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.

INSTITUTE 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 share human and academic resources with industries, schools and public agencies through partnerships and outreach activities.

VISION OF THE DEPARTMENT

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 OF THE DEPARTMENT

M1: 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.

M2: 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.

M3: To develop the interaction with the Industry experts to gain practical knowledge.

M4: To provide best teaching & learning practices as well as creating opportunities for Research, maximise student results and placements.

M5: To inculcate and promote lifelong learning skills, problem solving skills, leadership qualities and team work.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)	
PEO 1:	A strong foundation to access, analyze, plan and implement their knowledge in basic sciences & mathematics, core and interdisciplinary courses.
PEO 2:	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.
PEO 3:	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
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Specific
	PROGRAMME SPECIFIC OUTCOMES
PSO1	Solve engineering problems in the area of Robotics and Automation.
PSO2	Design, Simulate and Analyze using CAD/CAM/CAE tools.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA ANANTAPURAMU)

I YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMISTER

MECHANICAL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2017-2018)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks		Duration In Hours	Max. Marks	100
1	17SH1101	Functional English	3	-	-	3	2	40	2	40	0.8*Best of two+0.2*least of two	3	60	100
2	17SH1102	Engineering Chemistry	3	-	-	3	2	40	2	40		3	60	100
3	17SH1103	Numerical Analysis	2	2	-	3	2	40	2	40		3	60	100
4	17CS1102	Introduction to Computing	3	-	2	4	2	40	2	40		3	60	100
5	17ME1101	Elements of Mechanical Engineering	3	-	1	3	2	40	2	40		3	60	100
6	17ME1102	Engineering Mechanics – I	2	2	0	3	2	40	2	40		3	60	100
		PRACTICALS												
7	17SH11P1	English language Laboratory	-	-	3	2	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	17SH11P2	Chemistry Laboratory	-	-	3	2	-	-	-	40		3	60	100
9	17ME11P1	Engineering Workshop	-	-	2	1	-	-	-	40		3	60	100
		TOTAL	16	04	11	24	-	-	-	360		-	540	900

17SH1101- FUNCTIONAL ENGLISH

(Common to all Branches)

I B.Tech I Semester

(With effect from 2017-18)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected: ❖ To develop their basic communication skills in English ❖ To achieve specific linguistic and communicative competence ❖ To acquire relevant skills and function efficiently in a realistic working context ❖ To inculcate the habit of reading	
Course Outcomes	On successful completion of this course students will be able to:	
	CO1	Correct the error of the sentence; improve language proficiency and face competitive exams; GATE, GRE, TOEFL, GMAT etc.
	CO2	Write clear and coherent passages for social and professional contexts.
	CO3	Acquire considerable flair in using broad range of vocabulary.
	CO4	Write proposals, business letters.
	CO5	Draft, speech-building and critical thinking.
	CO6	Comprehend the advanced level of reading comprehensions.
Course Content	**Unit –I** **GRAMMAR**: Parts of Speech & Subject- Verb Agreement **WRITING-PARAGRAPH WRITING:** Expressions of ideas, concepts etc., in unambiguous grammatically acceptable and logically coherent manner (in general items); In particular skills in sentence construction emphasizing on function of word and Basic sentence patterns- framing sentences leading to effective paragraph) **Unit-II** **GRAMMAR:** Pronoun - Agreement & Usage, Articles: Kinds & Omission of Article **READING:** Different Reading Strategies: Skimming, Scanning, Inferring, Predicting and Responding to content –Guessing from Context and Vocabulary Extension. **WRITING:** Letter writing - Formal and Informal Writing	

	Unit-III **GRAMMAR:** Tenses, Conditional Sentences, Non-Finite Verbs: Kinds of Non-Finite: Infinitives, Gerund & Participle. **WRITING**: Dialogue writing: Communicating and presenting ideas effectively and coherently, Exchanging conversation in a group or between two persons directed towards a particular subject. **Unit-IV** **GRAMMAR:** Prepositions: Kinds, Position, Adverb usage, Question tags & Transformation of sentences-Degrees of comparison Writing: Telephonic conversations and Etiquettes **Unit-V** **GRAMMAR:** Transformation of sentences- Direct- Indirect Speech, Active- Passive Voice & Modifiers **WRITING:** Story Writing **Unit –VI** **GRAMMAR:** Simple, Complex, Compound Sentences - Parallelism **WRITING:** Drafting of Public Speech**:** Ideas / Content Generation, Structure **REFERENCE BOOKS:** 1. Essential English Grammar: Raymond Murphy, Cambridge University Press 2. Advanced Grammar in Use: Martin Hewings, Cambridge University Press 3. High School English Grammar: Wren and Martin, S Chand Publications 4. Effective Technical Communication: Ashraf Rizvi, Tata Mc Graw Hill Publication

17SH1102-ENGINEERING CHEMISTRY

(Common for ME and CE)
I B.Tech I Semester
(With effect from 2017-18)

Course Category:	Basic science	**Credits**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ Strengthen the fundamentals of Chemistry and then build an interface of theoretical and experimental concepts with their industrial/ engineering applications. ❖ The extension of fundamentals of Electrochemistry to energy storage devices such as batteries and fuel cells is one such example. ❖ Know the factors affecting the rate of corrosion and its prevention. ❖ Design engineering materials and solve problems related to them. ❖ Understand various water softening methods. ❖ Understand preparation of polymers and their applications.	
Course Outcomes	On successful completion of this course students will be able to:	
	CO1	Understand the electrochemical sources of energy
	CO2	Identify and investigate means of protecting metal against corrosion.
	CO3	Understand industrially based engineering materials
	CO4	Understand the classification of fuels and their analysis
	CO5	Know the disadvantages of hard water and ability to remove hardness by using various methods
	CO6	Understand the basics of polymers and their preparation and uses in engineering field

UNIT – I

Single electrode potential-explanation and measurement
Reference electrodes-hydrogen gas electrode-calomel electrode-glass electrode
Electrochemical cells: Lead-Acid storage cells
Batteries: Li-ion Batteries
Fuel Cells: Hydrogen - Oxygen fuel cell
Conductometric titration of strong acid and strong base

UNIT – II

Definition-classification- theories of corrosion-factors affecting the corrosion- Prevention methods of corrosion-metallic coatings (Electroplating, cementation) and cathodic protection.

UNIT-III

Electrical insulators: Definition-classification-Characteristics- Application of electrical insulating materials (solid, liquid and gaseous insulators).
Refractories: Classification- properties and applications of refractories.
Lubricants: Lubricant-Lubrication-classification of lubricants-Properties and applications of lubricating oils.

