Availability, Helmholtz function and Gibbs function.
	CO4	Ability to describe: Gas Power Cycles and to design and solve problems on Cycles.
	CO5	Ability to express: Classifications of IC Engines, Operation principle, SI and CI engine and to estimate the performance of IC Engines.
Course content	**UNIT-I** **Basic Concepts and Scope of Thermodynamics**: Macroscopic and Microscopic properties Thermodynamic system, Control Volume, Thermodynamic Properties, Process and Cycle, Thermodynamic Equilibrium, Quasi static process, Zeroth Law of Thermodynamics, Gas Thermometers, Thermocouple, Work transfer, pdv work, Network done by a system, Specific heats and latent heat. **First Law of Thermodynamics:** Energy, Different forms of stored energy, closed systems and steady flow systems – First Law, First law applied to flow process – Mass balance and energy balance in steady flow process – Perpetual motion machine of first kind. **UNIT-II** **Gas Laws:** Boyle's Law, Charles Law, Characteristic equation of gas, Avogadro's Law, Joule's Law, Non- flow Processes: Constant volume, Constant Pressure, Isothermal, Hyperbolic, Adiabatic, Free expansion and Polytropic processes. Real gases, Dalton's Law of Pressures, Avogadro's Law, Gibb's, Dalton's Law of mixture of gases. **Second Law of Thermodynamics:** Limitations of first law, Heat engines and Heat reservoirs, Kelvin Plank statement of second law, Claussius inequality, Refrigeration and heat pump, reversibility and irreversibility, Carnot cycle, Reversible heat engine, Carnot Theorem, Corollaries, Efficiency of reversed heat engine.	

	UNIT-III **Entropy and Availability:** Claussius theorem, The property of entropy, Temperature entropy plot, Principle of increase of entropy , Entropy changes in various thermodynamic processes. **Availability:** Availability energy referred to a cycle, The Helmholtz function and Gibb's functions, T-ds equations, energy equation, Joules Kelvin effect. **UNIT-IV** **Gas Power cycles:** Carnot cycle, Air standard cycles , Otto cycle, Diesel cycle, Mixed cycle or dual cycle, Comparison of cycles, Atkinson cycle, Stirling cycle, Eriksson cycle, and Brayton cycle **UNIT-V** **Internal Combustion Engines:** classification, principles of operation, SI and CI engines. **Performance of IC Engines:** Valve and port time diagrams, indicator diagrams, testing of engines, indicated power, Brake power, efficiencies, air fuel ratio, volumetric efficiency and heat balance.
Text Books and reference Books:	**TEXT BOOKS:** 1. Engineering Thermodynamics: Nag. P.K.5th ed., Tata McGraw-Hill, 2013 2. Heat Engineering :Vasandani V.P. and Kumar D.S., Metropolitan Publishers, 2005 3. Heat Engines : Ballaney P.L., Khanna publishers,2000 **REFERENCE:** 1.Applied Thermodynamics : Thomas DeasEastop, Allan McConkey, Longmans, 2002 2. Thermal Engineering : KurmiR.S , Gupta J.K, S.Chand& Co, 2010 3. Thermal Engineering : Domakundwar, Kodandaraman, DhanapatRai& Co, 2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13EC21P2– ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0- 0 - 3
Prerequisite:	Performance characteristics of various diodes and explain different circuits.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Describe the basic properties of electrical elements and A.C fundamental calculations. 2. Describe the principal of transformer construction, working principle. 3. To provide knowledge on the concepts of single phase induction motor construction. 4. To make the students explain about Junction Diode and Rectifier. 5. Describe the concepts of BJT operations, configurations and characteristics	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Able to analyze operation and characteristics of P-N Junction diode and Zener Diode.
	CO2	Able to analyze and plot the performance characteristics of Bi-Polar Junction Transistor.
	CO3	Able to analyze Kirchhoff's laws for basic Electrical circuits.
	CO4	Able to analyze transformer operation on No-load and on load, find its performance indices.
	CO5	Able to analyze Dynamic behaviour of Three phase induction motor and find its performance indices.
Course contents	List of Experiments: **Electrical Engineering** 1. Verification of KVL and KCL. 2. Load test on D.C .Shunt Motor. 3. Load test on 3phase induction Motor. 4. Sumburne's test. 5.OC and SC Test on Single Phase transformer. **Electronics Engineering** 1.V I characteristics of PN junction Diode and zener Diode. 2. Outputcharacteristics of npn transistor.	

	3. Single phase bridge rectifier. 4.OP-amp application. 5. VI characteristics of FET.
Text Books and reference Books:	**TEXT BOOKS:** 1. A course in basic electrical engineering by J.B. Guptha, Dhanpat Rai publishers 2. Principles of electrical engineering and electronics by Mehta .V.K, S.Chand& Co publishers. **REFERENCES:** 3. Electrical Machines by IJ Nagrath and DP Kothari, TMH publishers 4. Electrical Machines by P.S.Bimhra, Khanna publications. 5. Electronic devices and Circuits by Boylestad, Louis Nashelsky, 9ed..,2008 PE
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm.**

13ME21P1– FUELS AND LUBRICANTS LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0 - 0 - 3
Prerequisite:	An idea of fluid properties	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	The main objective of this lab is to develop an idea of fuel properties and their variation with temperature, determination of viscosity, flash point, fire point, aniline point and calorific value of different fuels and lubricants.	
Course Outcomes	Upon successful completion of the course , the students will able to:	
	CO1	Find the kinematic viscosity and absolute viscosity of different grades of lubricating oils at various temperatures using different apparatus.
	CO2	Know at what temperatures flash&fire points occur for different oils.
	CO3	Understand how to measure Cetane number of oils.
	CO4	Learn about the measurement of calorific value of gaseous fuel.
	CO5	Acquire knowledge about pour point and cloud point temperature.
Course content	. **LIST OF EXPERIMENTS** 1. Determination of Viscosity of Liquid Lubricants & Fuels by Saybolt's viscometer. 2. Determination of Viscosity of Liquid Lubricants & Fuels by Redwood Viscometer-I 3. Determination of Viscosity of Liquid Lubricants & Fuels by Redwood Viscometer-II 4. Determination of Flash point of Liquid Fuels by Abel's apparatus. 5. Determination of Flash and Fire points of Liquid Fuels by Pensky Marten's	

	apparatus 6. Determination of Flash and Fire points of Liquid Fuels by Cleveland 's apparatus 7. Carbon Residue Test for Solid / Liquid Fuels. 8. Test on Distillation Apparatus. 9. Test on Aniline Point Apparatus. 10. Test on Pour point and Cloud Point Apparatus. 11. Test on Junker's Gas Calorimeter. 12. Test on Bomb Calorimeter. 13. Grease Penetration Test. 14. Measurement of Octane and Cetane number
Text Books and reference Books:	**TEXT BOOKS:** 1. Fluid Mechanics with Engg. Applications : Daugherty R.L and J.B. Franzini, TMH, 10^{th} ed. 2. Fluid Mechanics and Fluid Machinery : Rajput R.K.;S.Chand Publications 3. Fluid Mechanics and Fluid Machinery : Bhansal R.K.;Laxmi Publications, 9^{th} ed. **REFERENCES:** 1. Hydraulics and Fluid Mechanics : Modi and Sethi,Standard Book House, 2002 2. Theory and applications of Fluid Mechanics : SubramanyamK.,Tata McGraw-Hill
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR:NELLORE)
SPSRNELLORE DIST
II YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMISTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2014-2015)
(For the batch admitted in the academic year 2013-2014)

Course Code	Course Title	Instruction			Credits	Evaluation							Max. Total Marks
		Hours/Week				Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		
		L	T	D/P		Duration In Hours	Max. Marks	Duration in Hours	Max Marks		Duration in Hours	Max Marks	100
13CE2207	Environmental	4	-	-	4	2	40	2	40	0.8(best test) + 0.2(other test)	3	60	100
13CE2208	Hydraulic	3	1	-	4	2	40	2	40		3	60	100
13CE2209	Strength of	3	1	-	4	2	40	2	40		3	60	100
13ME2201	Applied	3	1	-	4	2	40	2	40		3	60	100
13ME2202	Machine Drawing	1	-	4	4	2	40	2	40		3	60	100
13ME2203	Machine Tools	4		-	4	2	40	2	40		3	60	100
	LABS		-							Day to day Evaluation and test			
13CE22P3	Strength of Materials Lab	-	-	3	2	--		--			3	60	100
13ME22P1	Production	-	-	3	2	--		--			3	60	100
	TOTAL	18	3	10	24+4								

13CE2207-ENVIRONMENTAL STUDIES

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4-0-0
Prerequisite:	Engineering Physics & Chemistry	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Describe the scope and importance of Environment. 2. Describes the land sources and water sources. 3. Explain about different types of pollution. 4. Describe the population and its and its effects. 5. Acquire knowledge on prevention and control of pollution.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to learn about importance of environmental components.
	CO2	Able to understand different types of resources and its importance.
	CO3	A recognition of solid waste management and its utilization.
	CO4	An ability to learn about Effects of urbanization, transportation.
	CO5	Ability to learn about prevention and control of pollution.
Course content	**UNIT-I** **Introduction:**Definition, Scope and Importance of Environmental studies, Environmental components. Ecosystem: Introduction, types, characteristics, features, structure and functions of EcosystemsBio-diversity and its conservation- Value of bio-diversity consumptive and productive use, social, ethical, aesthetic and option values. Threats to biodiversity, Conservation of bio diversity. **UNIT-II** **Environment and Natural Resources Management**: Land Resources and its importance, Land degradation, Soil erosion and desertification, Effects of modern agriculture, fertilizer and pesticide problems. Forest Resources: Use and over- exploitation - Mining and dams- their effects on forest and tribal people. Water Resources: Use and over- utilization of surface and ground water, Floods and droughts, Water logging and salinity, Conflicts over water sharing, Rain water harvesting, clouds seeding and watershed management. Energy resources Energy needs: Renewable and non-renewable energy needs use of alternate energy sources, Impact of energy use of environment **UNIT-III** **Environmental pollution:** Local and global issues, Causes, Effects and control measures of Air pollution, Water	

	Pollution, Soil pollution, Marine Pollution, Noise pollution. **Solid waste management:** Composing, Vermiculture- Urban and industrial Wastes, recycling and reuse. Nature of Thermal pollution and nuclear hazards, Global warming, Acid rain, Ozone depletion. **UNIT-IV** **Environmental problems in India**: Drinking water, sanitation and public health.Effects of urbanization, transportation, Industrialization on the quality of environment, Green revolution. **Economy and Environment:** The economy and environment interaction, Sustainability, Environment Impact Assessment, Social Issues. **UNIT-V** **Environmental Acts:** Water (Prevention and control of pollution) Act- Air (Prevention and control of pollution) Act - Environment protection Act, Wildlife protection Act, Forest conservation Act, Coastal Zone Regulations **Case Studies:** Silent Valley Project, Madhura Refinery and TajMahal, Tehri Dam, Kolleru lake – aquaculture, Flourosis in Andhra Pradesh **Field Work:** Visit to Local Area having river/ Forest/grass land/hill/mountain to document and environmental assets.Study of local environment- common plants, insects, birds. Study of simple ecosystems- pond, visits to Industries, water treatment plants, effluent treatment plants.
Text Books and reference Books:	**TEXT BOOKS:** 1.Environmental Studies :Dr.A.S.Chauhan, 2nd ed., Jain Brothers, 2004 2.Environmental Science :Kaushik A, Kaushik C P, 2nd ed., New Age Publishers, 2010 3.Enviromental science and Engineering :P.Anandan and R.Kumaravelan, Scitech Publishers, 2005 **REFERENCES BOOKS:** 1. Environmental Science : Chandra Sekhar M 2. Introduction of Environmental Science : Anjaneyulu Y, B.S Publications, 2004
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13CE2208-HYDRAULIC MACHINES

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-1-0
Prerequisite:	Fluid Mechanics and Engineering mechanics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the concept of hydrodynamic forces on stationary and moving blades 2. Understand the working principle of different hydraulic turbines and performance characteristics 3. Understand the working principle of centrifugal pump and performance characteristics 4. Understand the working principle of reciprocating pumps and performance characteristics 5. Understand the working principle of different hydraulic devices	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	An ability to apply knowledge of mathematics, science and engineering, to understand effect of hydrodynamic force on various types of vanes.
	CO2	An ability to design a system, component or process to meet desired needs with in, realistic constraints such as economic , safety, manufacturability and sustainability etc.., while computing performance of hydraulic turbines ,reciprocating pumps, centrifugal pumps.
	CO3	An ability to identify, formulate, analyze and solve Engineering Problems in finding out internal forces of different beams, lifting machines, support reactions, using equilibrium concept and analyze by different techniques
	CO4	A recognition of the need for, and an ability to engage in lifelong learning with the concepts of rough and smooth planes while solving friction and analyze using applications like ladder and wedge problems
	CO5	An ability to use the techniques, skills and modern engineering tools necessary for engineering practice with the concept of Hydraulic Machinery and Systems.
Course content	**UNIT-I** **Impact of Jets** Impact of water jets - Hydrodynamic forces of jets on stationary and moving flat, inclined and curved vanes – Jet striking centrally and at tip- Velocity triangle at inlet and outlet –work done and efficiency **UNIT-II** **Turbines** Turbines – Classification of Hydraulic turbines – Pelton Wheel, Francis turbine, Kaplan turbine- working principle - Work done and efficiency of Pelton wheel, Francis, Kaplan turbine - Draft tube, Specific speed unit quantities, Specific speed, Performance characteristics, Model testing. **UNIT-III**	

	Centrifugal Pumps Centrifugal pumps – Classification of pumps, Working of a centrifugal pump work done by the impeller on liquid, Heads and efficiencies, Multi–stage centrifugal pumps – Specific speed, Performance characteristics, Model testing. **UNIT-IV** **Reciprocating Pumps** Classification of Reciprocating Pumps, Working of a reciprocating pump, Coefficient of discharge and slip, Single acting and double acting reciprocating pumps. **UNIT-V** **Hydraulic Systems** Hydraulic devices - Hydraulic accumulator, Hydraulic intensifier, Hydraulic press, Hydraulic ram, Hydraulic crane and Hydraulic lift, Hydraulic coupling, Hydraulic torque converter.
Text Books and reference Books:	**TEXT BOOKS:** 1. Hydraulic & Hydraulic Machines : Modi and Seth, Standard Book House, 6th ed., 2002 2. Fluid Mechanics and Hydraulic Machines : Bansal R.K, Laxmi Publications, 9th ed., 2010 **REFERENCES:** 1. Fluid Power with Applications : Anthony Esposito, Pearson Education, 5th ed. 2004 2. Fluid Mechanics and Hydraulic Machines : Rajput R.K. S. Chand & Co, 4th ed., 2008
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13CE2209-STRENGTH OF MATERIALS

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-1-0
Prerequisite:	Engineering Physics Engineering Mechanics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Analyze the different beams with different support conditions and to calculate Shear Force and Bending Moment at various points across the beam. 2. Analyze different beams with various cross sections and to calculate bending and shear stresses across the sections and to find the value of maximum bending stress and shear stress. 3. Describe and derive the expressions for deflections in beams under various conditions and expression for torsion used for basic design of shafts. 4. Describe and demonstrate thoroughly the concepts of principal stresses applied to solid structural members and drawing Mohr's circle diagram and study of theories of failures and deflections of fixed beams. 5. Analyze slender, long columns subjected to axial loads and having knowledge on basic design concepts for spherical shells	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to analyses beams shafts under various loading conditions and draw S.F and B.M diagrams
	CO2	Able to design and analyze beams with various external loading conditions under consideration of bending and shear stresses
	CO3	Derive expressions and determine deviation of the beams under various conditions and basic design of shafts under torsion.
	CO4	Able to design and analysis of principle stresses on deformable objects and study of theories of failures and deflection of fixed beams
	CO5	Analyze slender,long columns subjected to axial loads and having knowledge on basic design concepts for spherical shells
Course content	**UNIT-I** **Bending Moments and Shear Forces:** Beam – Types of loads, Types of supports, Shear Force and Bending Moment diagrams for cantilever, simply supported and over hanging beams. **UNIT-II** **Bending Stress in beams:** Theory of simple bending, Assumptions, Derivation of bending equation, Moment of Resistance of rectangular section, I-Section and triangular section. **Shear stress**: Equation for shear stress distribution across any cross section of beam, shear stress distribution across rectangular, circular, triangular, I-Sections.	

	UNIT-III **Deflections of Beams:** Relation between curvature, slope and deflection, double integration method, Macaulay's method, Moment area method. **Torsional Stresses in shafts:** Analysis of torsional stresses, Power transmitted, combined bending and torsion. **UNIT-IV** **Complex Stresses:** Stresses on an inclined plane under different uniaxial, biaxial conditions, Principal planes and principal stresses, Mohr's circle. **Theories of Failure:** Applications to Machine Elements. **Fixed Beams:** Fixing moments for a fixed beam of uniform section, Effect of sinking support, Slope and deflection. **UNIT-V** **Columns and struts:** Columns with one end free and the other fixed, both ends fixed, One end fixed and other hinged, Limitations of Euler's formula **Cylinders and Spherical Shells:** Stresses and strains in thin cylinders, Thin Spherical shell.
Text Books and reference Books:	**TEXT BOOKS:** 1. Analysis of Structures :Vaizirani and Ratwani, Khanna Publishers,Vol.1, 17th ed., 2011 2. Advanced Topics in strength of Materials : ShahL.B. &Shah R.T.Acharya Book Depot, 1962 3. Strength of Materials :Ramamrutham, DhanpatRai Publication, 2011 **REFERENCES:** 1. Strength of Materials : Timoshenko.CBS Publishers, 2004 2. Mechanics of structures Vol. I & II : S.B. Junnakar, Charotar Book Publishers, 2011 3. Strength of Materials : R.K. Rajput. S.K.Kataria& Sons, 2010 4. Strength of Materials : R. K. Bansal, Laxmi Publications, 5th ed., 2012
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME2201-APPLIED THERMODYNAMICS-1

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-1-0
Prerequisite:	Basic thermodynamics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To understand the steam formation and properties of steam 2. To explain the working of steam generators 3. To explain the working of steam turbines, nozzles and condensers 4. To analyze the performance of steam turbines, nozzles and condensers 5. To explain, analyze and design the Steam Turbines	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to explain Properties of Steam, Processes.
	CO2	Ability to explain the working of Steam Generators
	CO3	Ability to discuss, demonstrate the working of Steam Engines and analyse the performance of Steam Engines.
	CO4	Ability to explain, analyze and design the Steam Nozzles and Steam Condensers.
	CO5	Ability to explain, analyze and design the Steam Turbines.
Course content	**UNIT-I** **Steam Properties and power cycles:** Properties of steam, use of steam tables – PV, TS, HS diagrams, steam processes – Constant volume, Constant pressure, Isothermal, Adiabatic and Hyperbolic processes – Throttling expansion, Claussius–Clapeyron equation, Gibbs phase rule. **Basic Steam Power Cycles:** Carnot cycle and Rankine cycle, Modified Rankine cycle. **UNIT-II** **Steam Generators and Nuclear Reactors:** Classification- Cochran, Babcock and Wilcox, Lamont, Benson boilers. Boiler mountings and accessories. **UNIT-III** **Steam Nozzles:** Type, isentropic flow of steam through nozzles, velocity & enthalpy drop, variation of velocity, area and specific volume, critical pressure ratio for maximum discharge, effect of friction, super saturated flow. **Steam Condensers:** Functions of a condenser, classification, jet condenser- parallel flow and counter flow, surface condenser, vacuum efficiency, loss of vacuum & air leakage, air removal. **UNIT-IV** **Steam Turbines:** Impulse Turbines – Introduction, Classification of Steam Turbines, Simple,	