Course Content	**UNIT – IV** Classifications of Fuels - Characteristics of fuels - Calorific value – determination – Bomb calorimeter – Boy's gas calorimeter - Theoretical calculation of calorific value. Solid fuels: coal-analysis of coal. Liquid fuels: Petroleum-refining of petroleum - Synthetic petrol – Fischer Tropch's synthesis Gaseous fuel – Flue gas analysis by Orsat's apparatus. **UNIT – V** Impurities in water-Hardness of water-Estimation of hardness by EDTA method-Estimation of dissolved oxygen-alkalinity-chlorides in water Industrial use of water: For steam generation-troubles in 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-VI** Introduction to polymers- Polymerization process-types of polymerization Elastomers: natural rubber – vulcanization of rubber – compounding of rubber- Synthetic rubbers: preparation, properties and engineering applications of Buna – N, Neoprene, Thiokol and silicon rubbers Plastomers: Thermosetting and thermoplastics- Preparation, properties and engineering applications of PVC, Bakelite, Nylons and Urea-Formaldehyde **TEXT BOOKS:** 1**.** Engineering Chemistry, First Edition, Jayaveera KN, Subba Reddy GVand RamachandraiahC, McGraw Hill Higher Education, New Delhi, 2013. 2.A Text Book of Engineering Chemistry, 15th Edition, Jain and Jain, Dhanapathi RaiPublications, New Delhi, 2013.REFERENCES: **REFERENCES:** 1. A Text book of Engineering Chemistry, 12th Edition, SS Dhara,Uma, S. Chand Publications,New Delhi, 2010. 2. Engineering Chemistry, First edition, K.B. Chandra Sekhar, UN.Das and Sujatha Mishra,SCITECH Publications India Pvt Limited, 2010. 3. Engineering Chemistry, First edition, Seshamaheswaramma K and Mridula Chugh, PearsonEducation, 2013.

17SH1103-NUMERICAL ANALYSIS

(Common to all Branches)

I B.Tech I Semester

(With effect from 2017-18)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre – requisite:	Intermediate Mathematics	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ The Bisection, False Position, Iteration and Newton-Raphson Methods. ❖ The basic concepts of numerical solutions of simultaneous linear and non-linear algebraic equations. ❖ The concepts of Interpolation. ❖ The concepts of Numerical Differentiation and Integration. ❖ The numerical methods to solve Ordinary Differential Equations by using Taylor's series method, Picard's method, Euler's and Modified Euler's Methods and Runge-Kutta methods of 2^{nd} and 4^{th} order. ❖ The concepts of Curve Fitting and Regression Analysis.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Acquire knowledge in solving algebraic and transcendental equations by using the appropriate numerical methods.
	CO2	Develop skills in analyzing the simultaneous linear and non-linear algebraic equations by various numerical methods.
	CO3	Attains skills in analyzing the methods of interpolating the given data.
	CO4	Acquire knowledge in Numerical Differentiation by Newton's formula and in Numerical Integration by Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules.
	CO5	Apply appropriate numerical methods to solve Ordinary Differential Equations.
	CO6	Develop skills in designing mathematical models for fitting geometrical curves to the given data and also acquire knowledge in Regression Analysis.

Course Content	**UNIT – I** **SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS:**Bisection - False position- Iteration - Newton-Raphson Methods. **UNIT - II** **SOLUTION OF SIMULTANEOUS LINEAR AND NON-LINEAR ALGEBRAIC EQUATIONS:**Iteration method - Gauss Jordon method - Gauss Elimination with Pivotal condensation method - Triangular Factorization method - Gauss-Seidal method - Newton-Raphson method. **UNIT – III** **INTERPOLATION:**Newton's forward and backward interpolation formula - Lagrange's interpolation - Gauss forward and backward formulae - Stirling's formula. **UNIT – IV** **NUMERICAL DIFFERENTIATION AND INTEGRATION:**First and Second Order Derivatives at given points by Newton's formula. Trapezoidal rule - Simpson's 1/3 rule and Simpson's 3/8 rule. **UNIT – V** **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:**Solution by Taylor's Series - Picard's Method of Successive Approximations - Euler's and Modified Euler's Methods - Runge-Kutta Method of 2^{nd} order and 4^{th} order. **UNIT - VI** **CURVE FITTING:** Introduction - Method of least squares - Linear and Non-linear equations. Correlation coefficient - Lines of regression - Rank correlation coefficient (Spearman's Rank-Correlation).
Text Books and Reference Books	**TEXTBOOKS:** 1. Higher Engineering Mathematics-B.S.Grewal, Kanna Publishers, New Delhi. 2. Mathematical Methods - Dr.T.K.V. Iyengar, Dr.B. Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N. Prasad, S.Chand Publication, New Delhi. **REFERENCE:** 1. Introductory Methods of Numerical Analysis - S.S. Sastry, Prentice Hall India Learning Private Limited, New Delhi. 2. Numerical Methods - E. Balagurusamy,Tata McGraw-Hill Education Pvt. Ltd, New Delhi. 3. Numerical Methods - E. Balagurusamy,Tata McGraw-Hill Education Pvt. Ltd, New Delhi

17CS1102 -INTRODUCTION TO COMPUTING

(Common to Civil and Mechanical)

I B.Tech I Semester

(With effect from 2017-18)

Course Category:	Engineering Science	**Credits:**	4
Course Type:	Theory	**Lecture – Tutorial – Practical:**	3-0-2
Prerequisite:	Basic usage of computer may be required and a few terms must be known in advance.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs
Course Objectives	❖ Understanding the basics of computer fundamentals, identification of various components of computers and their need. ❖ Creating awareness regarding various I/O and Storage devices. ❖ Studying the operating system basics. ❖ Learning the fundamental blocks of C Programming		

Course Outcomes	Upon the successful completion of the course, the students will be able to:	
	CO1	Identify physical components of a computer and their functionalities
	CO2	Learn, recognize and identify various interactive mechanisms through different devices.
	CO3	Study various types of operating systems and properties
	CO4	Learn the fundamental blocks of C language
	CO5	Understand the basics of formatted I/O, decision statements and its applicability
	CO6	Gain the knowledge about iterative statements, array fundamentals and basic application development.
Course Content	**UNIT – I** **Introduction to Computers**: Overview and definitions, Computers for individual users – Desktop, Workstations, Notebook computers, Tablet and Handheld computers, Smart phones, Computers for organizations – Network servers, mainframes, mini and super computers, Computers in society – why are so important, home, Education, Small Business, Industry, Government, Healthcare, Banking and Communication. **Inside the Computer:** Various parts of a Computer System - Software, Hardware, Data and Users, Information processing cycle, Essential Computer hardware - processor, Memory, I/O and Storage, Software and major categories- system software and application software. **UNIT – II** **I/ODevices**: The Keyboard – Layout,types of keys,input from keyboard,	

	TheMouse –Usage, Variants of mouse, Devices for Hand – Pens, Touch Screens, Game controllers, Optical devices – Bar Code readers, Image scanners and OCR, Monitors – Types, CRT monitors, Flat panel Monitors. **Data Storage**: Categories of storage devices, Magnetic – How data is stored and organized on disk, How OS access the data, Diskettes, Hard disks, Removable High-Capacity Magnetic disks, Tape Drives, Optical Storage devices – CD-ROM, DVD-ROM, Recordable Optical Technologies, Solid-state storage devices – Flash Memory, Smart Cards, Solid State Disks. **UNIT – III** **OS Basics**: types of Operating Systems – Real Time Operating Systems, Single-user/Single-Tasking OS, Single user/Multitasking OS, Multi-user/Multitasking OS, User interfaces – Graphical User Interfaces, Command-Line Interfaces, Running Programs – Sharing information. **UNIT – IV** **Fundamentals of C:** History, Structure of a C program, Programming rules and execution.Character set, Delimiters, C keywords, Identifiers, Constants, Variables, Rules for defining Variables, Data types, Declaration and Initialization of Variables. **Operators and Expressions:** Introduction, Operator Precedence and Associativity, Operator Types. **UNIT – V** **Input and Output in C:** Formatted and Unformatted functions, Commonly used libraryfunctions. **Decision Statements:** Introduction, Types of If statements, switch statement, Break, continue, goto. **UNIT – VI** **Iterative Statements**: while, do-while and for loops. **Arrays**: Definitions, Initialization, Characteristics of an array, Array Categories.

Text Books and References	**Text Book(s):** 1. Peter Norton "**Introduction to Computers**",McGraw Hill Publishers, 7th Edition 2011. 2. Programming with ANSI & TURBO C by Ashok N.Kamthane, Pearson Education 2007 **Reference Books:** 1. Alex Leon and Mathews Leon "Fundamentals of Information Technology", Vikas Publishers, 2nd Edition 1999. **2.** Let Us C byYashwant Kanetkar, BPB Publications. **3.** Programming in ANSI C by Balagurusamy 6th Edition, Tata McGraw Hill Education, 2012.
E-Resources	**1. https://nptel.ac.in/courses** **2. https://freevideolectures.com/university/iitm**

17ME1101-ELEMENTS OF MECHANICAL ENGINEERING

(Only for ME)

I B.Tech I Semester

(With effect from 2017-18)

Course Category	Programme core	Credits	3
Course type	Theory	Lecture- Tutorial-Practical	3-0-1
Prerequisite	-	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objectives	Students of Mechanical Engineering are made to learn fundamentals related to mechanical engineering and provide overview on various mechanical systems.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Understand the concepts of various methods of production processes.
	CO2	Identify appropriate application of engineering materials
	CO3	Summarize the working of IC engines
	CO4	Understand various sources of energy resources and applications.
	CO5	Grasp the working of refrigeration and air-conditioning systems.
	CO6	Understand the functions and applications of machine elements in power transmission and suspension.
Course Content	**UNIT – I** **Basic Manufacturing Methods:** Principles of casting, greensand moulding, advantages and applications of casting. **Welding:** Principles of gas welding and arc welding, soldering and brazing. **Metal working:** Hot working and cold working processes. **UNIT – II** **Engineering Materials:** Types, application of ferrous and non-ferrous metals and alloys. **Composites**: Definition, classification and applications. **Machine Tools:** Classification of machine tools, Lathe operations - Turning, Facing, Knurling, thread cutting, Boring, taper turning by swiveling compound rest. **UNIT – III** **Engines:** Classification, applications, Components of IC engines, working of 4-stroke petrol engine and diesel engine, working of 2-stroke petrol and diesel engine, comparison of 4- stroke and 2-stroke engines, IC engine performance characteristics. **UNIT – IV** **Energy sources:** Forms of energy, sources of energy, classification of energy sources, comparison between renewable and non-renewable energy sources, petroleum based fuels, alternate sources of energy – Nuclear, Solar, Wind and Tidal power.	

	Power plants: Introduction,working principle of hydraulic and steam power plant. **UNIT – V** **Refrigeration and Air-conditioning:** Working of domestic refrigeration and Air-conditioning systems, unit of refrigeration, applications of refrigeration and air conditioning system. **UNIT – VI** **Power Transmission:** Types – gear, chain, belt drives - Applications. **Springs:** Classification**-** Helical and leaf springs, applications. **Cams:** Types of cams and applications.
TEXT BOOKS	1. Elements of mechanical engineering, M.L.Mathur, F.S.Mehtha and R.P.Tiwari, Jain Brothers, New Delhi,2008. 2. Engineering basics, Saeed Moaveni, Cengage Learning, 2009
REFERENCE BOOKS	1. Basic Mechanical Engineering, K.Venugopal, Anuradha Agencies,2014 2. An Introduction to Mechanical Engineering, J. Wickert , Cengage Learning,2012 3. Elements of Mechanical Engineering, N.Krishnamurthy,H.S.Manohar, Sagar,Baligidad, and published bySunstarpublishers, 2015.

17ME1102-ENGINEERING MECHANICS – I (STATICS)

(Only for ME)

I B.Tech I Semester

(With effect from 2017-18)

Course Category	Programme core	Credits	3
Course type	Theory	Lecture- Tutorial-Practical	2-2-0
Prerequisite	Basic physics and mathematics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Objectives	Students are made to learn ❖ The laws of mechanics, concept of forces and moments. ❖ The conditions of equilibrium of a body and procedure for drawing free body diagrams. ❖ The usages of trusses in carrying load and apply procedures for their analysis. ❖ The laws of friction, the action of friction on bodies moving on horizontal as well as inclined planes. ❖ The basic idea of centre of gravity and compute centroid of plane figures and centre of gravity of solids. ❖ The importance of moment of inertia and the methods of calculating area moment of inertia of plane figures and mass moment of inertia of solids.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Understand the concepts of basic engineering mechanics for static structures
	CO2	Categorize various types of loading and support conditions that act on structural systems
	CO3	Solve problems using required skills or knowledge in equilibrium of forces and trusses
	CO4	Demonstrate use of laws of mechanics in simple machines with consideration of friction
	CO5	Understand the meaning of centers of gravity (mass)/centroids, moments of Inertia and mass moment of inertia.
	CO6	Solve problem on centers of gravity (mass)/centroids, moments of Inertia and mass moment of inertia
Course Content	**UNIT – I** **INTRODUCTION TO ENGINEERING MECHANICS**: Introduction, Resultant of forces, Resolution of forces, Laws of mechanics – Newton laws, Parallelogram law**,** Lami's theorem, Law of transmissibility, Triangle and polygon law of forces; System of forces, Varignon's principle, Moment of a force, Couple and equivalent system.	