	De-Laval , Pressure and Velocity of Steam in an Impulse Turbine, Velocity Triangles for Moving Blade of an Impulse Turbine, Combined Velocity Triangle for Moving Blade, Power Produced by an Impulse Turbine, Effect of friction on the combined velocity triangle, combined velocity diagram for axial discharge. **Reaction Turbines** – Introduction, Parson's Reaction Turbine, Pressure and Velocity in a Reaction Turbine, Comparison between Impulse Turbine and Reaction Turbine, Velocity Triangles for Moving Blades of a reaction turbine, Combined velocity triangle for moving blades, power produced by a reaction turbine, degree of reaction. **UNIT-V** **Performance of Steam Turbines:** Introduction, efficiencies of steam turbine, condition for maximum efficiency of an impulse turbine and reaction turbine, compounding of impulse steam turbines, velocity compounding of an impulse turbine, pressure compounding of an impulse turbine, pressure-velocity compounding of an impulse turbine, governing of steam turbines, throttle governing of steam turbines. **Modern Steam Turbines:** Introduction, reheating of steam, advantages of reheating of steam, reheat cycle, multi stage turbines, reheat factor, efficiencies of multi-stage turbine, regenerative cycle, bleeding.
Text Books and reference Books:	**TEXT BOOKS:** 1. Heat Engineering : Vasandani V.P and Kumar D.S., Metropolitan Book Company, 2006 2. Thermal Engineering (Engineering Thermodynamics and Energy Conversion Techniques) BallaneyP.L., Khanna Publishers, 5th ed., 2010 **REFERENCE:** 1. A course in Thermal Engineering : Domukundwar&Kothandaraman, DhanapatRai and Co. 2010 2. Thermal Engineering : R.K. Rajput, Laxmi Publications, 2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME2202-MACHINE DRAWING

Course category:	Program core	**Credits:**	4
Course Type:	practice	**Lecture - Tutorial - Practical:**	1-0-4
Prerequisite:	Basics in Engineering Graphics.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	**1.** Students have an ability to apply knowledge of Modeling, science & engineering. **2.** Students will learn to apply principles of technical drawing and acquire skills in the use of appropriate computer aids for effective preparation of 3D models in Machine Drawing. **3.** Students will able to demonstrate an ability to design and conduct experiments, analyze and interpret data and assembly and disassembly drawings knowledge will be provided. **4.** Able to use the techniques, skills and modern engineering tools necessary for engineering practice **5.** To Recognition of the need for, and an ability to engage in self-education and life-long learning.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	An Ability to understand and apply the knowledge of machine drawing as a system of Communication in which ideas are expressed clearly and all information fully conveyed.
	CO2	An ability to identify, formulates, analyzes and solves Engineering Problems in Optimum time.
	CO3	Recognize to use modern engineering tools, software and equipment to analyze different drawings for Design & manufacturing.
	CO4	An ability to use the techniques, skills and modern engineering tools necessary for engineering practice with the concept of virtual work
	CO5	Recognition of the need for, and an ability to engage in self education and life-long learning.
Course content	**UNIT-I** **Machine Elements:** Drawing views of the following machine elements: Thread profiles, bolted joint, machine and cap screws, types of nuts, locking devices for nuts, Foundation Bolts. **Keys:** Sunk Keys, Feather Keys, Spline Shaft, Wood–Ruff Key and round Key. **UNIT-II** **Shaft Couplings:** Muff Coupling, Split muff Coupling, Flanged Coupling, protective type	

	flanged coupling. **Riveted Joints:** Different types of riveted heads, Different types of lap joints and butt joint. **UNIT-III** **Assembly Drawing:** Preparation of assembly drawing of Plumber Block, Swivel Bearing, Screw jack, Stuffing Box, Lathe tail Stock, Clapper box. **Part Drawing:** Introductionto Limits Fits &Tolerances,Preparation of part drawing of IC engine connecting rod, Revolving Centre, Eccentric, Drill jig. Modelling of simple objects using **Auto-CAD** (For Practice Only)
Text Books and reference Books:	**TEXT BOOKS:** 1. Machine Drawing : Narayana K.L, Kannaiah P. and Venkata Reddy K., 4 th ed., New Age International publications, 2012 2. Machine Drawing : Bhatt N.D., Charotar Publishing House Pvt. Ltd., 2008 **REFERENCES:** 1. Production Drawing : Narayana K.L, Kannaiah P. and Venkata Reddy K., New Age International, 2009 2. Machine Drawing : Dhawan R.K. Revised Edition S. Chand Limited, 2011
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME2203- MACHINE TOOLS

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4-0-0
Prerequisite:	1.Machine drawing 2.Kinetics of Machines	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To understand the construction and operation of a lathe. Learn sequence of operations and calculate machining time. Understand automation aspects of Lathe. 2. To know the construction of drilling machines, Slotting, Shaper, Planer and learn about the operations performed on these machines and tools used. 3. To know the construction of milling machines, operations performed and understand gear cutting methods in particular. 4. To know the process of grinding, grinding machine types and wheel specifications. Learn the basics of super finishing processes namely Lapping and Honing. 5. To identify the need of non traditional methods of machining and familiarize with such processes.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Explain and operate various types of lathes and appreciate automation.
	CO2	Identify different hole making and use appropriate machine.
	CO3	Identify the advantage of using multipoint cutting tools and to produce plane surfaces as well as complex profiles.
	CO4	Identify and select secondary machining operations to meet the finish requirements
	CO5	Asseses different Non-Conventional machining processes depending on product application.
Course content	**UNIT-I** **ENGINE LATHE :** Specification of lathe, types of lathes, work holders, tool holders, Lathe operations and attachments for Lathes.Turret and capstan lathes – work holding devices and tool holding devices, Automatic lathes – classification, Single spindle and multi-spindle automatic lathes, Machining Time calculations. **UNIT-II** **SHAPING, SLOTTING AND PLANING:** Principles of working, Principal parts, specification, classification, Operations performed. Shaper Mechanisms.machining time calculations. **DRILLING AND BORING:** Specifications, types, operations performed, tool holding devices, twist drill and types. Boring machines, Jig Boring machines. **UNIT-III** **MILLING :** Specifications, classifications of milling machines, Principal features of horizontal, vertical and universal milling machines, milling operations, Types and	

	geometry of milling cutters, methods of indexing. Gear shaping & gear hobbing **UNIT-IV** **GRINDING :** Classification of grinding machines, Cylindrical andsurface grinding machines , Tool and cutter grinding machines, Grinding wheel- Different types of abrasives , bonds, specification, selection of a grinding wheel. **LAPPING, HONING AND BROACHING**: Constructional features, comparison of Broaching, lapping and honing,Broaching machines and operations. **UNIT-V** Principle and applications of AJM, WJM, USM,CM, ECM, EDM, LBM, EBM.
Text Books and reference Books:	**TEXT BOOKS:** 1. Production Technology: R.K. Jain and S.C. Gupta, New Delhi, 5th ed.,Khanna Publishers, 2010 2. Workshop Technology –VolII :HazraChowdary, S.K. Bose & A.K. Bose, Media publishers,2005 3. Workshop Technology – VolII : B.S. Raghuwanshi, New Delhi, 10th ed.,Dhanpathrai&Co, 2010. **REFERENCES:** 1.Manufacturing Engineering Technology : Kalpakjian, 2nd edition ,New Jersey, USA. Pearson Stores, Prentice hall Publication,2010 2. Production Technology,H.M.T. : 2nd edition Tata Mcgraw Hill, Noida-India,1986. 3. Introduction to Manufacturing Technology: PrashantT.Datta, 2nd ed., JaicoPublication House,2010.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13CE22P3- STRENGTH OF MATERIALS LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0-0-3
Prerequisite:	Mechanics of solids Engineering Mechanics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Analyze the various tests to be conducted on engineering materials. 2. The significance of tests in evaluating the corresponding mechanical properties. 3. Analyze the importance of technical parameters used during tests. 4. Applying the concepts learned in the real time. 5. Able to provide systematic documentation for various experimentation efforts.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Applying the theoretical concepts by conducting the tests on different materials.
	CO2	Evaluate the result of test and comment on the mechanical properties of materials.
	CO3	Decide a material and an appropriate test suitable for given application.
	CO4	Analyze the experimental results and compute Young's modulus for a materials using appropriate test procedure.
	CO5	Report experimental results and provide systematic documentation for various experimentation efforts.
Course content	**LIST OF EXPERIMENTS**: 1. Tension test on mild steel bar 2. Tension test on HYSD steel bar 3. Compression test on wood 4. Torsion test on mild steel specimen 5. Compression test on close coiled helical spring 6. Charpy&Izod impact test 7. Deflection test on a beam under Uniform Bending 8. Deflection test on simply supported beam	

	9. Deflection test on fixed beam 10. Rock well and BrinellHardness test. 11. Direct shear test on mild steel specimen.
Text Books and reference Books:	**TEXT BOOKS:** 1. Analysis of Structures :Vaizirani and Ratwani, Khanna Publishers,Vol.1, 17th ed., 2011 2. Advanced Topics in strength of Materials : ShahL.B. &Shah R.T.Acharya Book Depot, 1962 3. Strength of Materials :Ramamrutham, DhanpatRai Publication, 2011 **REFERENCES:** 1. Strength of Materials : Timoshenko.CBS Publishers, 2004 2. Mechanics of structures Vol. I & II : S.B. Junnakar, Charotar Book Publishers, 2011 3. Strength of Materials : R.K. Rajput. S.K.Kataria& Sons, 2010 4. Strength of Materials : R. K. Bansal, Laxmi Publications, 5th ed., 2012
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME22P1-PRODUCTION ENGINEERING LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0-0-3
Prerequisite:	Basic manufacturing processes	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To prepare mixing of sand for metal casting processes 2. Test and correct sand mixture for metal casting processes. 3. To prepare sand moulds for different kinds of patterns 4. To inculcate various kinds of metal joining process 5. To shape the given metal rod into desired shape by using forging process	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand and perform basic casting processes like moulding.
	CO2	Measure the different parameter in sand testing
	CO3	Prepare simple green sand molds and discuss how they meet quality specifications.
	CO4	To gain the knowledge for various parameters affecting sand moulding
	CO5	Able to compare the traditional metal joining processes with respect to the advantages, applications
Course content	**LIST OF EXPERIMENTS**: **PATTERN MAKING** **Model 1:** Stepped Block **Model 2:** Riser (Design) **SAND TESTING** **Model 3:** Sand Testing **Model 4:** Sand Analysis **MOULDING** **Model 5:** Loose Piece Pattern **Model 6:** Three Piece Pattern **FORGING** **Model 7:** S Hook **Model 8:** J Hook **WELDING**	

	Model 9: SMAW– Lap Joint **Model 10:** SMAW – T Joint **Model 11:** Resistance Spot Welding **Model 12:** Gas Welding/Brazing **CASTING** **Model 13:** Casting of a Stepped Block **Model 14:** Casting of a Flanged Pipe **MOULDING** **Model 15:** Plastic Injection Moulding **Model 16:** Hand Blow molding machine
Text Books and reference Books:	**TEXT BOOKS:** 1. Production Technology: R.K. Jain and S.C. Gupta, New Delhi, 5th ed.,Khanna Publishers, 2010 2. Workshop Technology –VolII :HazraChowdary, S.K. Bose & A.K. Bose, Media publishers,2005 3. Workshop Technology – VolII : B.S. Raghuwanshi, New Delhi, 10th ed.,Dhanpathrai&Co, 2010. **REFERENCES:** 1. Manufacturing Engineering Technology : Kalpakjian, 2nd edition ,New Jersey, USA. Pearson Stores, Prentice hall Publication,2010 2. Production Technology,H.M.T. : 2nd edition Tata Mcgraw Hill, Noida-India,1986. 3. Introduction to Manufacturing Technology: PrashantT.Data, 2nd ed., JaicoPublication House,2010.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

Vision and Mission of the Institute

Vision:

To emerge as a comprehensive Institute that provides quality technical education and research thereby building up a precious human resource for the industry and society.

Mission:

- To provide a learner-centered environment that challenges individuals to actively participate in the education process.
- To empower the faculty to excel in teaching while engaging in research, creativity and public service.
- To develop effective learning skills enabling students pick up critical thinking thus crafting them professionally fit and ethically strong.
- To reach out industries, schools and public agencies to partner and share human and academic resources.

Vision and Mission of the Department

Vision:

To become an excellent centre for technical education and research in the field of mechanical engineering to meet the societal, regional, national and global challenges.

Mission:

- To impart quality technical education and transform bud engineers into an effective and responsible engineers to work with the current technologies in multi-cultural and multi-discipline environment.
- To encourage the students to develop their creativity in the field of mechanical engineering by providing modern laboratory facilities with hands on training and contemporary curriculum.
- To develop the interaction with the Industry, experts in order to technical mastery.
- To provide best teaching & learning practices as well as creating opportunities for Research, maximise student results and placements
- To inculcate and promote lifelong learning skills, problem solving skills, leadership qualities and team work.

PROGRAM EDUCATIONAL OBJECTIVES

- **PEO1:** A strong foundation to access, analyze, plan and implement their knowledge in basic sciences & mathematics, core and interdisciplinary courses.
- **PEO2:** Graduate will be in a position to work with the members of multi-disciplinary teams and can play a leading role in handling the technical issues.
- **PEO3:** Graduates will have capability to work with modern engineering tools, software and equipment under the realistic constraints.
- **PEO4:** Graduates will engage in lifelong learning skills with research attitude and social responsibility.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO1. **Engineering knowledge:**The Graduate will be able to solve mechanical engineering related problems through the application of knowledge in mathematics, science and engineering.

PO2.Problem analysis: The graduate will be able to identify, formulate and solve complex engineering problems through literature reviews/surveys and fundamentals of mathematics, sciences and engineering.

PO3.Design/development of solutions: The graduate will be able to design and develop solution for complex engineering problems and systems or processes for specific needs within the realistic constraints of the civil society..

PO4.Conduct investigations of complex problems: The graduate will be able to investigate the complex engineering problems through research methodologies.

PO5.Modern tool usage: The graduate will be able to use modern engineering tools, techniques and skills necessary for engineering practice to obtain solution to the problems

PO6.The engineer and society: The graduate will be able to work as responsible professional engineer with contextual knowledge of the civil society.

PO7.Environment and sustainability: The graduate will be able to develop sustainable engineering solutions with environmental and societal context.

PO8.Ethics: The graduates will be able to work with professional ethics and commitment

PO9.Individual and team work: The graduate will be able to associate with the multi-disciplinary teams or lead the people associated with.

PO10.Communication: The graduates will be able to communicate effectively with appropriate representation of their views or ideas.

PO11.Project management and finance: The graduate able to execute the project effectively in multidisciplinary environments as a member or leader through knowledge acquired in engineering.

PO12.Life-long learning: Graduate will have an ability to engage in life-long learning of knowledge on contemporary issues.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR:NELLORE)
SPSRNELLORE DIST
III YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMISTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2014-2015)
(For the batch admitted in the academic year 2013-2014)

Course Code	Course Title	Instruction Hours/ Week			Credits	Evaluation							Max. Total Marks
						Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max.40)	End Semester Examination		
		L	T	P		Duration In Hours	Max. Marks	Duration in Hours	Max Marks		Duration in Hours	Max Marks	100
13SH3101	Economics & Accountancy	4	-	-	4	2	40	2	40	0.8(best test) + 0.2(other test)	3	60	100
13ME3101	Applied Thermodynamics - II	3	1	-	4	2	40	2	40		3	60	100
13ME3102	Engineering Metrology	4	-	-	4	2	40	2	40		3	60	100
13ME3103	Kinematics of Machinery	3	1	-	4	2	40	2	40		3	60	100
13ME3104	Materials Science & Metallurgy	4	-	-	4	2	40	2	40		3	60	100
13ME3105	Operations Research	3	1	-	4	2	40	2	40		3	60	100
	LABS		-							Day to day Evaluation and test			
13CE31P3	Fluid Mechanics& Hydraulic Machinery Lab		-	3	2	--		-			3	60	100
13ME31P1	Machine Tools Lab		-	3	2	--		-			3	60	100
	TOTAL	21	-	6	24+4								

13SH3101 ECONOMICS & ACCOUNTANCY

Course category:	Humanities	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Basic Economics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40M 60M 100M

Course Objectives	1. Explain the basic concepts of economics such as law of demand, elasticity of demand and marginal utility. 2. Describe various cost concepts in managerial decisions and also the managerial uses of production function 3. Demonstrate price and output decisions under various market structures 4. Describe the formalities to be fulfilled to start a business organization 5. The principles of financial and management accounting	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to explain the basic concepts of economics such as law of demand, elasticity of demand and marginal utility.
	CO2	Able to describe various cost concepts in managerial decisions and also the managerial uses of production function.
	CO3	Able to demonstrate price and output decisions under various market structures.
	CO4	Able to show the formalities to be fulfilled to start a business organization.
	CO5	Able to demonstrate the principles of financial and management accounting
Course content	**UNIT – I** **Demand Analysis:** Definition and basic concepts of Economics. Consumer's equilibrium: Marginal Utility Analysis - the concept of Demand - Law of demand – Elasticity of Demand: Types, determinants and its importance. **UNIT – II** **Theory of Production and Cost:** Production function, Cobb–Douglas production function and its properties, Law of variable proportions, Law of Returns to Scale, Cost concepts, Revenue curves, Break-Even Analysis, Money –functions of money, functions of commercial banks, Features of Indian Economy **UNIT – III** **Theory of Pricing:** Classification of markets, Pricing under perfect Competition, Pricing under Monopoly, Price discrimination, Monopolistic Competition. **UNIT – IV** **Types of Business Organizations:** Sole tradership, partnership and Joint Stock Companies, Formation of companies, Shares and debentures.	

	UNIT – V **Financial & Management Accounting:** Concepts and principles, Journal and Ledger, Trial Balance, Final Accounts: Trading account, Profit and Loss account and Balance Sheet. **Basic concepts in Capital Budgeting process and Methods**. Working Capital: operating cycle, factors and sources.
Text Books and reference Books:	**TEXT BOOKS:** 1. Managerial Economics and Financial Analysis: A R Aryasri, TMH, 2010 2. Management Accounting : S N Maheswari, S Chand, 2002 3. Economic Analysis : K. Sankaran, Margham Publications, 2003 **REFERENCES**: 1. Double entry book keeping : J.R. Battlibai, Standard Accountancy Publications 2. Cost Accounting : Jain and Narang, Kalyani Publishers, 2012 3. Managerial Economics : Maheswari and Varshaney, S Chand Publications, 2007
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME3101 APPLIED THERMODYNAMICS – II

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Basic Thermodynamics Fluid Mechanics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Describes the working principle of reciprocating compressor and design of compressor for higher presser ratios with intercooler. 2. Describe the working principal of rotary compressor and evaluate the process parameters. 3. Explains and provides knowledge on gas turbines, air craft engines and rocket propulsion and its application in generation of mechanical power. 4. Describe the working principal of Refrigeration systems and evaluate performance of various thermodynamic cycles used in RAC. 5. Describe the working principal of Air Conditioning and measure the psychrometric properties of air.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Analyze and evaluate performance parameters (work output, isothermal & volumetric efficiency) for reciprocating and rotary compressors
	CO2	Analyze rotary compressors gives a set of operational parameters & Velocity Diagrams.
	CO3	Analyze gas turbine cycles gives a set of operational parameters & constraints determine cycle efficiency, its power output and required heat input. Apply the principles of turbo machines.
	CO4	Determine the moisture content in air performance calculations for humidification & dehumidification. Measure the psychrometric properties of air.
	CO5	Apply the basic principles on the Thermodynamics to solve an engineering problem related to Compressors, Gas Turbines, Jet Propulsion, Refrigeration and Air conditioning.
Course content	**UNIT – I** **Reciprocating Compressors** Mechanical details, Methods of compression, shaft work and isothermal efficiency of a single stage compressor indicator diagram, effect of clearance, volumetric efficiency, losses during compression, multistage compression optimum pressure condition in two stage compression inter coolers. **UNIT – II** **Rotary Compressors** Classification – positive displacement and rotary dynamic (non-positive displacement) compressors, fans, blowers and compressors, static and total head, centrifugal compressors -	

	velocity diagrams, type of impeller vanes, slip factor, diffuser isentropic efficiency. **UNIT – III** **Gas Turbines & Jet propulsions** Simple gas turbine cycle - open and closed cycle, constant volume cycle, constant pressure cycle, efficiency and work output, cycle with inter coolers, reheat and regeneration cycles, losses in a turbine. **Jet Propulsion** Specific thrust, thermal efficiency and propulsion efficiency, turbo prop, turbo jet, rocket propulsion, performance evaluation. **UNIT – IV** **Refrigeration** Performance and capacity of refrigeration, refrigeration cycles – vapour compression cycles, properties of common refrigerants, vapour absorption cycles. **UNIT – V** **Air Conditioning** Psychrometry – psychrometric chart, psychrometric process, Human comfort factors, principles of air conditioning, bypass factor, simple systems for winter and summer air conditioning.
Text Books and reference Books:	**TEXT BOOKS:** 1. Heat Engineering : Vasandani V P and Kumar D S, Metropolitan, 2010 2. Thermal Engineering : Ballaney P L.,Khanna Publishers, 2010 3. Refrigeration &Air conditioning : C.P. Arora, 3rd ed., TMH, 2008 **REFERENCE BOOKS:** 1. Applied Thermodynamics : T.D Eastop& A McConkey, 5th ed.,Pearson Education,2005 2. Engineering Thermodynamics : Nag. P.K., 5th ed., Tata McGraw-Hill, 2013
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13ME3102 ENGINEERING METROLOGY

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Concepts of measurement and metrology.Basic applications include measurement.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To impart the knowledge of fits, tolerances and gauging. 2. To introduce the means of angular measurements, methods of performing geometry checks namely straightness, flatness, squareness and roundness. To understand the need of comparators. 3. To input the concept of Interference of light, use the phenomenon for making measurements. To introduce the surface texture pattern, know about surface measuring instruments. 4. To identify the terminology of screw thread and gears, know the methods, instruments for carrying out those measurements. 5. To understand the methods of carrying out alignment tests on Lathe, radial drilling and milling machines. To understand the meaning of quality, apply the quality control procedures like control charts in a production situation. To get introduced to coordinate measuring machines for carrying out reverse engineering.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Students learn and understand the need, history for the development of new concepts with metrology and measurement.
	CO2	Students will demonstrate the knowledge of standards, comparison between the standards and their conclusion.
	CO3	Will have learnt the capability to recognize the need for measurement, the fundamental concepts of measurement, surface finish
	CO4	Will have acquired the ability to recognize the concept Screw Thread Measurement and Gear Measurement.
	CO5	Ability to apply the skills to draw Control charts and to conduct Alignment tests.
Course content	**UNIT – I** **Introduction to Metrology:** Line and end standards, concept of tolerance. Interchangeability and selective assembly. Limits and fits - systems of limits and fits. According to Indian standards and ISO standards. Limit gauges- Taylors principles- Gauge tolerance and wear allowance. **UNIT – II** **Angle Measurement:** Angle gauges, Protractors, Levels, Clinometers and Sine bar. Profile projector, Autocollimator, Angle Dekkor and Tool maker's Microscope. Straightness, Flatness, Squareness and Roundness Testing. Application of slip gauges.	