	UNIT – II **EQUILIBRIUM OF COPLANAR FORCE SYSTEM**: Principle of Equilibrium – concurrent and non-concurrent force systems, Concept of free body diagram, Support reactions - Types of supports, loads and their reactions. **UNIT – III** **PLANE TRUSSES**: Types of engineering structures, Perfect truss-mathematical condition and assumptions, Cantilever frames and simply supported frames – Analysis of frames using method of joints and method of sections for vertical loads, horizontal loads and inclined loads. **UNIT – IV** **FRICTION:** Types of friction-Static and Dynamic Frictions, laws of Friction, Limiting friction, Cone of limiting friction, angle of repose, Motion of bodies on inclined planes – Ladder friction. **SIMPLE LIFTING MACHINES:** Velocity Ratio, Mechanical Advantage and Efficiency of Machines and their relation, self-locking of machine, Simple Screw Jack – Effort required to raise and lower the load. **UNIT – V** **CENTER OF GRAVITY:** Centroid of simple plane figures - Method of moments & Integration method, Centroid of Composite figures. Centre of Gravity of bodies - Integration method, Centre of Gravity of Composite figures. **UNIT – VI** **MOMENT OF INERTIA:** Area moment of Inertia, Radius of gyration, Parallel axis and perpendicular axis theorems, Moment of Inertia of some standard geometrical shapes. **MASS MOMENT OF INERTIA:** Definition, mass moment of inertia of rectangular and circular plate, cylinder, cone and sphere.
Text Books	1. A text book of Engineering Mechanics – Bhavikatti, S.S, "Engineering Mechanics", New Age International (P) Limited Publishers,2014 2. A text book of Engineering Mechanics – D. R.K. Bansal ,Laxmi publications (P) Limited,2016 3. Engineering Mechanics – K. L. Kumar, Tata Mc Graw Hill, New Delhi,2010
Reference Books	1. Engineering Mechanics: Statics and Dynamics – N.H Dubey, Tata Mc Graw Hill, New Delhi,2016 2. Engineering Mechanics – S. Timoshenko, D.H. Young – Mc Graw Hill International Edition,2013 3. Engineering Mechanics – Statics and Dynamics – Irving H Shames, G Krishna Mohana Rao – Pearson Education,2006

17SH11P1-ENGLISH LANGUAGE LABORATORY

(Common to all Branches)

I B.Tech I Semester

(With effect from 2017-18)

<table>
<tr><td>Course Category:</td><td colspan="2">Basic Sciences</td><td>Credits:</td><td>2</td></tr>
<tr><td>Course Type:</td><td colspan="2">Practical</td><td>Lecture-Tutorial-Practical:</td><td>0-0-3</td></tr>
<tr><td>Pre-requisite:</td><td colspan="2">Basic Level of LSRW Skills</td><td>Sessional Evaluation:
External Exam Evaluation:
Total Marks:
External Exam Duration:</td><td>40
60
100
3 hrs</td></tr>
<tr><td>Course Objectives</td><td colspan="4">❖ The main objective is to develop students' basic skills of communication viz. LSRW in English through which communicative competence can be enhanced and can communicate efficiently in a realistic professional ambience.</td></tr>
<tr><td></td><td colspan="4">After completing the course the student will be able to</td></tr>
<tr><td rowspan="2">Course Outcomes</td><td>CO1</td><td colspan="3">These activities practiced in the laboratory are helpful in comprehending the Important language aspects which are useful for the real life situations.</td></tr>
<tr><td>CO2</td><td colspan="3">These are also helpful in enhancing the language competency and communicative level of confidence</td></tr>
<tr><td>Course Content</td><td colspan="4"><u>LIST OF EXPERIMENTS</u>
I. Listening Skills:
Listening for Pleasure,
Listening for Details and Listening for Information
II. Speaking Skills:
Jam,
Extempore
Presentations
Seminars
III. Reading Skills:
News Paper Reading
IV. Writing Skills:
Story Writing
Description
1. Object
2.Place
3. Person
4.Situation
Giving Directions & Instructions
REFERENCES:
1. A Manual for English Language Laboratories: Dr. D. Sudha Rani , Pearson Publications
2. Pronunciation Dictionary: Daniel Jones
3. Techniques of Teaching English: A.L. Kohli
4. A Textbook of English Phonetics: For Indian Students: T Balasubramanian., Macmillan India Limited.</td></tr>
</table>

17SH11P2-ENGINEERING CHEMISTRY LABORATORY

(Common for ME and CE)

I B.Tech I Semester

(With effect from 2017-18)

Course Category:	Basic science	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Objectives	❖ The main objective is to provide students to learn about experimental techniques in chemistry with knowledge in theoretical aspects so that they can excel in that particular field.	
Course Outcomes	After completing the course the student will be able to	
	CO1	These experiments in the laboratory are helpful in understanding key concepts of chemistry through involvement in the experiments by applying theoretical knowledge.
	CO2	It helps to recognize where the ideas of the student agree with those accepted by chemistry and where they do not.

Course Content

Minimum of 8 experiments to be completed out of the following:

LIST OF EXPERIMENTS

1. Determination of total hardness of water by EDTA method
2. Determination of Copper by EDTA method
3. Estimation of dissolved oxygen by Winkler's method
4. Determination of Acidity of water
5. Determination of total alkalinity of water.
6. Estimation of chlorides using potassium chromate indicator
7. Conductometric titration of strong acid Vs strong base.
8. Determination of pH of unknown solution
9. Preparation of Bakelite
10. Determination of viscosity of oils with Redwood viscometer

Text Books:

1. Vogel's text books of quantitative chemical analysis, Mendham et all, person publications.
2. Chemistry lab manual – KN Jayaveera, Subbareddy & Chandrasekher.
3. Instrumental methods of chemical analysis – Chatwal & Anand Himalaya publications.

17ME11P1- ENGINEERING WORKSHOP

(Common to ME and CE)

I B.Tech I Semester

(With effect from 2017-18)

Course Category	Engineering Science	Credits	1
Course type	Practical	Lecture- Tutorial-Practical	0+0+ 2
Prerequisite	-	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objectives	❖ To understand the basic work shop tools and operations such as carpentry, fitting & sheet metal trades. ❖ To understand the basic work tools of house wiring & house wiring connections etc. ❖ To understand the basic joints and manufacturing processes such as foundry and welding.	
Course Outcomes	After completing the course the student will be	
	CO1	Understand the usage of the general purpose engineering workshop tools
	CO2	Demonstrate the correct usage of a method or procedure for different engineering trades
Course Content	1. **Carpentry**: Lap joint, Mortise and Tenon joint, Bridle joint . 2. **Fitting:** Square, V, half round and dovetail fittings 3. **Tin-Smithy:** Tray, cylinder, hopper, cone 4. **House-wiring:**One lamp controlled by one switch, Two lamps (bulbs) controlled bytwo switches, Stair- case connection, Water pump connected with single phase starter. 5. **Foundry**: single-piece pattern, Two- piece pattern **TRADES FOR DEMONSTRATION:** 1. Machine Tools 2. Welding **3.** Black Smithy	
Text Books	1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd,2009 2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers,2004 3. Engineering Practices Lab Manual, Jeyapoovan, SaravanaPandian, Vikas publishers,2007.	

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR (AUTONOMOUS)

(AFFILIATED TO JNTUA ANANTAPURAMU)

I YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMISTER

MECHANICAL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2017-2018)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks		Duration In Hours	Max. Marks	100
1	17SH1201	Professional English	3	-	-	3	2	40	2	40	0.8*Best of two+0.2*least of two	3	60	100
2	17SH1202	Engineering Physics	3	-	-	3	2	40	2	40		3	60	100
3	17SH1203	Engineering Mathematics-I	3	2	-	4	2	40	2	40		3	60	100
4	17EE1204	Basic Electrical & Electronics Engineering	3	-	-	3	2	40	2	40		3	60	100
5	17ME1201	Engineering Mechanics - II	3	2	-	4	2	40	2	40		3	60	100
		PRACTICALS												
6	17ME12P1	Computer Aided Engineering Drawing	-	-	6	3	2	40	2	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	17CS12P2	Computer Programming Laboratory	-	-	3	2	-	-	-	40		3	60	100
8	17SH12P2	Physics Laboratory	-	-	3	2	-	-	-	40		3	60	100
		TOTAL	15	04	12	24	-	-	-	320		-	480	800

17SH1201- PROFESSIONAL ENGLISH

(Common to all Branches)

I B.Tech II Semester

(With effect from 2017-18)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ Develop their basic professional writing skills in English ❖ Achieve specific linguistic and verbal competence ❖ Acquire relevant skills and function efficiently in a realistic professional working environment ❖ Inculcate the habit of reading &writing	
Course Outcomes	Upon successful completion of the course, the students will able to:	
	CO1	Equip verbal proficiency and face competitive exams; GATE, GRE, TOEFL, GMAT etc.
	CO2	Draft professional writings: email drafting, professional Letters, etc. for social and professional contexts.
	CO3	Write effective book reviews and make effective notes in professional environment
	CO4	Procure considerable knack in using wide range of vocabulary.
	CO5	Write proposals, business letters, project reports, writing proposals.
	CO6	Acquire skills: Prepare Speeches in analytical and critical procedures.

Course Content	**UNIT –I** **Data Interpretation:** Interpretation and analysis of the data based on text, tables, graphs (linear), charts- bar, pie etc. Verbal: Verbal reasoning- Analogies, Homophones & Homonyms **UNIT-II** **Writing:** Email Communication- WritingEffective Business Email Verbal: Idioms and Phrases, One word substitutes **UNIT-III** **Analytical Writing:** Presenting perspective of an issue- Compare & Contrast, Cause and Effect, Analyze an argument Verbal: Affixes-prefix and suffix, root words, derivatives **UNIT-IV** **Technical Writing:**Writing Proposals: Significance; Structure, Style & Writing of Project Reports. Verbal: Synonyms & Antonyms **UNIT-V** **Writing:** Introduction to different kinds of materials: Technical & Non-technical- Note Taking and Note Making- identification of important points and precise the content Verbal: Words often confused **UNIT-VI** **Book Reviews**- Review of a Technical and Non-Technical - a brief written analysis including summary and appreciation Verbal: Sentence Completion . **References:** 1. A Textbook of English for Engineers and Technologists (combined edition, Vol. 1 & 2); Orient Black Swan 2010. 2. Word Power Made Easy by Norman Lewis 3. A Communicative Grammar of English By: Geoffrey Leech

17SH1202-ENGINEERING PHYSICS

(Common for ME and CE)

I B.Tech II Semester

(With effect from 2017-18)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamental Concepts of Physics	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objectives	Students undergoing this course are expected to 1. Explain the structure of crystalline solids and their uses in X-ray diffraction techniques. 2. Basic properties of magnetic materials and the uses in Science & Technology. 3. Explain and provide the knowledge about semiconductors and their use in electronic devices. 4. Describe the basic principles of communication system and their uses in communication filed. 5. Describe the characteristics of lasers and their fibers construction and applications in Science & Technology. 6. Understand the behavior of these nanomaterials, quantum phenomena and the limitations of basic physical laws.	
Course Outcomes	Upon successful completion of the course, the students will able to:	
	CO1	Understand the structure of Crystalline solids and their applications in x-ray diffraction.
	CO2	Understand the concept of magnetization and polarization and applications of magnets and dielectric materials in various disciplines.
	CO3	To know the properties of semiconductor materials by projecting the view of energy bands.
	CO4	Understand the concept of communication system with its applications in the field of Science & Technology.
	CO5	Understand the utilization of laser technology in various disciplines and know the concept of optical fiber and its applications.
	CO6	Basic ideas about superconductors and nano materials with their uses in various fields of Science & Technology

Course Content

UNIT-I

CRYSTALLOGRAPHY: Introduction – Space lattice – Unit cell – Lattice parameters – Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC – planes in crystals – Miller indices – Interplanar spacing in cubic crystals.

X-RAY DIFFRACTION: X-ray diffraction in crystals - Bragg's law of diffraction – X-ray diffraction techniques - Laue method - powder method (Debye-Scherer method).

UNIT-II

DIELECTRIC PROPERTIES: Basic definitions, Electronic, Ionic (Quantitative) and Orientation polarizations (Qualitative) – Internal Fields in Solids, Classius – Mossotti Equation.

MAGNETIC MATERIALS: Introduction and basic definitions – Origin of magnetic moments – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials – Hysteresis – Soft and Hard magnetic materials – Applications of

magnetic materials.