	Comparators: Mechanical, Optical, Electrical and Pneumatic Comparators. **UNIT – III** **Interferometery:** Interference of light, optical flat and sources of light, lasers. NPL flatness and gauge length interferometers. **Surface Finish:** Importance, Elements of surface texture, R_a, $R_{T\&}$Rzand sampling length. Bearing area curve and form factor.Instruments for measuring Surface Roughness – Tomlinson surface meter, Talysurf, piezoelectric instruments.Plastic Replica method. **UNIT – IV** **Screw Thread Measurement:** Pitch and angle errors, concept of VED, measurement of major ,minor and effective diameters(wire methods). **Gear Measurement**: Nomenclature, Involute Form Tester, Rolling Gear Tester, Toothtickness measurement- Chordal thickness and Base Tangent method. **UNIT – V** **Alignment tests** on Lathe, Radial Drilling machine and Milling machine. **Introductionto quality control**- Control charts - $\overline{X}$, R, c, p, np. **Co-ordinate Measuring Machine (CMM)-** Working principle and its applications
Text Books and reference Books:	**TEXT BOOKS:** 1. A Text Book of Engineering Metrology – R.K.Jain, Khanna Publishers, 2009 2. A Text Book of Engineering Metrology – I.C Gupta., DhanpatRai publishers, 2008 3. Metrology for Engineers ,John Frederick Wise Galyer, Charles Reginald Shotbolt,Cassell P L C, 1990 **REFERENCES:** 1. Engineering Metrology - MahajanDhanpatRai Publishers, 2009 2. Production Technology - HMTTata McGraw-Hill Education 2001
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME3103 KINEMATICS OF MACHINERY

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Engineering Mechanics,Machine drawing.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the fundamentals of various links, kinematic pairs and mechanisms. 2. Apply the synthesis procedure for a four bar mechanism. 3. Determine the velocity and acceleration of four bar mechanisms graphically 4. Understand the terminology of toothed gearing and interference and determine the number of teeth 5. Study the different types of gear trains.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Identify and demonstrate different links, kinematic pairs.
	CO2	Develop ability to come up with innovative ideas regarding mechanisms/machines
	CO3	Determines the velocity & accelerations of various links of any mechanism
	CO4	Calculate the speeds of the gears of an automobile or machine tools
	CO5	Design gear trains to produce a desired motion
Course content	**UNIT – I** **Mechanisms:** Elements or Links– Classification – Rigid Link, flexible and fluid link- Types of kinematic pairs- sliding, turning, rolling, screw and spherical pairs – lower and higher pairs- closed and open pairs- constrained motion- completely, partially or successfully constrained and incompletely constrained, DOF or mobility **Machines:** Mechanism and machines- classification of machines- kinematic chain-inversion of mechanism- inversions of quadric cycle, chain- single and double slider crank chains. **UNIT – II** **Steering mechanisms:** Conditions for correct steering – Davis Steering gear, Ackerman's steering gear- velocity ratio. **Kinematic synthesis of mechanisms:** Introduction – function generation – path generation – rigid body guidance – Chebychev spacing of precision points – two position – synthesis – four bar mechanism – three position synthesis – four bar mechanism – mechanism defects – branch defect, order defect, Greshof defect. **UNIT – III** **Analysis of linkages – Graphical:** Determination of Velocities in mechanisms. Relative velocity method, Relative velocities of Particles in common links. Velocity diagrams of various four bar mechanisms. **Resultant acceleration**: Resultant acceleration of particles on links having angular and linear motion, Coriolis component of acceleration.	

	UNIT – IV **Toothed Gearing:** Introduction,Friction wheels and toothed gears-types-law of gearing, condition for constant velocity ratio for transmission of motion, form of teeth, cycloidal and involute profiles. Velocity of sliding, interference, condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact. **UNIT – V** **Gear Trains**: Introduction- Train value- types- simple and reverted wheel train- Epicylcic gear train, method of finding train value or velocity ratio- Epicylcic gear trains; torques in gear trains.
Text Books and reference Books:	**TEXT BOOKS:** 1. Theory of machines and mechanisms : SarjitS. Rattan, TMH, 3rd ed., 2009 2. Theory of Machines : R S Khurmi&J.K.Gupta, S. Chand, 2013 **REFERENCE BOOKS:** 1. Theory of Machines : Thomas Bevan, 3rd ed., CBS Publishers, 2005 2. Theory of Machines and Mechanisms : John J. Uicker, G. R. Pennock, Joseph Edward Shigley, 3rd ed., Oxford University Press 2009
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13ME3104MATERIAL SCIENCE & METALLURGY

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Engineering physics. Engineering Chemistry	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To acquire the knowledge of regular crystal structures, crystal defects and physics of plastic deformation 2. To acquire a thorough knowledge of destructive testing properties of metal namely tension, compression, hardness, impact, creep and fatigue. Understand the mechanism of fracture. 3. To understand the solidification aspects of pure metals as well as alloys and construct phase diagrams. 4. To understand the different processes of producing Iron and Steel. Learn the effect of alloying elements on steel. Understand the classification of ferrous as well as nonferrous alloys. 5. To learn the construction of TTT diagrams and apply it for different heat treatment processes. Learn the procedure for producing powder metallurgy components.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to explain crystal structure and imperfection in solids
	CO2	Evaluate different methods of testing materials.
	CO3	Construct different Binary phase diagrams and also apply the Iron Iron-carbide diagram in ferrous material selection problems
	CO4	Ability to explain Extractive Metallurgy and Ferrous Materials
	CO5	Select suitable heat treatment process from TTT diagrams to obtain specific phases having different properties suiting different applications.
Course content	**UNIT -1** **Crystal structure** -Space lattice and unit cells, Crystal structures of common metallic materials – BCC, FCC, HCP. Atomic packing factor, Miller indices, spacing of lattice planes, Properties of Engineering Materials. **Imperfections in solids -** Crystal imperfections –point, line and surface defects.Edge and screw dislocations, Burger's vector. Plastic deformation by slip and twinning. Critical resolved shear stress for slip. Work hardening – mechanism and sages of work hardening. **UNIT – II** **Testing of Engineering materials** –tensile, compressive, hardness and impact tests. Creep –creep test, creep curve, Mechanism of creep. Fatigue – fatigue stress cycles, fatigue test, S-N curve, Mechanism of fatigue. Fracture – Ductile and brittle fracture, Griffith's criterion. **UNIT – III** **Equilibrium Diagrams -** Construction of cooling curves for a pure metal and a solid solution/alloy – Gibb's phase rule for a metal system. Construction and interpretation of	

	binary phase diagrams-Types of phase diagrams –Eutectic, Eutectoid, Peritectic, Peritectoid. Iron-Carbon system – cooling curve of pure iron. Iron–carbide equilibrium diagram **UNIT – IV** **Extractive Metallurgy:** **Ferrous Materials-** Production of Pig–Iron in the Blast furnace. Production of steel in Bessemer, and Basic Oxygen steel making. Plain carbon steels – Uses and limitations of plain carbon steels. **Alloy steels-** Effect of alloying elements in steels. High speed tool steel, stainless steels, High nickel and High chromium steels. **Cast irons**- grey, white, malleable and SG irons. **Non-Ferrous Materials-** Introduction- Extraction of Aluminum and Copper, Properties and applications of copper, Aluminum and Nickel. **UNIT –V** **Heat Treatment:** **Transformation points** – Construction of TTT diagram, TTT diagram and cooling curves. Heat treatment of steels – Annealing, Normalizing, Hardening, Tempering, Austempering, Mar tempering. Surface hardening of steels – Carburizing, Nitriding, Cyaniding, Flame Hardening and Induction Hardening. **Powder Metallurgy** – Production of metal powders, basic steps in powder metallurgy, advantages limitations and applications of powder metallurgy. Introduction to Nano materials.
Text Books and reference Books:	**TEXT BOOKS:** 1. Introduction to Physical Metallurgy : Avner, 2nd ed., Tata McGraw-Hill Education, 2010 2. Materials Science and Metallurgy : Kodgire V.D. 25th ed., Everest Publishing House, 2009 **REFERENCE BOOKS:** 1. Physical Metallurgy : Raghavan V., 2nd ed., PHI, 2006 2. Principles of Engineering Metallurgy : Krishna Reddy. L., New Age International, 2007 3. Materials Science and Metallurgy : Khanna O.P. 5th ed., DhanpatRai and Sons, 2009
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13ME3105 OPERATIONS RESEARCH

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -1 - 0
Prerequisite:	Engineering Mathematics, Matrices and Numerical Methods.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To analyze linear programming models in practical and their practical use. 2. To apply the Transportation, Assignment and sequencing models and their solution methodology for solving problems 3. To apply the theory of games, Replacement, Inventory and Queuing models and their solution methodology for solving problems.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand the mathematical tools that are needed to solve optimization problems
	CO2	Analyze Assignment, Transportation, Sequencing, Replacement, Inventory and Queuing problems.
	CO3	Apply Theory of games in various applications
	CO4	Evaluate the Problems using Linear Programming
	CO5	Apply dynamic programming problem solving and simulation models.
Course content	**UNIT – I** **Introduction & Linear Programming**-Introduction to general nature of Operations Research Models and their types. Linear programming – LP formulation, Graphical method of solution. Simplex Algorithm, Big-M method, Two-phase method, Dual simplex method. **UNIT – II** **Allocation Models** -Transportation and Assignment problems, Traveling Salesman Problem, **Non- Linear Programing**- Introduction to non-linear programming – Lagrangean multiplier techniques. **UNIT – III** **Replacement Models** -Replacement of items that deteriorate with time- with and without change in money value, group replacement of items that fail suddenly. **Sequencing models**: n jobs and two machines, n jobs and m machines, and 2 jobs and m machines. **UNIT – IV** **Inventory Models** - Costs used in inventory models, Basic inventory models with and without Shortages. Quantity discounts (Price breaks): Purchasing models with one price break and two price breaks - Single period models with probabilistic demand and without set up cost. **Inventory Control**- ABC and VED Analysis. Fixed order quantity, Fixed order interval systems. **UNIT – V**	

	Waiting Line Models - Basic structure of queuing models, single server and multi-server models- Finite and Infinite applications. Game theory: Two–person zero-sum games, saddle point, Algebraic and Arithmetic methods, Principle of Dominance, Graphical method.
Text Books and reference Books:	**TEXT BOOKS:** 1. Introduction to Operations Research : Hira and Gupta, S. Chand, 2007 2. Introduction to Operations Research : Sharma S.D.,KedarNath, Ram Nath and Co,2002 **REFERENCES:** 1. Introduction to Operations Research : Hamdy A Taha, Prentice Hall, 2011 2. Introduction to Operations Research : Hiller and Lieberman,McGraw-Hill Education, 2009 3. Operations Research : Pannerselvam R., 2nd ed., PHI, 2011
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13CE31P3 FLUID MECHANICS AND HYDRAULIC MAHINES LABORATORY

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0-0-3
Prerequisite:	Fluid Mechanics. Engineering Mathematics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To provide practical knowledge in verification of principles of fluid flow 2. To impart knowledge in measuring pressure, discharge and velocity of fluid flow 3. To understand Major and Minor Losses 4. To gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	To provide the students with a solid foundation in fluid flow principles
	CO2	To provide the students knowledge in calculating performance analysis in turbines and pumps and can be used in power plants
	CO3	Students can able to understand to analyze practical problems in all power plants and chemical industries
	CO4	Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
	CO5	Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design
Course content	1. Discharge Measurements: (a) Small Orifice (b) Venturimeter (c) Orifice Meter (d) Triangular Notch (e) Rectangular Notch (f) Elbow Meter (Pipe-bend Meter) 2. Losses in Pipes: (a) Pipe Friction (b) Sudden Contraction (c) Sudden Expansion (d) Gate Valve (e) Bend Loss	

	3. Determination of Efficiency in Pumps and Turbines: (a) Centrifugal Pump (b) Francis Turbine (c) Kaplan Turbine
Text Books	**TEXT BOOKS:** Fluid mechanics and hydraulic machines : R.K.Bansal, Lakshmi Publications,2015
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME31P1 MACHINE TOOLS LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0-0-3
Prerequisite:	Machine drawing Kinetics of Machines	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Perform operations on lathe 2. Perform operations on shaper, milling and drilling machines 3. Calculate force and power measurements on lathe 4. Prepare single point cutting tool 5. Able to perform single point cutting tool on a tool cutter machine	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to perform various operations such as turning, knurling, thread cutting etc. on lathe machine.
	CO2	Ability to perform various operations on shaper, milling and drilling machines.
	CO3	Ability to perform Alignment Test on Lathe.
	CO4	Ability to calculate force and power measurements on lathe.
	CO5	Ability to perform single point cutting tool on a tool cutter machine.
Course content	List of Experiments: 1. Exercise on step turning. 2. Exercise on Taper & Knurling. 3. Exercise on tread cutting. 4. Exercise on Capstan Lathe. 5. Exercise on eccentric turning. 6. Exercise on shaper . 7. Exercise on Milling Machine. 8. Exercise on Drilling & Tapping 9. Alignment Test on Lathe. 10. Force Measurement on Lathe. 11. Power Measurement on Lathe. 12. Exercise on Tool & cutter Machine	

Text Books and reference Books:	**TEXT BOOKS:** 1.Production Technology : R.K.Jain, S.C.Guptha, New Delhi, 5th Edition , KhannaPublications,2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR:NELLORE)
SPSRNELLORE DIST
III YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMISTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2014-2015)
(For the batch admitted in the academic year 2013-2014)

S. No	Course Code	Course Title	Instruction			Credits			Evaluation					Max. Total Marks
			Hours/ Week				Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max.40)	End Semester Examination		
		THEORY	L	T	P		Duration In Hours	Max. Marks	Duration in Hours	Max Marks		Duration in Hours	Max Marks	100
1	13ME3201	Dynamics Of Machinery	3	1	-	4	2	40	2	40	0.8(best test) + 0.2(other test)	3	60	100
2	13ME3202	Heat Transfer	3	1	-	4	2	40	2	40		3	60	100
3	13ME3203	Industrial Engineering & Management	4		-	4	2	40	2	40		3	60	100
	13ME3204	Mechanical Measurements & Control	4		-	4	2	40	2	40		3	60	100
5	13ME3205	Principles Of Machine Design	3	1	-	4	2	40	2	40		3	60	100
6		Elective - I	4		-	4	2	40	2	40		3	60	100
		ELECTIVES												
1	13ME32E1	Composite Materials	4			4	2	40	2	40		3	60	100
2	13ME32E2	Internal Combustion Engines	4			4	2	40	2	40		3	60	100
3	13ME32E3	Mechatronics	4			4	2	40	2	40		3	60	100
4	13ME32E4	Metal Forming Technology	4			4	2	40	2	40		3	60	100
5	13ME32E5	Solar Energy Engineering	4			4	2	40	2	40		3	60	100
6	13ME32E6	Total Quality Management	4			4	2	40	2	40		3	60	100
		LABS									Day to day Evaluation and test			
1	13SH31P1	Advanced Communication Skills Lab			3	2	--		-			3	60	100
2	13ME32P1	Thermal Engg Lab			3	2	--		-			3	60	100
		TOTAL	21	3	6	24+4								

13ME3201 - DYNAMICS Of MACHINERY

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -1 - 0
Prerequisite:	Engineering mechanics, kinematics of machinery	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Be able to identify and distinguish basic and advanced mechanisms in the study and control of motion. 2. Be able to identify the design parameters inherent in basic mechanism types. 3. Be able to evaluate the forces and torques in mechanisms and machines in operation. 4. Understand the fundamentals of engine dynamics and correlation to other machines. 5. Be able to perform static and dynamic balance of simple mechanism.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Determine and analyze the gyroscopic couple and its effects on different types of system such as aero planes, ships, two and four wheeler vehicles
	CO2	Design the flywheel for various types of engines such as steam and four stroke IC engines and punching machines
	CO3	Compute the range of speeds for various types of governors, such as dead weight and spring loaded governors.
	CO4	Apply the principles of friction in designing brakes
	CO5	Understand the construction and working of both absorption and transmission dynamometers.
Course content	**UNIT – I** **Friction** Inclined planes, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis. **Clutches** Friction clutches, single disc or plate clutch, multiple disc clutch, Centrifugal clutch **UNIT –II** **Brakes and Dynamometers** Simple block brakes, internal expanding shoe brake, band brake of vehicle, braking of a vehicle. Dynamometers - absorption and transmission types, general description and methods of operation**.** **UNIT-III** **Centrifugal Governors** Sleeve loaded governors, spring loaded governors, Hartnell, Hartung governors and governors with auxiliary springs, sensitiveness, isochromism, stability and hunting in governors, governor effort and power, insensitiveness**.**	

	UNIT-IV **Turning Moment Diagrams and Flywheel** Construction of crank effort and torque diagrams, fluctuation of energy and speed in flywheels, flywheel of an I.C. engine, flywheel of a punching press, determination of moment of inertia-design considerations **UNIT-V** **Gyroscopic Couple and Processional Motion** Gyroscopic couple – effect of precession on stability of moving vehicles such as motor cars, motor cycles, aero planes and ships – gyroscopic stabilization
Text Books and reference Books:	**TEXT BOOKS:** 1. Theory of Machines: John J. Uicker, G. R. Pennock, Joseph Edward Shigley, Oxford University Press, 2003 2. Theory of Machines: Thomas Bevan, 3rd ed., Pearson Education India, 2006 **REFERENCES:** 1. Mechanisms and Machine Theory : Rao J. S. and Dukkipati R. V., 2nd ed., New Age Publishers, 2007 2. Theory of Machines : Khurmi R. S., Eurasia Publishing House, 2008 3. Theory of Machines : Sarjit S. Rattan, McGraw-Hill, 2005
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME3202- HEAT TRANSFER

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -1- 0
Prerequisite:	Basic thermodynamics and differential and integral equations	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the fundamentals of Conduction heat transfer and measure the heat transfer through Homogeneous slabs, hollow cylinders, sphere, extended surfaces and fins. 2. Understand the fundamentals of fins and measure the transient heat conduction through systems with negligible internal resistance and systems with negligible surface resistance 3. To measure convective mode of heat transfer and derive exact and approximate solutions for convection problems 4. Understand the fundamentals of radiation heat transfer and measure heat transfer during radiation, boiling and condensation 5. To measure heat transfer through different types of heat exchangers	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to explain the basic laws of heat transfer and derive the general conduction equation in Cartesian, cylindrical and spherical coordinates and apply for the simple geometry
	CO2	Derive and apply equations in problems related to transient heat transfer through infinite thick plate and extended surfaces with uniform internal heat generation
	CO3	Derive and apply convective heat transfer equations to natural and forced flow
	CO4	Describe basic laws of radiation; derive expression for heat transfer between black surfaces.
	CO5	Design the devices that transfers heat and measure their effectivenessand explain pool boiling, also about the Introduction to condensation
Course content	**UNIT – I** **Introduction:** Modes of Heat Transfer- Basic Laws of heat transfer- Electrical Analogy of heat conduction- Conduction through composite walls- Overall heat transfer coefficient. **Conduction without heat generation:** The General heat Conduction equation in Cartesian-cylindrical and spherical coordinates-1D, 2D, 3D steady heat conduction without internal heat generation - the plane slab, the cylindrical shell, the spherical shell. Critical thickness of insulation. **UNIT – II** **Transient Heat Conduction:** Systems with negligible internal resistance – systems with negligible surface resistance – Heat flow in an infinitely thick plate. **Fins:** Fins of uniform cross-section- Governing equation- Temperature distribution and heat dissipation rate- Efficiency and effectiveness of fins.	

	UNIT – III **Convection:** Free and forced convection- Newton's law of cooling; convective heat transfer Coefficient- Dimensionless Analysis, Dimensionless Numbers- Reynolds Number, Prandtl Number, Nusselt Number, GrashoffNumber and Stanton Number and their significance. **Analysis of forced convection**- Analytical solution to forced convection problems- the concept of boundary layer- hydrodynamic and thermal boundary layer- Momentum and Energy equations for boundary layer. **Analysis of free convection**- Free convection heat transfer on a vertical flat plate - Relation between fluid friction and heat transfer- Reynolds analogy. **UNIT – IV** **Radiation:** Theories of thermal radiation- Absorption- reflection and transmission- Monochromatic and total emissive power- Black body concept- Planck's distribution law- Stefan Boltzmann law- Wien's displacement law- Lambert's cosine law- Kirchhoff's law- Shape factor- Heat Transfer between black surfaces. Radiation Shields –Introduction to Radiation Networks. **UNIT – V** **Heat Exchangers:** Introduction; classification of heat exchangers, Logarithmic mean temperature Difference, Area calculation for parallel and counter flow heat exchangers- Effectiveness of heat exchangers - NTU method of heat exchanger design, Applications of heat exchangers. **Phase change heat transfer**: Regimes of pool boiling, Introduction to condensation.
Text Books and reference Books:	**TEXT BOOKS:** 1. Heat Transfer : J.P. Holman, Tata McGraw-Hill Education, 2008 2. Fundamentals of Engineering Heat & Mass Transfer: Sachadeva R.C, New Age Science, 2009 3.Fundamentals of Heat & Mass Transfer: F.P. Incropera& D.P Dewitt, 5th ed., John Wiley and Sons, New York, 2002. **REFERENCES:** 1. Heat Transfer : Domukundwar, DhanpatRai Publishing Company, 2005 2. Principles of Heat Transfer: Frank kreith, Cengage Learning, 2010 3. Heat and Mass Transfer : D S Kumar, S. K. Kataria& Sons, 2009
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME3203- INDUSTRIAL ENGINEERING & MANAGEMENT

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 -0 - 0
Prerequisite:	Managerial economics and accountancy and production engineering.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand fundamental concepts & principles of Management including the basic role, skills & functions of Management. 2. Be well acquainted with the role and significance of human resources. 3. Identify required skills in recruitments, selection training & development of human resources. 4. Understand the locational factors & concept of Weber's Theory w.r.t Plant location. 5. Understand the concept of plant layout & types of layout.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Apply the conceptual knowledge of management and organization in work environment.
	CO2	Take decisions relating to location of plant and layout of plant.
	CO3	Conduct work study techniques for increased productivity and also able to calculate standard time.
	CO4	Manage human resources efficiently and effectively with best HR practices.
	CO5	Able to apply quality management techniques.
Course content	**UNIT – I** **INTRODUCTION:** Administration, Management and Organization. Scientific Management. Functions of Management. Principles of Management. Types of Organization. Principles of Organization. Fayol's and Taylor's contributions to Management. **SALES FORECASTING**: Need, Classification – moving average, exponential smoothing and linear regression technique. **UNIT – II** **PLANT LOCATION** – Factors influencing plant location, concept of Weber theory. Choice of city, Suburban and country locations. **PLANT LAYOUT** – Definition, Objectives, Types of plant layout - product, process and fixed position layouts. **PLANT MAINTENANCE:** Importance, Types of maintenance – Preventive, Predictive and Breakdown maintenance.	

	UNIT – III **WORK STUDY** – Basic procedure; Method study – definition, Objectives and steps in a Method study. **WORK MEASUREMENT** – Objectives, Techniques of work measurement – Time study, Work sampling, Analytical sampling and PMTS. Determination of Standard Time. **UNIT-IV** **PERSONNEL MANAGEMENT** – functions of personnel management. Job evaluation – Methods of job evaluation. Merit rating – Methods of merit rating. Incentive plans – Piece Rate System, Taylor's differential piece rate system, Halsey 50-50 plan, Rowan plan and Bedaux system. **UNIT-V** **QUALITY CONTROL:** Introduction to inspection and quality control, Acceptance sampling for attributes – description, advantages and disadvantages of sampling, types of sampling plans (single, double and multiple sampling plans). **QUALITY MANAGEMENT:** TQM, Six Sigma concept and Zero defect, QFD process, tools for continuous quality improvement.
Text Books and reference Books:	**TEXT BOOKS:** 1. Industrial Engineering and Management : Khanna O PDhanpatRai& Sons, 2005 2. Principles of Motion and Time Study : Ralph Barnes John Wiley, 2003 3. Quality control : Dale H Besterfield, Pearson Education, 2006 **REFERENCES:** 1. Production and Operations Management : R. Panneerselvam PHI Publications 2. Modern Production/Operation Management : Buffa E S John Wiley & Sons. 2007 3. Business Organization & Management : Dowar S.R
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME3204 - MECHANICAL MEASUREMENTS & CONTROL

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 -0 - 0
Prerequisite:	Metrology	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Provide an idea about generalized measurement system. 2. Understand the basic measurements of pressure and vacuum. 3. To provide essential elements of measurement of flow and temperature 4. An understanding of the measurement of vibration and acceleration. 5. Describe the automatic control systems and applications.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	An ability to apply the principles of uncertainty to data analysis from instrument measurement of a variety of properties.
	CO2	An ability to analyze the response of instruments that are first order systems.
	CO3	An ability to operate instruments and measurement systems to measure the Flow, Temperature, Force and Torque.
	CO4	An ability to apply the principles of Strain Measurement, digital sampling and signal conditioning to measurement instruments.
	CO5	An ability to write reports describing experimental setups, data collection, data analysis and data presentation.
Course content	**UNIT – I** **Basic concepts:** Introduction, Definition of terms – Span and Range, Readability, Sensitivity, accuracy, Precision, Threshold, Resolution and Hysteresis – Calibration standards, the generalized measurement system. Basic concepts in dynamic measurement – amplitude response, frequency response, phase response, delay time and time constant. Analysis of experimental data and types of experimental errors, combination of component errors in overall system accuracy. **UNIT – II** **Transducers** – Introduction, Loading of the Signal Source, Impedance matching, Piezoelectric, Inductive, Capacitance, Resistance, Ionization and Photoelectric transducer, calibration procedures. **Measurement of Pressure and Vacuum:** Pressure measurement – Manometers, Bourdon pressure gauge, Bellows and Diaphragm gauge. High vacuum measurement – Mcleod gauge, Pirani gauge and Thermocouple vacuum gauge. **UNIT – III** **Measurement of Flow**: Ultra sonic flow meters, Rota meters, turbine flow meter and magnetic flow meter, Measurement of fluid velocities – Pitot tubes, hot wire anemometer. **Measurement of Temperature:** Expansion, Electrical Thermometers, thermocouples, Resistance	

	thermometers and Pyrometers. **Measurement of Force and Torque:** Basic force measurement methods, hydraulic and pneumatic load cells, Torsion meters, Dynamometers. **UNIT – IV** **Strain Measurement:** Strain measurement by Electrical Resistance Strain gauge for bending, compressive and tensile strains. **Vibration and acceleration measurement:** Seismic instruments – Principle, application in the measurement of vibration and acceleration. **UNIT – V** **Control Systems:** Classification of control systems – Open loop, closed loop and automatic control systems, Concepts of servomechanism, process control and regulator. Transfer function, block diagrams, signal flow graphs, Hydraulic and pneumatic control systems.
Text Books and reference Books:	**TEXT BOOKS:** 1. Mechanical measurements and Control Engg: Kumar D.S., Metropolitan Book Company, 2006 2. Mechanical measurements : Beckwith T.G. & Lewis Buck N., Addison-Wesley Longman, 2002 **REFERENCES:** 1. Mechanical measurements : Sirohi R.S. &Radha Krishna H.C., 3rd ed., New Age International, 2009 2. Experimental methods for Engineer: Holmen J.P., 8th ed., Tata McGraw-Hill 2009 3. Basic Instrumentation : Higgins O., McGraw-Hill, 2000
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME3205 - PRINCIPLES OF MACHINE DESIGN

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Engineering Mechanics and Strength of materials	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the role of the Design engineer in transformation of ideas into real technical objects 2. Understand important machine design concepts including free body diagrams, shear and moment diagrams, factor of safety stress-strain relationships, combined stresses, failure theories, stress concentration, fatigue failure 3. Develop basic failure analysis skills 4. Synthesize and apply dynamics and mechanics background in the analysis and design of machine elements 5. Understand the application of these principles to the design of bolted joints, welded joints and springs.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Formulate and analyze stresses and strains in machine elements subjected to different loads.
	CO2	Analyze the failure criterion of mechanical parts under static and fatigue loads
	CO3	Apply design procedure for threaded and welded joints
	CO4	Analyses and apply design procedure for welded joints.
	CO5	Design knuckle and cotter joints for various engineering applications.
Course content	**UNIT – I** **Mechanical Engineering design** Traditional Design methods; Design considerations and standards; Engineering materials-classification and selection, Mechanical properties of materials **Design against static load** Modes of failure; factor of safety; Stress-strain relationships; shear stress and shear strain relationships; Axial, Bending, Torsional stresses; Principle stresses. **UNIT – II** **Design against Fluctuating loads** Stress Concentration factors; Reduction of stress concentration methods; Fluctuating stresses; Endurance limit; Notch sensitivity; Endurance limit; Soderberg and Goodman Diagrams; Modified Goodman's diagrams. **UNIT-III** **Design of Threaded joints** Threaded joints-Terminology, Bolted joint in tension; Torque requirement for bolt tightening; bolted joint under fluctuating load; eccentricity loaded bolted joints in shear; bolted joints with combined stresses; Bolt of uniform strength.	

	UNIT – IV **Deign of Welded joints** Welded joints-types of welded joints; stresses in butt and fillet welds; strength of welded joints; eccentricity welded joint; weld joint subject to bending moment and fluctuating forces; welding symbols; weld inspection. **UNIT – V** **Cotters and Knuckle Joints** Design of cotter joints; spigot and socket, sleeve and cotter, jig and cotter joints- Knuckle joints **Shafts** Design of solid and hallow shafts for strength and rigidity- Design of shafts for combined bending and axial loads- shaft sizes – BIS code.
Text Books and reference Books:	**TEXT BOOKS:** 1. Design of Machine Elements : Bhandari V. B., 3rd ed., Tata McGraw-Hill Education 2010 2. Machine Design: Khannaiah P., Scitech Publications, 2006 **REFERENCES:** 1. Machine Design : Khurmi R.S., S. Chand Publisher, 14th ed., 2010. 2.Mechanical Engineering Design: Shigley J. E., 9th ed., Tata McGraw-Hill Education 2010 3. Machine Design : Sharma P.C. &Aggarwal D.K., S. K. Kataria& Sons, 2006
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME32E1 - COMPOSITE MATERIALS

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4-0-0
Prerequisite:	Strength of materials, Material Science and Metallurgy, Basic manufacturing processes.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the classification of Composites. 2. Understand the types of reinforcements suitable for composites. 3. Learn the processes of manufacturing composite products. 4. Learn the methods of controlling the properties of composites. 5. To know the industrial applications of composite materials.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to Identify and explain the types of composite materials and their characteristic features.
	CO2	Ability to Understand the differences in the strengthening mechanism of composite and its corresponding effect on performance and application
	CO3	Ability to Understand and explain the methods employed in composite fabrication
	CO4	Ability to Appreciate the theoretical basis of the experimental techniques utilized for failure mode of composite.
	CO5	Ability to Understand mechanical behavior of composites due to variation in temperature and moisture
Course content	**UNIT – I** **INTRODUCTION TO COMPOSITE MATERIALS:** Introduction, Classification- Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber Reinforced Composites, and nature-made composites. Application of composite materials. **UNIT – II** **REINFORCEMENTS:** Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibers. Particulate composites, Polymer composites-Thermoplastics, Thermosets, Metal matrix and ceramic composites. **UNIT – III** **FABRICATION OF COMPOSITES:** Fabrication of Metal Matrix Composites: Commonly used Matrices, Basic Requirements in Selection of constituents, solidification processing of composites - Rapid solidification processing, Dispersion Processes - Stir-casting & Compo casting, Screw extrusion, and Liquid-metal impregnation technique - Squeeze casting, and Pressure infiltration. Fabrication of Polymer Matrix Composites - Commonly used Matrices Basic Requirements in selection of Constituents, Moulding method, Low pressure closed moulding, pultrusion, Filament winding, Fabrication of ceramic matrix composites - Various techniques of vapor deposition, Liquid phase method and Hot pressing.	

	UNIT – IV **CHARACTERISATION OF COMPOSITES**: Control of particle/fiber and porosity content, particle/fiber distribution, Interfacial Reaction of matrix-reinforcing component, Coating of reinforcing component, Strength analysis. **UNIT – V** **INDUSTRIAL APPLICATION OF COMPOSITE MATERIALS**: Civil constructions of structures/panels, Aerospace industries, Automobile and other surface transport industries, Packaging industries, House hold and sports components etc.
Text Books and reference Books:	**Text Books:** 1. K.K. Chawla, Composite materials, 3rd ed., Springer, NewYork, 2012. 2. R. M. Jones, Mechanics of Composite Materials, 2nd ed., McGraw Hill, 1999. **References:** 1. NPTEL http://nptel.iitm.ac.in Metallurgy and Material Science/ Composite Materials. 2. B. D. Agarwal, L.J. Broutman and K. Chandrashekhara, Analysis and performance of fibre Composites, 3rd ed., John Wiley and Sons,New York, 2006. 3. Autar K. Kaw, Mechanics of Composite Materials, (Mechanical Engineering), London, 2nd ed., CRC Publication, Taylor &francis group, 1993.
E-Resources	**1. https://nptel.ac.in/courses** **2. https://freevideolectures.com/university/iitm**

13ME32E2 - INTERNAL COMBUSTION ENGINES

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Basic thermodynamics Applied Thermodynamics-I	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Describes the working principle of I.C Engine 2. Explain the flame propagations in SI and CI Engines. 3. Explains requirement of fuels for engine to run efficiently. 4. Describes emissions from Engines and its control. 5. Explain the development of I.C Engine.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to define the I.C Engine and its types
	CO2	Ability to define the fuel requirements for internal combustion Engine, and able to identify differences between SI and CI combustion engines.
	CO3	Ability to define and Illustrate the scavenging and supercharging process in 2 stroke SI Engine.
	CO4	Ability to define the gasoline engine emission control
	CO5	Ability to define the developments in I.C Engine
Course content	**UNIT – I** **INTRODUCTION**: Historical development of internal combustion engines – basic engine types and their operation, comparison of S.I and C.I engines. Fuels and Combustion: Requirements of I.C. engine fuels – Hydrocarbon fuels their nature and properties, calorific value, volatility and vapor lock, fuel ratings for S.I engines and C.I. engines, additives, non –petroleum fuels. **UNIT – II** **COMBUSTION IN IC ENGINES:** Combustion in S.I. engines, abnormal combustion – detonation or knocking, its causes, effects and remedies, flame propagation, effect of engine variables on flame propagation – basic requirements of S.I. engine combustion chambers. Combustion in C.I. engines – Knocking, its causes, effects and remedies, importance of proper air movements, practical combustion chambers in use. **UNIT – III** **SUPERCHARGING AND SCAVENGING**: Objectives of supercharging, supercharged S.I. engines, supercharges C.I. engines, effects of supercharging on engine performance, methods of supercharging, superchargers, turbo charging – method of turbo charging, limitations of turbo charging. Scavenging of two stroke engines – scavenging systems, comparison of different scavenging systems. **UNIT – IV** **POLLUTION FROM GASOLINE ENGINES** – gasoline engine emission control, diesel emissions- control of diesel engine emissions comparison of diesel and gasoline emissions. Wankel rotary combustion engine – principles of operation and advantages over reciprocating engines.	