UNIT-III

SEMICONDUCTORS: Intrinsic and extrinsic semiconductors –Electrical Conductivity in Semiconductors – Drift and diffusion currents – Einstein relations – Hall Effect and its applications – Direct and indirect band gap semiconductors.

PHYSICS OF SEMICONDUCTOR DEVICES: Formation of PN Junction, I-V Characteristics of PN Junction Diode, LED, Photo Diode, Solar Cell.

UNIT-IV

Communication System – Principles of Basic Communication System – Digital Communication System – Analog Communication System - Basic Steps for Analog/Digital Conversion – Sampling Theorem.

System-Signal Bandwidth of signal – Signal impairment – Modulation – Different Types - Demodulation Process

UNIT-V

LASERS: Introduction – Characteristics of lasers – Spontaneous and stimulated emission of radiation – Condition for Population inversion – Ruby Laser - He-Ne Laser – Applications of Lasers.

OPTICAL FIBERS: Introduction – Construction and working principle of optical fiber – Acceptance angle –Numerical Aperture – Types of optical fibers – Block diagram of optical fiber communication system – Applications of optical fibers.

UNIT VI

SUPERCONDUCTIVITY: Introduction – effect of magnetic field – Meissener Effect – Type I and Type II superconductors – Flux quantization – BCS theory (Qualitative treatment) –Applications of superconductors.

PHYSICS OF NANO MATERIALS: Introduction – Significance of Nano scale and types of Nano materials – Physical properties: Optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials by Top down and bottom up approaches: ball mill, chemical vapour deposition and sol gel – Applications of nanomaterials.

TEXT BOOKS:

1. Principles of electronics by V.K.Mehtha, Tata Mc Graw Hill.
2. Solid State Physics by S.O.Pillai, New Age Publications (Labs edition).
3. Introduction to Solid State Physics by Charles Kittel, Wiley India Pvt Ltd, 7th Edition.
4. Engineering Physics by R.K.Gaur & S.L.Gupta, Dhanpat Rai Publications.

REFERENCES:

1. Modern Engineering Physics by Dr. K. Vijaya Kumar, Dr. S. Chandralingam, S.CHAND & COMPANY LTD.
2. Applied Physics by P.K. Palanisamy : Scitech Publishers.
3. Engineering Physics by Dr. K.T. Tyagarajan, V.Rajendran, Tata Mc Graw-Hill

17SH1203-ENGINEERING MATHEMATICS - I

(Common to all Branches)

I B.Tech II Semester

(With effect from 2017-18)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre – requisite:	Intermediate Mathematics	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ The basic concepts of Matrices. ❖ Solving Higher Order Differential Equations with RHS of different types by using analytical techniques. ❖ Taylor's and Maclaurin's series, Maxima and Minima of the functions of two and three variables. ❖ The concepts of Double and Tripple integrals, Areas and Volumes. ❖ The Gradient, Divergence and Curl operators, Solenoidal and Irrotational vectors. ❖ The basic concepts of Vector Integration.	
Couse Outcomes	After completing the course the student will be able to	
	CO1	Understand effectively the analyzation of the Rank of the matrix, Consistency of system of linear equations, Eigen values and Eigen vectors.
	CO2	Acquire knowledge in solving higher order differential equations by using various types.
	CO3	Attains skills in analyzing the Taylor's and Maclaurin's series and Maxima and Minima of the functions of two and three variables.
	CO4	Apply Double and Tripple integrals to find Areas and Volumes.
	CO5	Understand effectively Curl, Divergence and Gradient operators, Solenoidal and Irrotational vectors with their applications.
	CO6	Acquire knowledge in analyzing the applications of Green's, Stoke's and Gauss-divergence theorems.
Course Content	**UNIT - I** **MATRICES:**Rank of Matrix - Echelon Form and Normal Form - Consistency of system of linear equations- Eigen values and Eigen vectors. **UNIT – II** **HIGHER ORDER DIFFERENTIAL EQUATIONS:**Homogeneous linear differential equations of second and higher order with constant coefficients with R.H.S. of the type e^{ax}, $\sin ax$ or $\cos ax$, x^n, e^{ax} V and $x^n\, v(x)$.	

	UNIT – III **DIFFERENTIAL CALCULUS:** Taylor's and Maclaurin's series - Maxima and Minima of function of two variables - Lagrangian method of multipliers with three variables only. **UNIT - IV** **MULTIPLE INTEGRALS:**Double and Triple integrals - Change of order of integration - Change to polar coordinates - Area and Volumes by Double integration - Volume by Triple integration. **UNIT - V** **VECTOR DIFFERENTIATION:** Gradient, Divergence, Curl - Solenoidal and Irrotational vectors. **UNIT - VI** **VECTOR INTEGRATION:** Line, Surface and Volume integrals - Green's, Stoke's and Gauss-divergence theorem (without proof), Applications to theorems.
Text Books and Reference Books	**TEXTBOOKS:** 1. Higher Engineering Mathematics-B.S. Grewal, Khanna Publishers, New Delhi. 2. Engineering Mathematics – B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd, New Delhi. **REFERENCE:** 1. Higher Engineering Mathematics - H.K. Dass, Er. Rajnish Verma, S. Chand Publication, New Delhi. 2. Advanced Engineering Mathematics - N.P. Bali & M. Goyal, Lakshmi Publishers, New Delhi. 3. Engineering Mathematics-I& II - Dr.T.K.V. Iyengar, Dr.B. Krishna Gandhi, S. Ranganatham, Dr.M.V.S.S.N. Prasad, S. Chand Publication, New Delhi. **4.** Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India.

17EE1204- ELECTRICAL AND ELECTTRONICS ENGINEERING

(MECHANICAL ENGINEERING)

I B.Tech II Semester

(With effect from 2017-18)

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-1-0
Pre-requisite:	Concept of e.m.f, ohm's law, resistance, resistivity, series and parallel connections, power dissipation in resistance, effect of temperature on resistance Capacitors, energy stored in capacitor, R-C time constant. Faraday's laws of Electromagnetic induction, energy stored in an inductor, time constant in R-L circuit.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Objectives:	Students undergoing this course are expected to understand: ❖Learn the basic concepts of circuit analysis. ❖Learn Single Phase A.C Circuits ❖Learn the Resonance concept ❖Overview of the principles, operation and application of the analog building blocks like diodes, BJT,etc for performing various functions. ❖Elementary treatment and qualitative analysis and makes use of simple models and equation to illustrate the concepts involved.	
Course Outcomes:	CO1	Understand the basic concepts of D.C circuits
	CO2	Understand the Fundamental concepts of single phase A.C circuits.
	CO3	Understand the basic concepts of Resonance and perform Steady state analysis of A.C circuits.
	CO4	Understand the basic properties of semi-conductor materials.
	CO5	Understand the basic concepts of Rectifiers and Filters
	CO6	Understand the characteristics of semi-conductor devices.
Course Content:	**Unit-I:** **FUNDAMENTALS OF DC CIRCUITS:** Introduction to DC circuits, Active and passive elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis,Star -Delta transformation **Unit-II:** **FUNDAMENTALS OF AC CIRCUITS:** 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-III:** **Resonance:** Series and parallel resonance, Half power frequencies, Bandwidth and Quality factor, Relation between half power frequencies **Unit-IV:** **Junction Diode:** Band Structure of P-N junction diode, Current Components,	