	UNIT – V **DEVELOPMENTS IN I.C. ENGINES**: Stratified charge engine – methods of charge stratification. Dual-fuel and multi-fuel engines and their working principles – comparison of dual-fuel and multi fuel engines, alternative fuels- vegetable oils, Bio diesel, Alcohols.
Text Books and reference Books:	**TEXT BOOKS:** 1. A course in Internal Combustion Engines: Mathur, M.L.& Sharma, R.P., DhanpatRai, 1999 2. Internal Combustion Engines Fundamentals: Heywood, J.V., McGraw-Hill, 1988 3. Internal Combustion Engines :V.Ganeshan, 4th edition, 2005 **REFERENCES:** 1. Internal Combustion Engines :Maleev, V.L., McGraw-Hill, 1945 2. Internal Combustion Engines& Air Pollution: Obert,E.F., Harper & Row, 1973 3. Internal Combustion Engines :Lichty, McGraw-Hill, 1951
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME32E3 - MECHATRONICS

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Kinematics of Machines, Electrical& Electronics engineering principles.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the fundamentals and scope of mechatronics 2. Understand the fundamentals of sensors and actuators 3. Understand the fundamentals of control systems 4. Understand the fundamentals of programmable logic controllers 5. To design the mechatronics systems	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to explain basic needs of mechatronics.
	CO2	Able to explain and select the need of sensors and actuators for automation techniques.
	CO3	Able to explain and design the control systems for automation techniques.
	CO4	Able to explain and design programmable logic controllers
	CO5	Able to Design Of Mechatronics Systems for the product applications.
Course content	**UNIT – I** **INTRODUCTION:** Introduction to Mechatronics, Scope of Mechatronics, Electronics for Mechanical Engineer, Mechanical systems for Electronic Engineer. **UNIT – II** **SENSORS:** Introduction, Position and Speed measurement. **ACTUATORS:** Solenoids and relays, electric motors, D. C. Motors, Stepper motors, Selecting a Motor, Mechanical, Hydraulic and Pneumatic actuators, brief treatment. **UNIT – III** **BRIEF INTRODUCTION TO CONTROL SYSTEMS:** Control Systems – Closed loop and open loop control system. Feedback characteristics; Fundamentals of Analog and Digital Control Systems - block diagrams; Block diagrams of discrete time (Sampled data digital) components. Control Systems and Computer Controlled Systems, Servo Mechanics. **UNIT – IV** **PLC (PROGRAMMABLE LOGIC CONTROLLERS):** Introduction, PLC programming, Mnemonics, Timers, Internal relay, counters, specifications and selection of PLC. **UNIT – V** **DESIGN OF MECHATRONICS SYSTEMS:** Introduction, automatic front and back end cutting in steel rolling mill, lift control system, CNC lathe, Temperature control of a heat treatment furnace, electrode arm control in electric arc furnace.	
Text Books and Reference Books:	**TEXT BOOKS:** 1. Mechatronics : Shanmugham N., Anuradha Publications, 2009 2. Mechatronics : HMT Tata McGraw-Hill Education, 2000	

	REFERENCES: 1. Introduction to Mechatronics & Measurement System : David G. Alciatore, Michael B. Histand, Tata McGraw-Hill Education, 2005 2. Feed Back Control System : SchaumJoseph J. DiStefano, Allen Stubberud, Ivan Williams, 2nd ed., TMH, 2011
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME32E4–METAL FORMING TECHNOLOGY

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Basic Manufacturing processes, Strength of materials, Material Science & Metallurgy.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the overview and fundamentals metal forming 2. Understand the fundamentals of rolling 3. Understand the fundamentals of extrusionand types of extrusion 4. Understand the fundamentals of forging and types of forging 5. Understand the fundamentals of drawing	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to explain the necessary basics and then knowledge about special problems of metal forming
	CO2	Ability to Solve problems related metal forming processes like rolling,
	CO3	Able to identify force components involved in metal forming technology
	CO4	Able to identify various defects in metal forming process.
	CO5	Explain the influence various parameters on metal forming products
Course content	**UNIT – I** **Metal Forming:**Over view of metal forming, Material Behavior of metal forming, Temperature in metal forming, strain rate sensitivity, friction and lubrication **UNIT – II** **Rolling:** Principle, Typical Rolling Shapes, Rolling Stand arrangement, Hot Rolling, Cold Rolling – Forces and Geometrical relationships in rolling, Determination of roll separating force, roll passes, Draught, Rolling of rounds, defects in rolled products. **UNIT – III** **Extrusion:** Principle – Typical extrusion shapes, Classification – Direct extrusion, Indirect extrusion. Extrusion equipment –typical extrusion dies. Determination of work load from energy consideration – Hot extrusion, Cold extrusion, Hydrostatic extrusion – Extrusion of tubing, Production of seamless pipe and tubing, Defects in extrusion. **UNIT – IV** **Forging:** Principle, Forging operations – Forging equipment; board hammer, steam hammer, crank press, hydraulic press, - forging types; Smith forging, Drop forging, Press forging, Upset forging, Swaging, Roll forging,– Forging defects. **UNIT – V** **Drawing:** Principle, Rod and wire drawing, Wire drawing equipment, Determination of drawing force and power in drawing, determination of maximum allowable reduction, Tube	

	drawing, Defects in wire drawing.
Text Books and reference Books:	**TEXT BOOKS:** 1. Manufacturing Technology, Foundry, and welding : P.N.Rao, 2nd ed., TMH, 2001 2. Fundamentals of Modern Manufacturing Methods : Groover, 4th ed.,John Wiley & Sons, 2010 3. Manufacturing Science : AmitabhaGhosh&Ashok Kumar Malik, 2nd ed., EAST WEST, 2005 **REFERENCES:** 1. Mechanical Metallurgy, Material Science & Metallurgy: George E, dieter, McGraw Hill, 1988 2. Metal forming process and analysis : BetzaelAvitzur, McGraw-Hill, 2000 3. Metal forming process : G.R.Nagpal, Khanna publishers
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME32E5–SOLAR ENERGY ENGINEERING

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Energy systems, Environmental science.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the phases of the Sun and its energy transport and solar radiation data 2. Understand the fundamentals of flat plat collectors and thermal analysis of flat plate collectors 3. Identify the different reasons behind using concentrating collectors over flat plates and Understand the fundamentals of flat plat collectors 4. Know about the energy storage issues involved in solar energy 5. Know the different applications of solar energy	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to Deliver an outline and brief description, including fundamentals, of the Sun and its energy transport and Solar radiation geometry.
	CO2	Ability to explain an overview of the Flat Plate Collectors and their applications
	CO3	Ability to elucidate the knowledge of focusing type collectors for reducing the disadvantages of flat plat collectors
	CO4	Ability to elucidate and compare the different energy storing modes of solar energy. Evaluate the suitability of various storage of solar energy modes for different applications
	CO5	Ability to Summarize and operational characteristics for the applications of solar energy
Course content	**UNIT – I** **INTRODUCTION:** The phases of the Sun and its energy transport, Solar radiation geometry – Calculation of radiation intercepted by surfaces, Instruments for measuring Solar radiation, Solar radiation data. **UNIT – II** **FLAT PLATE COLLECTORS**. Energy balance equation – Thermal analysis of flat plate collectors, Transmission of cover system, Heat transport systems, Collector efficiency, Materials. **UNIT – III** **CONCENTRATING COLLECTORS**: reasons for using concentrating collectors, types of concentrating collectors, Performance analysis of cylindrical parabolic concentrating collector, Advantages and disadvantages of concentrating collectors over flat plate type collectors.	

	UNIT – IV **SOLAR ENERGY STORAGE:** Thermal – Electrochemical - Solar Pond- Materials for phase change energy storage. **UNIT – V** **SOLAR ENERGY APPLICATIONS:** Water heating- Space heating -Space cooling- Solar pumping –Solar furnace – Solar distillation- Solar cooking-Solar green houses- Solar production of hydrogen.
Text Books and reference Books:	**TEXT BOOKS:** 1. Solar Energy Utilization : G.D. Rai, Khanna Publishers, 2007 2. Principles of Solar Engineering : Kreith&Kreider, Taylor & Francis, 2000 **REFERENCES:** 1. Solar Energy of Thermal Process : Dufice& Beckman, 4th ed., John Wiley & Sons, 2013 2. Solar Energy and Non-Conventional Energy Sources : Domakundwar, Sterling Book House, 2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME32E6–TOTAL QUALITY MANAGEMENT

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Production and Industrial engineering.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the overview, concepts and elements of TQM 2. Understand the concept of process management and TQM tools and techniques 3. Understand the problem solving techniques and failure analysis 4. Understand the concept of quality circles 5. Understand the different types of quality standards	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Ability to explain the basic principle of TQM methodologies
	CO2	Ability to describe the Quality measurement systems & tools of TQM methodologies.
	CO3	Ability to explain the techniques of TQM for problem solving such as system failure analysis and fault tree analysis.
	CO4	Ability to explain and design the Quality circles TQM to improve organization performance
	CO5	Ability to explain and implement the Quality standards to improve organization performance.
Course content	**UNIT – I** **TQM** – overview , concepts, elements – History-Quality management philosophies Juran, Deming, Crosby , Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – objectives – internal and external customers. **UNIT – II** **PROCESS MANAGEMENT**- Quality measurement systems (QMS) – developing and implementing QMS – nonconformance database- TQM tools & techniques- 7 QC tools- 7 New QC tools. **UNIT – III** **PROBLEM SOLVING TECHNIQUES** - Problem Solving process – corrective action – order ofprecedence– System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis. **UNIT –IV** **QUALITY CIRCLES** – Organization – Focus Team Approach – Ishikawa Diagram ,Quality Function Development (QFD) – Elements Of QFD – Bench Marking-Types-Advantages & Limitations of Benchmarking – Taguchi Analysis – Loss Function – TaguchiDesign of Experiments, Deming Cycle.	

	UNIT – V **QUALITY STANDARDS** – Need Of Standardization - Institutions – Bodies of Standardization, ISO 9000 Series – ISO 14000 Series – Other Contemporary Standards Six Sigma Approach – Application of Six Sigma Approach to Various Industrial Situations
Text Books and reference Books:	**TEXT BOOKS:** 1. Total Quality Management : Joseph & Susan Berk, Sterling Publishers, 1994. 2. Total Quality Management : Besterfield, 3rd edition, Pearson Education India, 2003. **REFERENCE BOOKS:** 1. Quality Management Systems: A Practical Guide : Howard S Gitlow, CRC Press, 2000. 2. Managing for Quality & Performance Excellence, 9th ed., James R. Evans. 3. Quality management : KanishkaBedi, Oxford University Press, India, 2006. 4. Total Quality Management :B.SenthilArasu and J. Praveen Paul, 2nd ed., Scitech, 2007.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13SH31P1–ADVANCED COMMUNICATION SKILLS LAB

Course category:	Program language	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0 - 0 - 3
Prerequisite:	English Grammar, Comprehending the basic level of comprehensions,	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To enable students speak effectively in formal and informal situations. 2. To equip the students with a wide range of vocabulary, so as to enable they use language more effectively. 3. To understand the strategies of the interviewers to facilitate better responses during the 'Placement' interviews and other recruitment process. 4. To understand the characteristics of successful group discussions 5. To identify areas of evaluation in GDs conducted by organizations as part of the selection procedure.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	To enable students speak effectively in formal and informal situations.
	CO2	To equip the students with a wide range of vocabulary, so as to enable they use language more effectively.
	CO3	To understand the strategies of the interviewers to facilitate better responses during the 'Placement' interviews and other recruitment process.
	CO4	To understand the characteristics of successful group discussions
	CO5	To identify areas of evaluation in GDs conducted by organizations as part of the selection procedure.
Course content	1. Vocabulary building – Synonyms and antonyms, Word roots, One- word substitutes, Prefixes, Study of work origin, Analogy, Idioms and Phrases. 2. Group discussion- Dynamics of group discussion, Intervention, Summarizing, Modulation of voice, Body language, Relevance, Fluency and coherence. 3. Intrapersonal & Intrapersonal skills - Intrapersonal & Intrapersonal skills –To be an effective team player. 4. Resume's Writing- Structure and presentation, Planning, defining the career objective, Projecting one strengths and skills – Sets, Summary, Formats and styles, Letter writing. 5. Interview skills- Concept and process, Pre-interview planning, opening strategies, Answering strategies, Interview through tele and video conferencing. 6. Corporate etiquettes- Dressing Etiquettes- Dining Etiquettes- Nonverbal communication- Proximity of place.	
Text Books and reference Books:	1. Effective Telecommunication—M. Ashraf Rizvi, Tata Mc. Graw-Hill publishing Company Ltd. 2. A course in English communication—MadhaviApte, Prentice-Hall of India, 2007. 3. Communication Skills. LeenaSen, Prentice –Hall of India, 2005.	

13ME32P1 - THERMAL ENGINEERING LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0 - 0 - 3
Prerequisite:	Applied thermodynamics-1.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1.To enable the students understand the principles, working and performance of IC engines 2.To teach students how to draw VTD and PTD of 4 stroke and 2 stroke engines 3.To introduce students to the working of power absorbing devices such as compressors, blowers 4.To train students in dis- assembly & assembly of automobile mechanisms 5. To teach students the principles of waste heat recovery and thermal storage systems.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to conduct performance test on I.C. Engines
	CO2	Distinguish various methods used to determine frictional horse power of the engine
	CO3	Ability to identify parts, mechanisms of an IC Engine and the significance of IC Engines
	CO4	Able to conduct performance test on reciprocating compressor
	CO5	Ability to conduct load test on air blower and plot characteristic curves
Course content	**List of Experiments**: 1. Load Test and Smoke Test on I.C. Engines. 2. Morse Test on Multi-Cylinder Engine. 3. Heat balance sheet on I.C. Engines. 4. Study of Multi-Cylinder Engine and determination of its firing order. 5. Performance Test on Air Compressor. 6. Study of Automobile Mechanisms. 7. To draw the crank angle vs. pressure diagram for an I.C. engine using pressure transducer and cathode ray oscilloscope. 8. Load Test and Emission Test with 3-Gas Analysis & smoke meter on four stroke diesel engine with Bio-diesel fuel. 9. Performance Test on centrifugal blower. 10. Economical Speed Test & volumetric efficiency test on I.C engine. 11. Retardation Test on an I.C. Engine. 12. Test for optimum flow rate of cooling water for an I. C. Engine. 13. VTD on 4 Stroke Diesel Engine model 14. VTD on 4 Stroke Petrol Engine model 15. PTD on 2 Stroke Diesel Engine model	
Text Books and reference Books:	**Text Books** 1. A course in Internal Combustion Engines: Mathur, M.L.& Sharma, R.P., DhanpatRai, 2. Internal Combustion Engines Fundamentals: Heywood, J.V., McGraw-Hill, 1988 3. Internal Combustion Engines :V.Ganeshan, 4th edition, 2005	

	REFERENCES: 1. Internal Combustion Engines :Maleev, V.L., McGraw-Hill, 1945 2. Internal Combustion Engines& Air Pollution: Obert,E.F., Harper & Row, 1973 3. Internal Combustion Engines :Lichty, McGraw-Hill, 1951

Vision and Mission of the Institute

Vision:

To emerge as a comprehensive Institute that provides quality technical education and research thereby building up a precious human resource for the industry and society.

Mission:

- To provide a learner-centered environment that challenges individuals to actively participate in the education process.
- To empower the faculty to excel in teaching while engaging in research, creativity and public service.
- To develop effective learning skills enabling students pick up critical thinking thus crafting them professionally fit and ethically strong.
- To reach out industries, schools and public agencies to partner and share human and academic resources.

Vision and Mission of the Department

Vision:

To become an excellent centre for technical education and research in the field of mechanical engineering to meet the societal, regional, national and global challenges.

Mission:

- To impart quality technical education and transform bud engineers into an effective and responsible engineers to work with the current technologies in multi-cultural and multi-discipline environment.
- To encourage the students to develop their creativity in the field of mechanical engineering by providing modern laboratory facilities with hands on training and contemporary curriculum.
- To develop the interaction with the Industry, experts in order to technical mastery.
- To provide best teaching & learning practices as well as creating opportunities for Research, maximise student results and placements
- To inculcate and promote lifelong learning skills, problem solving skills, leadership qualities and team work.

PROGRAM EDUCATIONAL OBJECTIVES

- **PEO1:** A strong foundation to access, analyze, plan and implement their knowledge in basic sciences & mathematics, core and interdisciplinary courses.
- **PEO2:** Graduate will be in a position to work with the members of multi-disciplinary teams and can play a leading role in handling the technical issues.
- **PEO3:** Graduates will have capability to work with modern engineering tools, software and equipment under the realistic constraints.
- **PEO4:** Graduates will engage in lifelong learning skills with research attitude and social responsibility.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO1. **Engineering knowledge:**The Graduate will be able to solve mechanical engineering related problems through the application of knowledge in mathematics, science and engineering.

PO2.Problem analysis: The graduate will be able to identify, formulate and solve complex engineering problems through literature reviews/surveys and fundamentals of mathematics, sciences and engineering.

PO3.Design/development of solutions: The graduate will be able to design and develop solution for complex engineering problems and systems or processes for specific needs within the realistic constraints of the civil society..

PO4.Conduct investigations of complex problems: The graduate will be able to investigate the complex engineering problems through research methodologies.

PO5.Modern tool usage: The graduate will be able to use modern engineering tools, techniques and skills necessary for engineering practice to obtain solution to the problems

PO6.The engineer and society: The graduate will be able to work as responsible professional engineer with contextual knowledge of the civil society.

PO7.Environment and sustainability: The graduate will be able to develop sustainable engineering solutions with environmental and societal context.

PO8.Ethics: The graduates will be able to work with professional ethics and commitment

PO9.Individual and team work: The graduate will be able to associate with the multi-disciplinary teams or lead the people associated with.

PO10.Communication: The graduates will be able to communicate effectively with appropriate representation of their views or ideas.

PO11.Project management and finance: The graduate able to execute the project effectively in multidisciplinary environments as a member or leader through knowledge acquired in engineering.

PO12.Life-long learning: Graduate will have an ability to engage in life-long learning of knowledge on contemporary issues.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR:NELLORE)
SPSRNELLORE DIST
IV YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMISTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2014-2015)
(For the batch admitted in the academic year 2013-2014)

S. No	Course Code	Course Title	Instruction			Credits	Evaluation							Max. Total Marks
			Hours/ Week				Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max.40)	End Semester Examination		
		THEORY	L	T	P		Duration In Hours	Max. Marks	Duration in Hours	Max Marks		Durat-ion in Hours	Max Marks	100
1	13ME4101	Production Systems	4		-	4	2	40	2	40	0.8(best test) + 0.2(other test)	3	60	100
2	13ME4102	CAD/CAM	4		-	4	2	40	2	40		3	60	100
3	13ME4103	Design of Machine Elements	3	1	-	4	2	40	2	40		3	60	100
4	13ME4104	Machine Dynamics and Vibrations	3	1	-	4	2	40	2	40		3	60	100
5	13ME4105	Tool Design	3	1	-	4	2	40	2	40		3	60	100
6		Elective –II	4		-	4	2	40	2	40		3	60	100
		ELECTIVES												
1	13ME41E1	Foundry Technology	4			4	2	40	2	40		3	60	100
2	13ME41E2	Non-Destructive Evaluation	4			4	2	40	2	40		3	60	100
3	13ME41E3	Power plant Engineering	4			4	2	40	2	40		3	60	100
4	13ME41E4	Refrigeration & Air-Conditioning	4			4	2	40	2	40		3	60	100
5	13ME41E5	Turbo Machinery	4			4	2	40	2	40		3	60	100
6	13ME41E6	Work Study	4			4	2	40	2	40		3	60	100
		LABS									Day to day Evaluation and test			
1	13ME41P1	Heat Transfer& Dynamics Lab			3	2	_		_			3	60	100
2	13ME41P2	Metrology& Instrumentation Lab			3	2	_		_			3	60	100
		TOTAL	21	3	6	24+4								

13ME4101 PRODUCTION SYSTEMS

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Industrial Engineering and Management	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Provide framework for understanding production and operations management. 2. To develop an understanding of operations management principle. 3. Equip plan and control activities necessary to run the operations. 4. Theoretical understanding to underpin operational decisions at tactical and strategic level. 5. Learn and develop critical understanding of techniques used within the operations management like planning, control, problem-solving and communication.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand concepts and manage operations strategically and practically.
	CO2	Critically review current developments in the area of operations management.
	CO3	Recognize the importance of managing organizational resources.
	CO4	Solve operational problems in the areas of aggregate production planning.
	CO5	Development of core operations management, and quality control for production and operations.
Course content	**UNIT – I** **INTRODUCTION**: Production systems, Concept of production, Types of Production Systems – Job type, Batch type and Flow type. Lean and Agile Manufacturing, Introduction to JIT and KANBAN Systems. **UNIT – II** **SINGLE FACILITY LOCATION MODELS**: Rectilinear minisum, Rectilinear minimax, Squared Euclidean distance location problem. Multi facility location model – Squared Euclidean distance location problem. Use of REL charts and Travel charts. **UNIT – III** **ASSEMBLY LINE BALANCING**: RPW method, COMSOAL method. Line of Balance, Materials Requirement Planning (MRP), Lot sizing in MRP, MRP–II. Value Analysis: Types of values, Aim of value, Technique and procedure of value analysis, Advantages.	

	UNIT – IV **MANUFACTURING PLANNING:** Manufacturing and Service Strategies, Manufacturing as a competitive advantage, Manufacturing for competitive advantage frame work. Aggregate Planning Strategies – varying work force, changing inventory level, subcontracting. Transportation model for Aggregate planning. **UNIT – V** **PROJECT MANAGEMENT**: Introduction, construction rules of drawing, Fulkerson's rule, Critical path method (CPM) – floats, critical path, and project duration. PERT – Introduction, different time estimates, expected time, variance, expected project duration and probability of completion. Crashing of network problems.
Text Books and reference Books:	**TEXT BOOKS:** 1. Production and Operations Management : R. Panneerselvam, PHI Publications, 2012 2.Production Planning and Inventory Control : Seetharama L. Narasimhan, 2nd ed., PHI Publications, 1995 **REFERENCES:** 1. Analysis and Control of Production Systems : Elsayed A., Thomas O. Boucher, PHI, 1985 2. Modern Production / Operations Management: Buffa and Sarin, 8th ed., John Wiley & sons, 2007.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME4102 CAD/CAM

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 -0– 0
Prerequisite:	To provide students with the fundamentals of electronic circuits including design, construction and testing of experimental electronic circuits.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Ability to understand the working of modeling softwares. 2. Ability to understand and write simple CNC programs. 3. Ability to explain GT, FMS and CIM concepts. 4. Ability to explain Shop floor data systems 5. Ability to understand AS/RS, AGVs.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to describe the fundamental theory and concepts of the CAD/CAM.
	CO2	Able to develop the concepts and underlying theory of modeling and the usage of models in different engineering applications including transformations.
	CO3	Able to describe the principles of Computer Aided Designing systems and the concepts of Geometric modeling, solid modeling.
	CO4	Able to explain the concepts of CNC programming and machining and to develop APT (automatic program tool) programming.
	CO5	Able to explain the concepts of GT, FMS, Material handling devices, CAPP.
Course content	**UNIT – I** **FUNDAMENTALS OF CAD**: Design process, Applications of Computers for design, benefits of CAD. **Computer Graphics**: Transformations – Points and lines Transformation, Translation, Rotation, Scaling, Mirror, Reflection, Shear, Introduction to 3D transformations. **UNIT – II** **GEOMETRIC MODELING**: Wire frame Modeling, wireframe entities, parametric representation of Line, Circle, Ellipse, Cubic spline. **SURFACE MODELING**: Parametric representation of cylindrical surface, ruled surface, surface of revolution, cubic surface. **SOLID MODELING**: Sweep Representation, CSG and B-Rep. **UNIT – III** **CNC PRODUCTION SYSTEMS**: Numerical control, Numerical control modes, Numerical control Elements, Part programming-Manual part programming, Computer Aided part programming(APT),DNC, CNC Turning centres, CNC Machining centres.	

	UNIT – IV **GROUP TECHNOLOGY &FMS**: Introduction, Concepts of GT, Advances of GT, Cellular Manufacturing. **Flexible Manufacturing System(FMS**) – Definition, Different flexibilities,Need of FMS, classification of FMS, Advantages of FMS. **Basic Concepts of Material Handling Systems** – AS/RS, Conveyers, AGVS and their applications. Applications of Robots in manufacturing and material handling. **UNIT – V** **CIM** - Definition, components, Benefits. Computer Aided Process Planning – Variant and Generative CAPP systems. Benefits of CAPP, Capacity Planning. Computer Aided Quality control, Shop Floor control.
Text Books and reference Books:	**TEXT BOOKS:** 1. CAD/CAM/CIM : P.N.Rao, 3rd ed., Tata McGraw-Hill 2. CAD/CAM : Ibrahim Zeid, Tata McGraw-Hill 3. Automation, Production systems & Computer Integrated Manufacturing :Groover P.E., 2nded.,Prentice hall, 2007 **REFERENCES:** 1. Computer Graphics :A.N.Sinha&ArunD.Udai, TataMcGraw-Hill, 2008 2. Mathematical Elements of Computer Graphics : Rogers and Adam 2nd ed., McGraw-Hill 3. CAD/CAM :Besant and Lui, John Wiley &Sons, New York, 1986 4. CAD /CAM/CIM :Radhakrishnan and Subramanian, 3rd ed., New Age Publications 2009.
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13ME4103-DESIGN OF MACHINE ELEMENTS

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Engineering Mechanics, strength of materials.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the role of the Design engineer in transformation of ideas into real technical objects. 2. Understand important machine design concepts including free body diagrams, shear and moment diagrams, and fatigue failure. 3. Develop basic failure analysis skills. 4. Synthesize and apply dynamics and mechanics background in the analysis and design of machine elements. 5. Understand the application of these principles to the design of bolted joints, welded joints and springs.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Design keys and shaft couplings for various engineering applications.
	CO2	Demonstrate the design procedure for hydrodynamic journal bearings and evaluate the life of the antifriction bearings.
	CO3	Design the springs with respect to static and dynamic loads.
	CO4	Apply the design concepts to evaluate the strength of spur, helical and bevel gears.
	CO5	Design the internal combustion engine components for safe and continuous operation
Course content	**UNIT – I** **KEYS AND COUPLINGS** Keys- Introduction, Types of Keys; Design of sunk key, Design of Splines. Couplings- Types of Shaft Couplings, Design of Sleeve or muff couplings, Clamp or Compression coupling, Flange Couplings. **UNIT – II** **SLIDING CONTACT BEARINGS** Classification of Bearings, Hydrodynamic lubricated bearings; Materials for sliding contact bearings; Lubricants, Terminology used in Hydrodynamic journal bearings. Design procedure for journal bearings.	

	ROLLING CONTACT BEARINGS Merits and demerits of rolling contact bearings over sliding contact bearings. Types of rolling contact bearings. Static and dynamic load capacities, reliability of a bearing. **UNIT – III** **MECHANICAL SPRINGS** Helical springs-Stress and deflection equations; spring materials; Design against static and fluctuating loads; Design of helical springs; Compound springs ; Equalized stress in spring leaves; multi leaf springs. **UNIT – IV** **GEARS** Types of gears and their applications, gear materials, allowable stresses, Law of gearing. Spur gears: Terminology, force analysis, Design of spur gears – Lewis equation. Check for dynamic load and wear load. Helical Gears: Terminology, design of helical gears. Check for wear load. **UNIT – V** **ENGINE PARTS** Connecting rod: Thrust in Connecting rod – Stress due to whipping action on connecting rod ends; Cranks and Crank Shafts, Strength and proportions of overhang and center cranks;Pistons- forces acting on pistons, Constructional Design and proportions of Pistons.
Text Books and reference Books:	**TEXT BOOKS:** 1. Machine Design : Kannaiah P., Scitech Publications, 2006 2. Design of Machine Members : Bandari V.B., Tata McGraw-Hill, 2010 **REFERENCES:** 1.Mechanical Engineering Design : Shigley J.E., 9th ed., Tata McGraw-Hill, 2011 2.Machine Design : Pandya and Shah, Charotar Publishing House, 2006 3.Machine Design : Khurmi R.S., Eurasia Publishing House Limited, 2004
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME4104- MACHINE DYNAMICS AND VIBRATIONS

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Kinematics of machines, Dynamics of machines	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Provide the Static force analysis of four bar mechanism and slider crank mechanism 2. Understand the fundamentals of cam profiles design of cam profiles for different applications. 3. Understand the balancing of masses for both rotating and reciprocating masses of the engine. 4. Know the concepts of vibrations, both single freedom systems and two degree freedom systems	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Compute and analyse the forces on reciprocating parts of engine.
	CO2	Draw cam profiles for different conditions of follower motion.
	CO3	Evaluate balancing masses for both rotating and reciprocating parts of the engine.
	CO4	Able to determine the whirling speed of shafts.
	CO5	Analyze the Single Degree, Two Degree and Multi degree of Freedom Systems.
Course content	**UNIT – I** **FORCE ANALYSIS:** Introduction, Newton's Laws, applied and constraints forces, free body diagrams, condition for equilibrium, two and three force members and four force members. Forces on reciprocation parts of engines, Inertia force analysis. **UNIT – II** **CAMS:** Classifications of cams and followers, Displacement, Velocity & acceleration diagrams when the follower moves with uniform velocity, S.H.M, uniform acceleration & retardation motion, construction of cam profiles for radial cam with knife edge follower, roller follower. **UNIT – III** **BALANCING OF MASSES**: Static and dynamic balance – balancing of rotating masses analysis and graphical methods. balancing of reciprocating masses – Single and multi cylinder in line engines – firing order, balancing of radial and V engines. partial balancing locomotive balancing – Variation of tractive effort, swaying Couple and Hammer blow. **UNIT – IV** **VIBRATIONS**: Introduction – Single degree freedom system, Differential equation of motion – linear vibrations, Transverse vibrations of beams with concentrated and distributed loads, Dunkerly's Method, energy Method – equivalent shaft – torsional Vibration of two and three rotor systems, torsional vibrations of geared system, Whirling or critical speeds of shafts.	

	UNIT – V **DAMPED AND FORCED VIBRATIONS**: Introduction – Critical damping, damping ratio logarithmic decrement forced vibrations, Harmonic excitation amplitude and phase determination and resonance. Force transmitted and transmissibility, vibration and shock isolation- Introduction to multi degree freedom system – differential equation of motion, general solutions, Normal modes, Practical applications.
Text Books and reference Books:	**TEXT BOOKS:** 1. Theory of Machines : Khurmi R.S., S.Chand& Co, 2008 2. Mechanisms and Machine Theory: Rao J.S. and Dukkipati R.V., 2nd ed., New Age Publishers, 2007 3. Mechanical Vibrations : V.P. Singh, DhanapathiRai& Co 2010 **REFERENCES:** 1. Theory of Machines : Thomas Bevan, 3rd ed., Pearson Education India, 2008 2. Principles of Vibration : Benson H.Tongue,Oxford University Press, 2002 3. Theory of Machines : Rattan S.S., 2nd ed., Tata McGraw-Hill, 2005
E-Resources	**1.https://nptel.ac.in/courses** **2.https://iete-elan.ac.in** **3.https://freevideolectures.com/university/iitm**

13ME4105-TOOL DESIGN

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 1 - 0
Prerequisite:	Engineering Mechanics, Strength of Materials, Material Science and Metallurgy	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the tool signature and mechanics of metal cutting. 2. Understand the tool wear and damage in usageand identify the need of cutting fluids. 3. Recognize the properties desired for cutting tool materials and design of cutting tools. 4. Realize the costs associated with machining operations. Understand the mechanics of press working and identify the accessories required. 5. Understand the need of Jigs and fixtures. Recognize their principal parts.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to compute theoretically cutting forces and carry out power requirement calculations.
	CO2	Able to Apply correct tool life criteria and follow the correct procedure for selecting cutting fluids and applying.
	CO3	Able to evaluate different cutting tool materials suitable for specific applications.
	CO4	Able to carry out optimization in machining operations and arrive at profitable process variables.
	CO5	Able to design Jigs and fixtures suitable for specific job order.
Course content	**UNIT – I** **METAL CUTTING TOOLS**: Classification, Nomenclature of single point cutting tool, Difference between orthogonal and oblique cutting, Mechanism of metal cutting, Types of chips, chip breakers, Forces acting on a tool, Merchant circle diagram - Velocity relations. Specific energy in cutting. **UNIT – II** **TOOL WEAR &TOOL LIFE**: Factors affecting tool life, Taylor's Tool life Equation. Tool wear mechanisms, Types of tool wear, Machinability, Heat distribution in metal cutting, Measurement of temperature in metal cutting. Lathe tool Dynamometer. Cutting fluids – Selection and applications. **UNIT – III** **CUTTING TOOL MATERIALS**: Requirements of tool materials, advances in tool materials, HSS, Coated HSS, Carbides ,Coated Carbides, Ceramics, Ceramic Composites, CBN, Diamond- properties, Advantages and Limitations, Specifications for Inserts and	

	tool holders. Design of single point cutting tool shanks and form tools for Lathe work- Design of Milling and Broach tools. **UNIT – IV** **ECONOMICS OF MACHINING:** Costs associated with machining operations- Optimum **PRESS WORKING :**Press working operations- Press selection and Tonnage- Centre of Pressure- Cutting forces and clearances for Die Design – Compound and Progressive Die, Strip layout. **UNIT – V** **JIGS & FIXTURES** - Uses, Locating devices, 3-2-1 principle of location, pin location, Radial location, 'V' location and Diamond locators. Types of clamping devices, principles of clamping. Design principles of Jigs & Fixtures, types of Drill Jigs, types of Drill Bushes, Fixtures for Turning, Milling and Welding.
Text Books and reference Books:	**TEXT BOOKS:** 1. Fundamental of Tool Design : ASTME, PHI 2. A Text Book of Production Engineering: P.C. Sharma, S. Chand& Co. 11th ed., 2005 **REFERENCES:** 1. Fundamental of Metal Cutting and Machine Tools: Juneja and Sekhan, 2nd ed., New Age International2005 2. Metal Cutting Principles: Milton C.Shaw, Oxford University Press, 2012 3. Introduction to Jig and Fixture Design: Kempster, Hodder and Stoughton, 2004 4. Metal cutting (Theory and Practice), New central book agency:A. Bhattacharya 5. Tool Design :Donaldson, Tata McGraw Hill, 3rd ed., 2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME41E1-FOUNDRY TECHNOLOGY

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Production Engineering, Basic Manufacturing Processes, Materials science and Metallurgy.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Promote understanding of basic facts and concepts in foundry process while retaining the excitement of foundry industry. 2.Understand Design aspects of casting, Riser and gating system 3. Learn Melting and moulding techniques 4. Get awareness in Mechanization and Modernization of foundry. 5. Learn Ferrous and nonferrous foundry practices.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to Design casting, gating and risering systems.
	CO2	Have an overview of Solidification of alloys and evaluate microstructures obtained
	CO3	Able to Select melting and molding techniques for a particular alloy.
	CO4	Able to use the techniques, skills and engineering tools to produce castings as per product design.
	CO5	More idea of processing Foundry practices in ferrous and Non-ferrous alloys.
Course content	**UNIT – I** **Castings**- Reasons for success of the casting process, Steps involved in casting process. Pattern Making – Pattern Materials, Pattern allowances, Pattern design considerations, types of patterns. **Mould Making** – Moulding sand, basic requirements of moulding sand, testing of moulding sand. Moulding – Plaster moulding, Metallic moulding. **Core Making** – Core sand, basic requirements of core sand, Types of cores, Core prints and chaplets. **UNIT – II** **Melting:** Furnaces used in Foundry for melting ferrous and non- ferrous metals.Cupola furnace and its charge calculations. **Special casting/Moulding techniques** – shell Moulding, CO_2moulding process, Investment casting process, Vacuum Moulding, Centrifugal Casting, Continuous Casting. **UNIT – III** **Solidification:** Principles of solidification – Nucleation, Homogeneous nucleation, Critical radius size, Heterogeneous nucleation. **Solidification of pure metals** – alloy where no eutectic occurs, alloys where eutectic occurs, Effect of variables, Thermal characteristics of the mould – sand mould, Chill mould. Fluidity – Factors affecting fluidity, Fluidity measurement.	

	UNIT – IV **Gating system** – Components of gating system, Design of pouring basin, sprue, runner and gates.Gating Ratio, Pressurized and un-pressurized gating system. **Risering**– Shape and size of risers, Chvorinov's rule, Caine's method improvement of riser efficiency, padding, Insulation pads and sleeves, Chills, Exothermic Riser compounds, Types of Risers. **UNIT – V** **Foundry mechanization** – Foundry Layout for Ferrous and non-ferrous foundries, description of equipment used for mechanization, sand conditioners, conveyors, Cranes, Equipment for handling moulds, cores and molten metal, casting defects **Inspection of castings** – Destructive and non-destructive testing of castings – A brief outline.
Text Books and reference Books:	**TEXT BOOKS:** 1. Foundry Technology : Jain P.L.4th Edition Tata McGraw Hill 2. Principles of Metal Casting : Heine, Rosenthal and others Tata McGraw Hill 3. Manufacturing Technology : P.N Rao ,Tata McGraw Hill **REFERENCES:** 1. Foundry Engineering : R. L. Agarwal, T. R. Banga, TahilManghnani Khanna publications 2. Foundry Engineering : Taylor, Wiley John Wiley & Sons Canada
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME41E2-NON DESTRUCTIVE EVALUATION

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Engineering Physics, Material science and metallurgy, Strength of Materials.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Explain the NDT methods, visual inspection and its applications. 2. Describe liquid penetrating and eddy current testing. 3. Describe the Acoustic emissions, Thermography and Leak testing 4. Explain ultrasonic testing which enables them to perform inspection of samples. 5. Describe radiographic, magnetic testing, interpretation and evaluation.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Describe surface NDE techniques which enables to carry out various inspection in accordance with the established procedures
	CO2	Explain liquid penetrating and eddy current testing.
	CO3	Calibrate the instrument and evaluate the component for imperfection and explain principles of thermography and methods for leak testing.
	CO4	Describe ultrasonic testing which enables them to perform inspection of samples.
	CO5	Explain radiographic, magnetic testing, interpretation and evaluation.
Course content	**UNIT – I** **NON-DESTRUCTIVE TESTING:**An Introduction, Visual inspection: Introduction to NDT methods, comparison of destructive and nondestructive testing, Visual inspection, optical aids used for visual inspection, applications. **UNIT – II** **LIQUID PENETRANT TESTING**: Physical principles, procedure for penetrant testing, penetrant testing materials, penetrant testing methods – water washable, post-emulsifiable method, applications. **EDDY CURRENT TESTING**: principles, Instrumentation for ECT & Techniques **UNIT – III** **ACOUSTIC EMISSION:** Technique, Instrumentation, Sensitivity and applications. **THERMOGRAPY**: Basic principles, Detectors & Equipment, Techniques & applications. **LEAK TESTING**: Measurement of leakage, Leak Testing Methods, Detection – Bubble & Helium Leak testing. **UNIT – IV** **ULTRASONIC TESTING:** Basic properties of sound beams, ultrasonic transducers, inspection methods, techniques for normal beam inspection & angle beam inspection, flaw characterization and detection, modes of display, immersion testing, applications, advantages and limitations.	

	UNIT – V **RADIOGRAPHY:** Basic principle, Electromagnetic radiation sources, Radiation attenuation in the specimen, effect of radiation in film, Radiographic imaging, Inspection techniques, applications, limitations. **MAGNETIC PARTICLE TESTING** Definition and principle, techniques, testing procedures & equipment, limitations.
Text Books and reference Books:	**TEXT BOOKS:** 1. Practical Nondestructive Testing :Baldev Raj, T. Jayakumar, M. Thavasimuthu Narosapublishing house 1997. 2. Hand Book of Nondestructive Evaluation: Charles Hellier, McGraw Hill Publishing House, 2003. **REFERENCE BOOKS:** 1. Manufacturing Technology : Kalpak Jain, Pearson Education, 2005 2. Nondestructive Evaluation – Theory and Applications :Shull, P.J., , Marcel Dekker, New York, NY, 841 pages, 2002
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME41E3-POWER PLANT ENGINEERING

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Thermodynamics, Heat transfer.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Describes the working principle of steam power cycle and layout of steam cycle. 2. Explains and provides knowledge on steam cycle and its application in generation of mechanical power. 3. Describe ash handling, coal handling method in a thermal power plant. 4. Describe feed water systems and control systems for power plants. 5. Describe the generation of power from nuclear reactor.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Describe sources of energy and types of power plants.
	CO2	Propose ash handling, coal handling method in a thermal power plant.
	CO3	Calculate the performance of steam generators.
	CO4	Explain feed water systems and control systems for power plants.
	CO5	Explain working principle of different types of nuclear power plant.
Course content	**UNIT – I** **STEAM POWER PLANTS**: Introduction, flow diagram of steam power plants. **CYCLES**: Reheat, Regeneration, Binary Vapour cycle. **FUEL SYSTEM**: Mechanical stokers, Pulverized fuel fired furnace, Cyclone furnace, Oil fired system – Supply, handling, storage and preparation of fuels, Introduction to fluidized bed combustion. **UNIT – II** **STEAM GENERATORS**: Classification, Arrangement of heat absorbing surfaces, boiler drum, internal circulation principles, modern trends in boiler – design, boiler performance, boiler draught-furnace construction, steam generator rating, super heaters, re-heaters, economizer and air heaters. **ASH HANDLING**: Dust emissions from boiler furnaces, fly ash separators, hydraulic and pneumatic systems of ash handling. **DRAFT SYSTEMS**: Introduction to Draft systems, draft control, fan drives. **UNIT – III** **STEAM TURBINES:** Types and arrangement, Construction and Operation, Governing and Lubrication. **CONDENSERS:** Types – Surface condenser, Steam and Water flow arrangement, Steam jet air ejectors, Mechanical Vacuum pumps, Supply of condensing Water, Cooling towers, Circulating Water Pumps. **UNIT – IV** **FEED WATER SYSTEM**: Feed Water heating cycle, Heater types, heater construction and	

	operation, deaerators, evaporators, condensate and boiler feed pumps. **INSTRUMENTS AND CONTROL:** Fuel measurement, flow recorders for feed water, air steam temperature and pressure recorders. **UNIT – V** **NUCLEAR REACTOR ENGINEERING:** Basic principles, types of reactors, properties of nuclear fuels, moderators, coolants, control and safety rods, structural materials, radiation hazards, shielding, radioactive waste disposal.
Text Books and reference Books:	**TEXT BOOKS:** 1. A Course in Power Plant Engineering : Arora S.C. &Domkundwar S., DhanpatRai, 1988 2. Power Plant Engineering : Rajput R.K., Laxmi Publications, 2005 **REFERENCES:** 1. Power Station Engineering and Economy : Skrotzki&Vopat, 2nd ed., TMH, 1972 2. Power Plant Engineering : P.K.Nag, TMH 3. Fundamentals of Power Plant Engg. : Georg Edward Pemp, National Press
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME41E4-REFRIGERATION AND AIR CONDITIONING (SI UNITS)