	Volt-Ampere Characteristics and its temperature dependence, Diode resistance and capacitance, Zener diode and tunnel diode **Unit-V:** **Rectifiers:** Diode equivalent circuit, Half-Wave, Full-Wave and Bridge rectifiers,Analysis of filters with full-wave rectifier. **Unit-VI:** **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 & Reference Books:	**Text Books:** 1. "Circuit Theory Analysis & Synthesis" by Abhijit Chakrabarti,2010 2. William H. Hayt & Jack E. Kemmerly Engineering Circuit Analysis McGraw-Hill Book Company Inc.Seventh edition,2006 3. Thomas L. Floyd - "Electronic devices ", Pearson new international Ninth edition, 2012. **Reference Books:** 1.Network Analysis: Vanvalkenberg Third edition, PHI,2014 2. Millman and Halkias, "Integrated Electronics" MC Graw Hill & Co.Second edition,2009. 3.David.A.Bell. "Electronic Devices and circuits", PHI,Fifth edition,2007.
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

17ME1201-ENGINEERING MECHANICS – II
(DYNAMICS)

I B.Tech II Semester

(With effect from 2017-18)

(Only for ME)

Course Category	Programme core	Credits	4
Course type	Theory	Lecture- Tutorial-Practical	3-2-0
Prerequisite	Engineering Mechanics static analysis	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objectives	Students are made to understand / learn ❖ The concept of rigid body kinematics under conditions such as uniform velocity, uniform acceleration. ❖ The concept of rigid body kinematics pertaining to circular motion. ❖ The effect of forces in producing motion of rigid bodies, applying Newton's laws of motion. ❖ The meaning of Impulse and momentum, the implications of conservation of momentum principle. (a) The concept of Work – change in energy equivalence instead of directly applying the Newton's second law. (b) The basic idea of simple harmonic motion. (c) The idea of using the principle of virtual work which is very effective to solve equilibrium problems. ❖ The meaning of stress & strain, and their relationships.	
Course Outcomes	At the end of the course, the student will be able to	
	CO1	Recall definitions and technical terms of engineering mechanics.
	CO2	Understand the procedures, principles, and theories in different motions of kinematics and kinetics.
	CO3	Solve problems using principles, and theories in different motions of kinematics and kinetics.
	CO4	Demonstrate the usage impulse momentum principles
	CO5	Demonstrate work energy principle, simple harmonic motions and virtual work.
	CO6	Understand the stress, strain and thier relations
Course Content	**UNIT – I** **KINEMATICS OF LINEAR MOTION**: Equations of motions for linear movement with uniform velocity, uniform acceleration, variable acceleration, under gravity and inclined planes. Motion Curves – graphical representation. Relative motion. **UNIT – II** **KINEMATICS OF CIRCULAR MOTION, ROTATION AND TRANSLATION:** Equations of motion along a circular path, Types of rigid body motion – Velocity and acceleration for combined motion of translation and rotation, Instantaneous centre. **PROJECTILES:** Equation of path of a projectile-Motion of a body projected horizontally – Projection on inclined plane. **UNIT – III** **KINETICS OF RIGID BODIES:** Movement of bodies on smooth and rough	

	planes, analysis of lift motion, analysis of two bodies connected by string over pulley, one body resting on horizontal/inclined planes with and without friction. D'Alembert's Principle - application to linear and rotary motion. **UNIT – IV** **IMPULSE MOMENTUM:** Principle of Impulse and momentum, Linear Impulse and Linear Momentum, Angular Impulse and Angular Momentum **IMPACT OF ELASTIC BODIES:** Types of impact**-** line of impact, central and non central impact, direct central impact, oblique central impact, Coefficient of restitution- Problems on Direct central impact. **UNIT – V** **WORK ENERGY PRINCIPLE:** Work energy equation, work done by varying force, work energy equation for translation, motion of connected bodies. **SIMPLE HARMONIC MOTION:** Definitions of terms – Amplitude, time period and frequency; Equation of simple harmonic motion. **VIRTUAL WORK:** Principle of virtual work and its application to beam and ladder problems. **UNIT – VI** **SIMPLE STRESS AND STRAIN**: Types of stress and strain, Hooke's law, stress and strain curve, Factor of safety, stepped bars, compound bars, thermal stresses, elastic constants and their relations.
Text Books	4. A text book of Engineering Mechanics – Bhavikatti, S.S, "Engineering Mechanics", New Age International (P) Limited Publishers,2014. 5. A text book of Engineering Mechanics – D. R.K. Bansal, Laxmi publications (P) Limited,2016. 6. Engineering Mechanics – K. L. Kumar, Tata Mc Graw Hill, New Delhi,2010.
Reference Books	4. Engineering Mechanics: Statics and Dynamics – N.H Dubey, Tata Mc Graw Hill, New Delhi,2016. 5. Engineering Mechanics – S. Timoshenko, D.H. Young – Mc Graw Hill International Edition,2013. 6. Engineering Mechanics – Statics and Dynamics – Irving H Shames, G Krishna Mohana Rao – Pearson Education,2006.