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Basic thermodynamics Applied thermodynamics Heat transfer	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Explains principles and working of various refrigeration systems 2. Describes the component parts and controls of vapour compression refrigeration systems. 3. Explains psychometrics of moist air and apply to HVAC processes. 4. Designing of air-conditioning systems using cooling load calculations 5. Explains comfort air conditioning and equipment required, control systems and ventilation systems	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand and explain principles and working various refrigeration systems.
	CO2	Describe the component parts and controls of vapour compression refrigeration systems.
	CO3	Develop generalized psychrometrics of moist air and apply to HVAC processes.
	CO4	Design air-conditioning systems using cooling load calculations
	CO5	Review fluid mechanics and engineering and develop techniques for the analysis of duct and piping systems and room air distribution systems and review associated turbo machines and control systems.
Course content	**UNIT -I** **REFRIGERATION:** Cycles: Thermodynamic analysis of vapour compression, absorption, air cycle, steam jet and thermoelectric refrigeration systems. Comparison of COP and cost, Properties and selection of refrigerants, alternative refrigerants. **UNIT – II** **COMPONENT PARTS:** Reciprocating compressors, Condensers – Air cooled and Water cooled, Economical water rate, Evaporators, Defrosting, Design of cooling towers and Evaporative condensers **UNIT – III** **REFRIGERATION CONTROL:** Automatic and thermostatic expansion valve, Capillary tube, Compressor controls, miscellaneous controls. Testing and charging of refrigeration units. **CRYOGENICS** – liquefaction and purification of gases. Applications of refrigeration, dry	

	ice, walk-in-Cooler, Water Coolers, refrigerators, Transportation, Food processing & Preservation, Recent developments in refrigeration **UNIT – IV** **AIR CONDITIONING:** Basic Concepts: Fundamental functions of air conditioning, psychometrics, air and humidity calculations, sensible heat factor, analysis of air conditioning process and cycles with psychometric chart, Cooling load calculations **UNIT – V** **COMFORT AIR CONDITIONING:** Physiological reactions to cooling, the effective temperature and its use in the determination of standards of comforts, comfort chart, comparison of domestic, industrial and commercial applications of air conditioning. **VENTILATION SYSTEM:** Summer and winter ventilation, Ventilation of hot working spaces, industrial ventilation, air cleaning. **CONTROLS:** Automatic control of air conditioning systems, Duct work, selection of fans.
Text Books and reference Books:	**TEXT BOOKS:** 1. A Course in Refrigeration and Air Conditioning : Arora S.C. &Domkundwar S., DhanpatRai& Company, 2006 2. Refrigeration and Air Conditioning : Misra L.N., Vikas Publication 3. Refrigeration and Air Conditioning : C.P. Arora **REFERENCES:** 1. Refrigeration and Air Conditioning : Jordan &Priester, London, 2000 2. Principles of Refrigeration : Dossat, 4th ed., Pearson Education India, 1997. 3. Refrigeration and Air Conditioning : Stocker, McGraw-Hill, 2000.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME41E5-TURBOMACHINERY

Course category:	Program elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Fluid mechanics Applied thermodynamics Heat transfer.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Give an overview of different types of turbo machinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic, steam and gas-turbines. 2. Focus on applications in power generation, transport, refrigeration and the built environment. 3. Teach students how to apply various understandings from other courses. 4. Provide students with opportunities to apply basic flow equations. 5. How to compare and chose machines for various operations.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand and apply laws of conservation of mass and momentum and energy.
	CO2	Specify airfoils for axial flow compressors and understand its design criteria.
	CO3	Explain the working principle of centrifugal compressors and know its performance characteristics.
	CO4	Understand and classify gas turbines and methods for improving their performance.
	CO5	Understand concepts of compressible flow and nozzle design for steam turbines.
Course content	**UNIT – I** **BASIC THERMODYNAMICS AND FLUID MECHANICS** : Introduction, one dimensional compressible flow equations, Equation of motion–energy equation, Euler's turbine equation, Concept of boundary layers, Isentropic flow with varying area, theoretical volume flow rate, Impulse and Reaction Principles, Compression and expansion efficiencies, stage and overall efficiency. **UNIT – II** **AEROFOIL THEORY AND AXIAL FLOW COMPRESSOR**: Flow over aerofoil sections, Pressure distribution, lift and drag coefficients, effect of compressibility, blade terminology, cascade testing of blades, energy transfer and its losses in terms of lift and drag method, losses in flow passages, analysis of lift and drag method, cascade analysis, characteristic curves, stalling and surging. **UNIT – III** **CENTRIFUGAL COMPRESSOR**: Introduction, Principles of operation, losses to compressor, limitations, inlet and impeller design, characteristic curves, chocked flow. **UNIT – IV** **GAS TURBINE**: Classification, ideal and modified cycles, component efficiencies effect of maximum temperature, specific output and cycle efficiency, means of improving the performance of simple open cycle, effect of intercooling, reheat and regeneration, combustion chamber requirements.	

	UNIT – V **STEAM TURBINES** : Flow through nozzles, effect of Friction, Nozzle performance, Velocity Triangles, Compounding steam turbines, reheat factor, reheating, bleeding, turbine performance at varying loads, throttle and bypass governing, heat drop, mean diameter, speed and number of stages.
Text Books and reference Books:	**TEXT BOOKS:** 1. Gas Turbine Theory, Design and Applications: Khjuria, P.R &Dubey, S.P, 2000 2. Principles of Turbo machinery : Dennis G. Shepherd, Macmillan, 2002 **REFERENCES:** 1. Steam Turbine Theory and Practice : Kearton, W.J, Pitman publishers, 2005 2. Gas Turbine Theory : Cohen, H & Rogers, G.F.C. 6th ed., 2008 3. Turbines, Compressors and Fans :S. M. Yahya, Tata McGraw-Hill Education, 2010
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13ME41E6 WORK STUDY

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	Mathematics, statistics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To optimize the use of plant, equipment, manpower and material 2. To develop efficient work methods. 3. To improve productivity. 4. To determine the standard time and apply work measurement techniques 5. To understand techniques of job evaluation, merit rating and ergonomics.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Analyze and redesign processes for improved efficiency and effectiveness, using best practices and work-study techniques.
	CO2	Calculate the number of staff required in a unit or function using the techniques of work-study mathematics.
	CO3	Understand the critical linkage between process and organization design.
	CO4	Apply modern organizational models and team-based structures to redesign an organization for improved effectiveness and decision making.
	CO5	Link decision-making models with organization and job design.
Course content	**UNIT - I** **INTRODUCTION TO WORK STUDY**- Scientific management- Productivity. Advantages of work study- work study and workers – work study and management **UNIT - II** **METHOD STUDY**: Introduction- Significance of process charts. Critical Examination- Identification of key activities of exercises on process charts - Flow diagrams - String diagrams – travel chart. **UNIT - III** **MICRO MOTION ANALYSIS**- Memo motion films, Therbligs. Principles of Motion Economy: Work place layout, Human body, Design of tools and equipment. **UNIT - IV**	

	WORK MEASUREMENT: Work measurement techniques, Rating, Allowances, Standard time, problems on Standard time and Rating. Introduction to Synthetic data, Activity sampling, Analytical estimating, PMTS, Work factor, MTM. **UNIT - V** **JOB EVALUATION**- Techniques of job evaluation. Merit rating, Fatigue, Ergonomics, Ergonomics applied to work place layout.
Text Books and reference Books:	**TEXT BOOKS:** 1. Introduction to Work Study: 4th ed., Indian Labour Organization, 1992 2. Elements of Work Study and Ergonomics : DalelaEtal, Standard Publications, 1990 **REFERENCES:** 1. Motion and Time Study – Design and Measurement of Work : R.M. Barnes, Wiley, 1968 2. Work Study : Khanna O.P Khanna publications, 2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME41P1-HEAT TRANSFER AND DYNAMICS LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0 - 0 - 3
Prerequisite:	Thermodynamics Heat transfer Dynamics of machinery	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To Experimentally determine thermal conductivity and heat transfer coefficient through various materials 2. To Experimentally measure conduction ,convection and radiation of different systems 3. To Experimentally measure effectiveness of heat exchangers 4. To Conduct performance tests on refrigeration & air conditioning systems 5. To Experimentally measure critical speed of slender shafts. Verify gyroscopic rules	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	To practically relate to concepts discussed in the Heat Transfer & dynamics course.
	CO2	To conduct various experiments to determine thermal conductivity and heat transfer coefficient in various materials.
	CO3	To conduct performance tests and thereby improve effectiveness of heat exchangers
	CO4	To conduct performance tests and thereby improve effectiveness of refrigeration and air conditioning systems
	CO5	To experimentally investigate, precession and nutation of gyroscope and determination of moment of inertia
Course content	**List of Experiments:** 1. Test on Conduction in Composite Wall. 2. Test on Thermal Conductivity of a Metal Rod. 3. Test on Emissivity Measurement Apparatus. 4. Test on Lagged Pipe Apparatus. 5. Test on Stefan-Boltzmann Apparatus. 6. Test on Natural Convection Apparatus. 7. Test on Forced Convection Apparatus. 8. Test on Drop-wise Condensation Apparatus. 9. Test on Vapour Compression Refrigeration System. 10. Test on Air-Conditioning Test Rig.	

	11. Test on Gyroscopic Unit. 12. Test on Heat Exchanger. 13. Test on Critical Speed Analyzer. 14. Test on Vibration Test Rig.
Text Books and reference Books:	**TEXT BOOKS:** 1. Heat Transfer : J.P. Holman, Tata McGraw-Hill Education, 2008 2. Fundamentals of Engineering Heat & Mass Transfer: Sachadeva R.C, New Age Science, 2009 3.Fundamentals of Heat & Mass Transfer: F.P. Incropera& D.P Dewitt, 5th ed., John Wiley and Sons, New York, 2002. **REFERENCES:** 1. Heat Transfer : Domukundwar, DhanpatRai Publishing Company, 2005 2. Principles of Heat Transfer: Frank kreith, Cengage Learning, 2010 3. Heat and Mass Transfer : D S Kumar, S. K. Kataria& Sons, 2009
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME41P2-METROLOGY& INSTRUMENTATION LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0 - 0 - 3
Prerequisite:	Engineering Metrology, Mechanical Measurements, Mathematics	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Conduct measurement of linear and angular elements on different models such as tapered specimens, Jigs etc., 2. Conduct measurement of geometry parameters such as straightness and flatness. 3. Measure the parameters of standard elements like gears and screw threads. 4. Understand the principle of strain gauges, for measuring torque, pressure etc. 5. Learn the principle of measurement and control of flow, temperature etc.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to identify the correct instrument suitable for a particular measurement.
	CO2	Able to apply correct practices in conducting measurements.
	CO3	Able to evaluate different surfaces for their quality.
	CO4	Able to select proper measuring instrument and know requirement of calibration, errors in measurement etc.
	CO5	Able to control process parameters like temperature, flow etc., to get best process results.
Course content	**LIST OF EXPERIMENTS** **Metrology Lab** 1. Calibration of any two of the following instruments: (using slip gauges) (i) Calibration of Micrometer. (ii) Calibration of Mechanical Comparator. (iii) Calibration of Vernier Calipers (iv) Calibration of Dial Gauge. 2. Measurement of taper angle using (i) Bevel Protractor (ii) Dial Gauge (iii) Sine-Bar (iv) Auto-Collimator. 3. Gear testing: To find; (i) diameter, pitch/module (ii) pitch circle diameter (iii) pressure angle (iv) tooth thickness. 4. Check the straightness of a surface plate (i) Using spirit level (ii) Using Auto-collimator 5. Check the flatness of a surface plate using one of the above methods. 6. Tool Maker's Microscope: i. Establish the thread details ii. To find the cutting tool angles.	

	7. Miscellaneous: i. To find the diameter of a cylindrical piece ii. Taper angle of a V-block iii. Central distance of two holes of a specimen. **Instrumentation Lab** 1. Strain Measurement. 2. Pressure Measurement. 3. Temperature Measurement. 4. Torque Measurement. 5. Temperature Control. 6. Pressure Control. 7. Flow Control.
Text Books and reference Books:	**TEXT BOOKS:** 1. A Text Book of Engineering Metrology – R.K.Jain, Khanna Publishers, 2009 2. A Text Book of Engineering Metrology – I.C Gupta., DhanpatRai publishers, 2008 3. Metrology for Engineers ,John Frederick Wise Galyer, Charles Reginald Shotbolt,Cassell P L C, 1990 **REFERENCES:** 1. Engineering Metrology - MahajanDhanpatRai Publishers, 2009 2. Production Technology - HMTTata McGraw-Hill Education 2001
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR:NELLORE)
SPSRNELLORE DIST
IV YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMISTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2014-2015)
(For the batch admitted in the academic year 2013-2014)

S.No	Course Code	Course Title	Instruction			Credits								Max. Total Marks
			Hours/ Week				Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max.40)	End Semester Examination		
		THEORY	L	T	P		Duration In Hours	Max. Marks	Duration in Hours	Max Marks		Duration in Hours	Max Marks	100
1	13ME4201	Automobile Engineering	4		-	4	2	40	2	40	0.8(best test) + 0.2(other test)	3	60	100
2	13ME4202	Finite Elements Methods	3	1	-	4	2	40	2	40		3	60	100
3		Elective –III	4	-	-	4	2	40	2	40		3	60	100
4	13ME42PR	PROJECT	-		3	6	2	40	2	40		3	80	120
		ELECTIVES												
1	13ME42E1	Automation & Robotics	4	-	-	4	2	40	2	40		3	60	100
2	13ME42E2	Entrepreneurship	4	-	-	4	2	40	2	40		3	60	100
3	13ME42E3	Neural Networks & Fuzzy Logic	4	-	-	4	2	40	2	40		3	60	100
4	13ME42E4	Non-Conventional Energy Sources	4	-	-	4	2	40	2	40		3	60	100
5	13ME42E5	Tribology	4	-	-	4	2	40	2	40		3	60	100
6	13ME42E6	Welding Technology	4	-	-	4	2	40	2	40		3	60	100
		LABS												
1	13ME42P1	MATLAB & CAD Lab	-		3	2	-		-			3	60	100
		TOTAL	11	1	6	18+2								

13ME4201– AUTOMOBILE ENGINEERING

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	The pre- requisite knowledge required by the students to study this course is Basic Thermodynamics, Applied Thermodynamics-I.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To understand the layout of an automobile and functionalities of subsystems. 2. To analyze the combustion phenomena in Spark Ignition and Compression ignition Engines. 3. To Provide an overview on concepts of engine, heads, combustion chambers, cooling, lubrication and fuel systems. 4. To understand the working of various carburetors. 5. To understand the vehicle transmission system, braking system, alignment, electrical system.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	The students acquire sufficient knowledge to classify Engines, Chassis & Explain the functionalities of automotive systems and subsystems.
	CO2	The students discuss the functions and constructional details of Air cleaners, Fuel supply systems and Carburetors.
	CO3	Ability to describe the Cooling systems, Lubrication systems and Ignition systems.
	CO4	The students get the working knowledge of Clutch, Gear box and Propeller shaft.
	CO5	Students can have plenty of knowledge on steering mechanism, suspension system, breaking system and various components of layout of various electrical equipment of an automobile.
Course content	**UNIT – I** **INTRODUCTION:** Componentsof automobiles -Chassis and body,Power transmission system, Classification of I.C engines, arrangement of cylinders, valve arrangement of overhead, T-head, L-head, F-head engines, combustion chambers for petrol and diesel engines, Turbocharging and supercharging. Liners- dry and Wet type, Function and construction details of Piston. **UNIT – II** **AIR CLEANERS:** Functions and construction details of Air Cleaners, Air filters, Fuel supply system- mechanical and electrical fuel pumps- Fuel injection systems, fuel filters **CARBURETORS:** Functions and constructional details of simple, S.U and Solex carburetors. **UNIT – III** **COOLING SYSTEM:** Need, thermo siphon and forced systems of water cooling, air cooling. **LUBRICATION:** Methods of engine lubrication, transmission and chassis Lubrication.	

	IGNITION SYSTEM: Coil and magneto systems, Storage battery- function and constructional details, rating of batteries, dynamo, cut-out, voltage and current regulator, starter drives- Bendix drive systems. **UNIT – IV** **TRANSMISSION SYSTEMS:** **CLUTCH:** Function of clutch, types of clutches - single plate, multiple plate, centrifugal clutches, fluid coupling, torque converter and clutch materials. **GEAR BOX:** Need, types of gear boxes - sliding type, constant and synchromesh, Automatic transmission and differential gear box. **PROPELLER SHAFT:** Need and constructional details- Hotch-Kiss drive, Torque tube drive Universal joint **UNIT – V** **FRONT AXLE:** Rigid axle andIndependent suspension systems, torsion bar, stub axle and front hub. **REAR AXLE:** Semi, three fourth and full floating systems, shock absorbers **STEERING:** Steering linkages, Wheel alignment - caster camber, toe-in and toe-out, power steering **BRAKES:** Mechanical, Hydraulic, Vacuum, Air brake Systems, arrangements of brake shoes, vehicle electrical and electronic systems.
Text Books and reference Books:	**TEXT BOOKS:** 1. Automobile Engineering Vol. I & II: Kirpal Singh, Standard Publishers Distributors, 2004 2. Automobile Engineering: R.K. Rajput, Laxmi Publications, 2007 **REFERENCES:** 1. Automotive Mechanics By William H. Crouse, William Harry Crouse, 10th ed., TMH, 1997 2. A Course in I.C. Engines : Mathur M.L. & Sharma R.P., DhanapatRai and Sons 3. Fundamentals of Motor Vehicle Technology : Victor Albert Walker Hillier, Frank William Pittuck Hutchinson, 1999
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME4202 FINITE ELEMENTS METHODS

Course category:	Program core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-1– 0
Prerequisite:	The pre-requisite knowledge required by the students to study this course Engineering Mathematics, Engineering Mechanics, Strength of Materials, Design of machine elements,	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand where FEM becomes useful, types of problems and applications. 2. Learn to formulate a problem for FE solution from weighted residual methods 3. Learn to formulate a problem for FE solution from Principle of Stationary Total Potential. 4. Generate Finite element equations for 1d bar, beam, conduction and fin elements in a generic manner 5. Generate Finite element equations for 2d structural problems using elements like triangles, rectangles. Learn the procedure for computer implementation of finite element model.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to convert given physical problem into a mathematical model and formulate it into a finite element model.
	CO2	Student able to formulate realistic problems using various governing differential equations.
	CO3	Able to formulate physical problems using 1-D bar and conduction elements with PSTP, Rayleigh– Ritz Method, Piece-wise Trial Functions.
	CO4	Able to generate shape functions for linear bar element and quadratic bar element and able to develop element matrices.
	CO5	Able to simplify complex geometry and field variable to get a problem of lower dimensions that are easy to analyse; also, develop computer code for solutions.
Course content	**UNIT – I** **Basic Concepts :** Introduction, How does the FEM work – Comparison of Finite Element and Exact Solutions and Comparison of Finite Element and Finite Difference Methods. A General Procedure for Finite Element Analysis with simple examples: determination of circumference of a circle&centre of mass of an irregular body. Concepts of formulation, Boundary and Initial value problems, Brief History of Finite Element Methods, Typical applications of FEM. **UNIT – II** **Finite Element Formulations starting from Governing Differential Equations**: Weighted Residual Methods – simple continuous trial functions, collocation and Galerkin	

	methods, The General weighted Residual, weak (variational) Forms, Piece–wise continuous trial function solutions of the weak form. **UNIT – III** **Finite Element Formulation based on the stationarity of a Function:** Functional and differential equation forms, Principle of Stationary Total Potential (PSTP) – Rayleigh– Ritz Method, Piece-wise Trial Functions – Finite Element Method – bar element and one dimensional heat transfer based on the stationary of a functional. Meaning of Finite Element equations. **UNIT – IV** **One Dimensional Finite Element Analysis**: General form of the total potential for 1-D, Generic form of FEM equations. Linear Bar Element, Quadratic bar element – determination of shape functions, Element Matrices; beam element – Selection of nodal D.O.F., determination of shape functions, Element matrices. One-dimensional bar elements, one-dimensional heat transfer element. **UNIT – V** **Two Dimensional Finite Element Analysis** : Dimensionality of a problem, Approximation of Geometry and field variable – Simple three noded Triangular element, Four-noded rectangular Element. Natural coordinates for four- node quadrilateral Element and triangular element. 2-D elements for structural mechanics – Generic relations for Three-noded triangular element, Four-noded rectangular element, Numerical integration- Gauss quadrature in two dimensions, Computer implementation.
Text Books and reference Books:	**TEXT BOOKS:** 1. An Introduction to Finite Element Method : J.N.Reddy, McGraw Hill, 3rd ed., 2008 2. A Text Book of Finite Element Analysis: P. Seshu, PHI, 2009 **REFERENCES:** 1. Introduction to Finite Elements in Engineering : Chandrupatla T.R. &Belegundu A.D., Pearson Education, 2011 Fundamentals of Finite Element Analysis : David V Hutton, TMH, 2005
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME42E1 AUTOMATION & ROBOTICS

Course category:	Program Elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 -0 - 0
Prerequisite:	The pre-requisite knowledge required by the students to study this course is Kinematicsof Machines, Mechatronics.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To inculcate various automation strategies in Industries. 2. To develop the student's knowledge in various robot structures and their workspace. 3. To understand the various actuators and sensors used in robotic systems. 4. To develop student's skills in perform kinematics analysis of robot systems. 5. To provide the student with some knowledge and analysis skills associated with trajectory planning and provide the information about robotic programming languages.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Students are able to explain what is automation, types of automation, components of automation, strategies and levels of automation
	CO2	Students are able to understand the types of flow lines and analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines
	CO3	Students will know the various components in the anatomy of robot &demonstrate the working of various actuators.
	CO4	Students are able to understand the applications of various types of end effectors, and sensor devices also learn about the homogeneous transformations and its applications in the analysis of a robotic structure and method of developing different types of mechanisms and kinematics of the robot
	CO5	Students will demonstrate an ability to generate joint trajectory for motion planning & will demonstrate the robot programming.
Course content	**UNIT – I** **INTRODUCTION TO AUTOMATION:** Need ,Types,Basic elements of an automated system, levels of automation, hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices. **UNIT – II** **AUTOMATED FLOW LINES:** Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, qualitative analysis. **ASSEMBLY LINE BALANCING**: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.	

	UNIT – III **INTRODUCTION TO INDUSTRIAL ROBOTS:** Introduction, Definition of robot Classification, Robot configurations, robot work space, Degrees of Freedom. Components -robot joints,grippers, Actuators-Pneumatic and Hydraulic actuators, electric & stepper motors and comparison **UNIT– IV** **SENSORS** : Position sensors, potentiometers, resolvers, encoders, Velocity sensors, tactile sensors, Proximity sensors **MANIPULATOR KINEMATICS:** Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics. **UNIT – V** **TRAJECTORY PLANNING:** Trajectory planning and avoidance of obstacles, path planning, joint integrated motion – straight line motion, basics of trajectory planning, polynomial trajectory planning. **ROBOT PROGRAMMING:** Types, features of languages and software packages. Industrial applications of robots
Text Books and reference Books:	**TEXT BOOKS:** *1.* Automation, Production systems and CIM : M.P.Groover, , Pearson Education publications , 2008. *2.* Industrial Robotics :M.P. Groover, New Delhi, Tata McGraw Hill edition 2008. **REFERENCES:** 1. John J. Craig, Introduction to Robotics, New Delhi, 3rd ed., Pearson Edition, 2005. 2. Introduction to Robotics – Analysis, systems, applications,Saeed B. NikuWiley Publishing House.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME42E2 ENTREPRENEURSHIP

Course category:	Program Elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	The pre- requisite knowledge required by the students to study this course work study, Economics and Accountancy, Industrial Engineering & Management.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Graduates of the Small Business option can assess and apply their strengths in management. 2. Graduates of the Small Business option can distinguish themselves as effective communicators. 3. Graduates of the Small Business option excel in problem solving. 4. Graduates of the Small Business option model ethical and professional behavior. 5. Graduates of the Small Business option are prepared to pursue professional development opportunities and/or graduate education.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Student can define what entrepreneurship is, consider how everyone has the potential to be entrepreneurial, and to explore the constituents of the entrepreneurial process
	CO2	Able to Identify steps required to research the potential for an innovative idea for the development of an existing enterprise, a new venture or a social change opportunity
	CO3	Student can examine the key resources required to exploit an innovative idea or opportunity to develop an existing business, launch a new venture, or initiate a social enterprise
	CO4	Student can able to understand the record keeping , recruitment process, marketing strategies, advertisements& importance of motivating the teams.
	CO5	Able to gain the knowledge in the production techniques, designing the work place, quality control , maintenance & material handling design in the plant.
Course content	UNIT – I Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. UNIT – II Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process. New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issue sand stock splits.	

	UNIT – III The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities UNIT – IV Financing and Managing the new venture, Sources of capital, venture capital, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising. Global aspects of Entrepreneurship. UNIT – V Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing.
Text Books and reference Books:	**TEXT BOOKS:** 1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.2. 2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004. **REFERENCES:** *1.* Dynamics of Entrepreneurial Development and Management, Vasant *2.* Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.3. *3.* Entrepreneurial Management, Robert J.Calvin, TMH, 2004.4. *4.* Essential of Entrepreneurship and small business management, Thomas W.Zimmerer& Norman M. Scarborough, 4/e PHI, 2005.7 *5.* Industrial Relations &Labour Laws, Srivastava, Vikas, 2005.8.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME42E3 NEURAL NETWORKS & FUZZY LOGIC

Course category:	Program Elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	The pre- requisite knowledge required by the students to study this course is Mechatronics.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. It deals with Introduction and different architectures of neural network. 3. It deals with the learning methods of Neural Networks. 4. It deals with working of Fuzzy Logic Controller. 5. It deals with applications of Fuzzy logic.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	The student will be able to obtain the fundamentals and types of neural networks, analyse the feedback networks& know the learning rules.
	CO2	The student will have knowledge in supervised learning to develop the different algorithms for neural networks and will have perception to solve different engineering problems.
	CO3	The student can understand the unsupervised learning (i.e learning with no help) & comprehend the fuzzy logic control.
	CO4	The student can Understand the concept of fuzziness involved in various systems and fuzzy set theory.
	CO5	Student will able to explain the components of fuzzy systems and determine different methods of deffuzification.
Course content	**UNIT – I** **INTRODUCTION TO NEURAL NETWORKS** : Biological neurons, artificial neurons, McCulloch – Pitts model, neuron modeling for artificial neural systems, Feed forward network, Feedback network, Perception network, Supervised and Unsupervised learning. **LEARNING RULES**: Hebbian learning rule, Perception learning rule, Delta learning rule, Winner take all learning rule, ouster learning rule. **UNIT – II** **SUPERVISED LEARNING**: Perceptions, exclusive OR problem, single layer Perception network, Multi layer feed forward networks: linearly nonseparable pattern classification, delta learning rule for multi Perception layer, Error back propagation algorithm, training errors, ADALINE, Introduction to Radial basis function networks (RBFN).	

	UNIT – III **UNSUPERVISED LEARNING**: Hamming net, Max net, Winner take all learning, counter propagation network, feature mapping, Self organizing feature maps Applications of neural algorithms: elementary aspects of applications of character recognition Neural network Control applications: Process identification: Basic non dynamic learning Control architecture. **UNIT – IV** **FUNDAMENTALS OF FUZZY LOGIC AND FUZZY SETS**: Definition of Fuzzy set, a level fuzzy set Cardinality, and operations of Fuzzy set cardinality. Operations of Fuzzy Sets: Union, intersection, Complement, Cartesian product Algebraic sum, definition of Fuzzy relation, Properties of fuzzy relations, fuzzy composition. **UNIT – V** **DESIGN OF FUZZY SYSTEMS**: Components of Fuzzy systems, Functions of Fuzzification, Rule base Pattern, Inference mechanisms. Method of defuzzification: Centre of Gravity method, Mean of Maxima method, Weighted average method, Height method. Design of Fuzzy systems for temperature setting of storage water heater, fuzzy system for control of air conditioner, Fuzzy system for simple turning process.
Text Books and reference Books:	**TEXT BOOKS:** 1. Introduction to Artificial Neural Systems : KacelM.ZuradaPWS Publishing Co., 1992 2. Fuzzy Set Theory and its Applications : Zimmerman K.J. Springer 2001 **REFERENCES:** 1. Fuzzy Logic with Engineering Applications: Timoti J Ross (Wiley Publications) 2. Introduction to neural networks using MAT Lab 6.0 : Sivanandan S.N, Sumati S, 3. Neural Network a comprehensive Foundation: Haykin. S
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME42E4 NON-CONVENTIONAL ENERGY SOURCES

Course category:	Program Elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	The pre-requisite knowledge required by the students to study this course is Basic, Applied Thermodynamics, Environmental Sciences.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Recall the energy densities of petrol, diesel and kerosene, effect of CO_2 on environment and list the greenhouse gases and their relative impact on the environment global warming 2. Compare the various fossil fuel sources with respect to their impact on the environment and describe the difference between the non-conventional energy and the renewable energy 3. Analyse the impact of fossil fuels on peoples' health. 4. What other social problems arise out of the deteriorating environment conditions due to the over use of fossil fuels. 5. Synthesize and evaluate the performance of the various non-conventional and renewable energy sources and evaluate the volumetric efficiencies of the various energy sources.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to describe conventional and non-conventional sources of energy, role of energy in the development of society and its impact on the environment and economy
	CO2	Ability to calculate direct and diffuse radiation on different dates, times and locations.
	CO3	Ability to Formulate flat plate collectors for air and water heaters.
	CO4	Able to explain concepts, working principles and use of solar heating and cooling in buildings, solar refrigeration, power generation from solar energy, solar ponds and solarstills, solar energy storage, photovoltaic and solar cells.
	CO5	Able to propose site selection for wind energy resources and aerodynamic design of wind turbines.
Course content	**UNIT – I** **INTRODUCTION:** Role and potential of new and renewable sources, The solar energy option, Environmental impact of solar power. **PRINCIPLES OF SOLAR RADIATION:** Physics of the sun, The solar constant, Extraterrestrial and Terrestrial solar radiation, Solar radiation on tilted surface, Instruments for measuring solar radiation and sun shine, Solar radiation data. **UNIT – II**	

	SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, Classification of concentrating collectors, Orientation and Thermal analysis, Advanced collectors. **SOLAR ENERGY STORAGE:** Different methods – Sensible, Latent heat and Stratified storage, Solar Ponds. **SOLAR APPLICATIONS:** Solar heating/cooling techniques, Solar distillation and drying, Photovoltaic energy conversion. **UNIT – III** **WIND ENERGY:** Sources and potentials, Horizontal and Vertical axis windmills, Performance characteristics. **GEOTHERMAL ENERGY:** Resources, Types of wells, Methods of harnessing the energy, Potential in India. **UNIT – IV** **BIO-MASS:** Principles of Bio-conversion, Anaerobic/Aerobic digestion, Types of Bio-gas digesters, Gas yield, Combustion characteristics of bio-gas, Utilization for cooking, I.C. engine operation, Economic aspects. **OTEC:** Principles, Utilization, Setting of OTEC plants, Thermodynamic cycles. **TIDAL AND WAVE ENERGY:** Potential and Conversion techniques, Mini-hydal power plants and their economics. **UNIT – V** **DIRECT ENERGY CONVERSION:** Need for DEC, Carnot cycle, Limitations, Principles of DEC, Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, Figure of merit, Materials, Applications. MHD generators – Principles, Dissociation and Ionization, Hall effect, Magnetic flux, MHD accelerator, MHD engine, Power generation systems, Electron gas dynamic conversion, Economic aspects. **FUEL CELLS:** Principle, Faraday's laws, Thermodynamic aspects, Selection of fuels and Operating conditions.
Text Books and reference Books:	**TEXT BOOKS:** 1. Non-conventionalEnergy Sources : Rai G.D., KhannaPublishers4th ed., 2000 2. Non-conventionalEnergy : Ashok V Desai, New Age International 1990 **REFERENCES:** 1. Renewable Energy Sources : Twidell and Weir, Taylor & Francis, 2006 2. Solar Energy : Sukhatme, TMH, 2008 3. Solar Power Engineering : Magal Frank Kreith B.S. &Kreith J.F.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME42E5 TRIBOLOGY

Course category:	Program Elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	The pre- requisite knowledge required by the students to study this course is Engineering Mechanics, fluid mechanics and dynamics of machine elements.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Understand the principles for selecting compatible materials for minimizing friction and wear in machinery. 2. Understanding the principles of bearing selection and bearing arrangement in machines. 3. Learn the computations required for selecting and designing bearings in machines. 4. Understanding the fundamental principles of lubrication for reduction of friction and wear. 5. Understanding the fundamental principles of high contact stresses, fatigue-failure, and elasto hydrodynamic lubrication in rolling bearings and gears.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Have knowledge of surface topography and know how to model a rough engineering surface.
	CO2	Have a clear overall picture about the basics of tribology and related sciences, theoretical background about processes in tribological system, mechanisms and forms of interaction of friction surfaces.
	CO3	Be familiar with adhesion theories and the effect of adhesion on friction and wear
	CO4	Have a mastery of the friction/lubrication mechanisms and know how to apply them to the practical engineering problem.
	CO5	Know the methods to reduce the friction for engineering surface.
Course content	**UNIT – I** **INTRODUCTION** - Brief View, elements of tribology, Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index, determination of viscosity, different viscometers used. **UNIT – II** **HYDROSTATIC LUBRICATION:** Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing. **UNIT – III** **HYDRODYNAMIC THEORY OF LUBRICATION:** Various theories of lubrication, Petroff's equation, Reynold's equation in two dimensions,Effects of side leakage, Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti-friction bearing. **UNIT – IV**	

	FRICTION AND POWER LOSSES IN JOURNAL BEARINGS: Calibration of friction, loss friction in concentric bearings, bearing modulus, Sommerfeld number, heat balance, practical consideration of journal bearing design considerations. **AIR LUBRICATED BEARING:** Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings, Hydrostatic thrust bearings, Hydrostatic bearing Analysis including compressibility effect. **UNIT – V** **TYPES OF BEARING OIL PADS:** Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings. **BEARING MATERIALS :**General requirements of bearing materials, types of bearing materials.
Text Books and reference Books:	**TEXT BOOKS:** 1. Fundamentals of Tribology : Basu, SenGupta and Ahuja, New Delhi, 2nd edition, PHI, 2005. 2. Tribology in Industry : Sushil Kumar Srivatsava, Hyderabad, 5th edition, S. Chand &Co, Publisher, 2007. **REFERENCES:** 1. Tribology :B.C. MajumdarNewdelhi, 2nd edition, S.Chand& Co Publishers, 2012. 2. Engineering Tribology : PransantaSahoo, PHI Pvt. Ltd, 2005
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME42E6 WELDING TECHNOLOGY

Course category:	Program Elective	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practical:**	4 - 0 - 0
Prerequisite:	The pre- requisite knowledge required by the students to study this course is basic manufacturing process.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Evaluate potential hazards and apply procedures to maintain workplace safety with respect to welding applications. 2. Theoretical and practical analysis of various Welding techniques 3. To understand the power sources related to the welding processes. 4. Theoretical exposure on special welding processes EBM, LBM, AHW etc. 5. To learn Destructive and Non- Destructive Testing (NDT).	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Able to select tools and equipment to support welding as well as related activities.
	CO2	Able to apply problem solving and decision making skills to overcome obstacles in welding industries.
	CO3	Able to evaluate weld quality and generate recommendations for continuous improvements in welded structures.
	CO4	Able to leads to select appropriate welding techniques for the applications.
	CO5	Able to apply correct welding procedures to achieve the quality
Course content	**UNIT –I** **GAS WELDING**: Introduction, Gases, Production of Oxygen and Acetylene, Setup and Equipment, Cylinder valves, Pressure regulators, Welding torches, Types of flames, Gas Welding techniques, Filler rods, Fluxes rods, Fluxes, Oxy hydrogen welding. **UNIT – II** **ARC WELDING**: Carbon Arc Welding, Metal arc Welding, TIG welding, MIG welding, submerged arc welding. DC generators, AC Transformers, Rectifiers, B.I.S. Classifications of Electrodes for Arc welding, Coating of electrodes. **UNIT – III** **SPECIAL WELDING PROCESSES**: Electron beam Welding, Laser welding, Thermit welding, Atomic Hydrogen welding, soldering, Brazing, Braze welding, Adhesive bonding, Metal spraying. **THERMAL CUTTING PROCESS:** Gas Cutting, Arc cutting, Plasma Arc Cutting, Oxygen lance cutting. **UNIT – IV** **PRESSURE WELDING PROCESS:** Forge welding, Friction welding, Explosive welding, Ultrasonic welding and Diffusion bonding.	

	RESISTANCE WELDING: Spot & Seam Projection welding, Flash Butt welding and Upset welding. Heat balance in Resistance welding. **UNIT – V** **DESTRUCTIVE AND NON- DESTRUCTIVE TESTING (NDT)** – Defects in welding, X-ray and Gamma ray testing, testing of pipe, plate, boiler, drum etc., Magnetic particle testing, Liquid penetrant testing, Ultrasonic testing.
Text Books and reference Books:	**TEXT BOOKS:** 1. Welding and Welding Technology :Little, Richard L, McGraw-Hill Companies, 1993 2. Welding Processes and Technology :R.S. Parmar, Khanna Publishers, 2nd ed., 1995 **REFERENCES:** 1. Welding Technology :Konigsberger F., Hart Pub. Co., 1968 2. Welding Technology : O.P.Khanna, DhanpatRai& Sons, 1993 3. Welding Engineering &Technology : Parmar R.S, 2nd ed., Khanna Publishers, 2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

13ME42P1 MAT LAB & CAD LAB

Course category:	Program core	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practical:**	0 - 0 - 3
Prerequisite:	The pre- requisite knowledge required by the students to study this course is CAD/CAM, Finite Element Method.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To learn 2D basic features of AUTOCAD, 3D modeling using AIP. 2. To analyze 2d structural and thermal problems using ANSYS. 3. To learn how to carry out basic operations in MATLAB. 4. To generate graphs and plots using MATLAB. 5. To perform algebraic, differential operations & Series generation using MATLAB.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Students will be able to review and train in CAD modeling
	CO2	Ability to generate Solid Modeling of various machine elements using AIP.
	CO3	Students will be get trained on various areas of finite element modeling in thermal structural analysis of mechanical components.
	CO4	Students will be able to Use variables, operators, and control structures to implement simple sequential algorithms.
	CO5	Ability to write Generalize program code to create modules implements single numerical methods and algorithms. Analyze the accuracy of numerical solutions to diverse engineering problems
Course content	**List of Exercises:** 1. Introduction to ANSYS, AIP & C-Graphics 2. Finite Element Analysis of a Simply supported beam using ANSYS 3. One dimensional heat transfer analysis of a Composite wall using ANSYS 4. Finite Element Analysis of a bi metallic rod using ANSYS 5. Design and drafting of Helical Compression Spring using AIP Software 6. Preparation of solid models for the given sketches using AIP Software 7. Generation of Isometric Views using AUTO CAD 8. Generation of sectional front and top views of a Knuckle Joint using AUTO CAD 9. Write a Program for generating a Straight Line 10. Write a Program for generating a Circle 11. Write a Program for Straight Line Transformations	

	12. Write a Program for Circle Transformations 13. Write a Program for Circle Boolean Operations 14. Introduction to MAT LAB 15. Matrix Operations (Determinant, Multiplication, Inverse, Transpose) 16. Deletion and addition of an element in an array. 17. Searching an element in the matrix 18. Factorial of Number. 19. GCD of two numbers 20. ncr calculations 21. Reversing order of numbers. 22. Sum of Geometric series. 23. Fibonacci series 24. Derivative of a Polynomial. 25. Computation of various functions (e^x . sin x^2, x^2+2x+3) 26. Roots of a quadratic equation. 27. Drawing a circle. 28. Types of plots. (Line, bar, stem, Stairs)
Text Books	**CAD/CAM/CIM** **:** P.N.Rao, 3rd Edition , TataMcGrawhill,2015
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**