17ME12P1-COMPUTER AIDED ENGINEERING DRAWING LABORATORY

(Common to ME and Civil)

I B.Tech II Semester

(With effect from 2017-18)

Course Category	Engineering Science	Credits	3
Course type	Practical	Lecture- Tutorial-Practical	0-0-6
Prerequisite	Geometrical Construction	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course	Marks	Examination and Evaluation		Scheme of examination
Computer Aided Engineering Drawing	60	Semester end Examination for 3 hours duration in the CAD Laboratory		60 marks are allotted for the drawing examination during semester end.
	40	20	Day-to-Day evaluation during the practice.	Marks are evaluated based on average performance of student in day-to-day exercises and finalized for 20 marks
		20	Drawing examination	Two drawing examinations are conducted for 20 marks. 80% of better one and 20% of the other are added and finalized for 20 marks. Drawing examination-I: Shall be conducted just before I mid-term examinations. Drawing examination-II: Shall be conducted just before II mid-term examinations.
Course Objectives	Students are made to understand / learn ❖ To enable the students with various concepts like dimensioning, construction of conic sections, polygons, cycloids and involutes. ❖ To impart and inculcate proper understanding of AutoCAD fundamentals. ❖ To apply the knowledge of AutoCAD for the projections of points, lines and solids. ❖ To know about sections and developments of solids. ❖ To improve the visualization skills with isometric projections.			
Course Outcomes	At the end of the course, the student will be able to			
	CO1	Understand the conventions and methods of engineering drawings		
	CO2	Sketch the solutions to the problems on projection of points, lines, planes and solids		
	CO3	Demonstrate orthographic and Isometric principles		
	CO4	Understand and apply the knowledge of engineering drawing in modern CAD tools.		
	UNIT – I: GEOMETRICAL CONSTRUCTIONS, CONICS AND SPECIAL CURVES. Importance of Drawing, Drawing Instruments, Sheet layout, BIS Conventions, Types of lines, Lettering, and dimensioning methods.			

Course Content	**Geometrical Constructions:** Regular Polygons. **Conic Sections:** Introduction, Construction of Ellipse, Parabola and Hyperbola using Eccentricity method and Rectangular/ Oblong methods, Rectangular hyperbola. **Special Curves:** Introduction, Construction of Cycloids and Involute curves. **UNIT – II: INTRODUCTION TO CAD SOFTWARE.** **Introduction:** Importance ofComputer Aided Drawing, software tool environment, drawing size and scale, main menu, tool bar and menus, co-ordinate system, drafting settings. **Creation and Editing:** Points, Lines, Poly lines, Polygons, Splines, circle, ellipse, text, move, copy, off-set, pan, mirror, rotate, trim, extend, break, chamfer, fillet, curves, block, layers, line representations, dimensioning and hatching. **UNIT – III: PROJECTIONS OF POINTS AND LINES.** **Projections of Points:** Principles of projections, Planes of projection, Points in four quadrants. **Projections of Lines:** Line inclined to both the principal planes (first angle projection only). **UNIT – IV: PROJECTIONS OF PLANES AND SOLIDS.** **Projections of Planes:** Plane (triangle, square, rectangle, pentagon, hexagon and circular) inclined to both the principal planes. **Projections of Solids:** Solids such as Prisms, Pyramids, Cylinders and Cones. **UNIT – V: SECTIONS OF SOLIDS, DEVELOPMENT OF SURFACES.** **Sections of Solids:** Solids such as Prisms, Pyramids, Cylinders and Cones resting on their bases on HP. **Development of Surfaces:** Lateral surfaces of solids such as Prisms, Pyramids, Cylinders and Cones (cut by a plane inclined to HP). **UNIT – VI: ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS.** **Orthographic Projections:** Conversion of Pictorial views into Orthographic Views. **Isometric Projections of simple objects**.
TEXT BOOKS	1. Engineering Drawing, N.D. Bhat / Charotar Publishing House,. Gujarat, 53rd edition, 2014. 2. AutoCAD 2 0 13 For Engineers and Designers, Sham Tickoo, Dream tech Press, 2013.
REFERENCE BOOKS	1. Engineering Drawing And Graphics + Autocad, Venugopal K, New Age International Pvt. Ltd.New Delhi, 2007. 2. Engineering Graphics with Auto CAD, D.M. Kulkarni, A.P. Rastogi and A.K. Sarkar, PHI Learning Private Limited, Revised Edition, August 2010. 3. Engineering Drawing and Graphics Using Autocad, T Jeyapoovan, Vikas Publishing House, 3rd Edition, 2010. 4. A Textbook on Engineering Drawing, P. Kannaiah, K. L. Narayana, K. Venkata Reddy, Radiant Publishing House, 2012.

17CS12P2 - FUNDAMENTALS OF C PROGRAMMING LABORATORY(Common to ME and CE)

I B.Tech II Semester

(With effect from 2017-18)

Course Category:	Engineering science	**Credits:**	2
Course Type:	Practical	**Lecture – Tutorial – Practical:**	0-0-3
Prerequisite:	Knowledge about computer fundamentals and basics of mathematics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Learning the fundamental blocks of C language to develop simple laboratory programs
Course Content	Students are made to understand / learn ❖ Write a C program to evaluate expressions. ❖ Write a C program to implement simple if and if-else constructs. ❖ Write a C program to implement nested if and else- if ladder constructs. ❖ Write a C program to implement break, continue and goto statements. ❖ Write a C program to implement a simple application using switch statement. ❖ Write a C program to implement a menu driven concept using switch statement. ❖ Write a C program to implement a few examples using while loop. ❖ Write a C program to implement a few examples using do-while loop. ❖ Write a C program to implement a few examples using for loop. ❖ Write a C program to implement factorial of a given number using loops. ❖ Write a C program to implement a few examples using one dimensional arrays. ❖ Write a C program to implement a few examples using two dimensional arrays.	
Text Books and References:	**Text Book(s):** 3. Programming with ANSI & TURBO C by Ashok N.Kamthane, Pearson Education 2007 4. Programming in ANSI C by Balagurusamy 6th Edition,Tata McGraw Hill Education, 2012. **Reference Books:** 1. Alex Leon and Mathews Leon "Fundamentals of Information Technology", Vikas Publishers, 2nd Edition 1999. 2. David Cyganski & John A.Orr "Information Technology-Inside and Outside", Pearson Education, 2002. 3. Marilyn Wolf "Computers as Components", MK publications, 3rd Edition, 2014. 4. Let Us C byYashavant Kanetkar, BPB Publications.	
E-Resources	**3. https://nptel.ac.in/courses** **4. https://freevideolectures.com/university/iitm**	

17SH12P2-ENGINEERING PHYSICS LABORATORY

(Common to ME and CE)

I B.Tech II Semester

(With effect from 2017-18)

Course Category:	Basic Science	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Engineering Physics	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objectives	Students are made to understand / learn ❖ The main objective is to provide students to learn about some important experimental techniques in physics with knowledge in theoretical aspects so that they can excel in that particular field.	
Course Outcomes	CO1	❖ These experiments in the laboratory are helpful in understanding important concepts of physics through involvement in the experiments by applying theoretical knowledge.
	CO2	❖ It helps to recognize where the ideas of the students agree with those accepted by physics and where they do not.
Course Content	Minimum of 8 experiments to be completed out of the following : **LIST OF EXPERIEMENTS** 1. Determination of Rigidity modulus of a material – Torsional pendulum 2. Melde's Experiment – Transverse and Longitudinal modes 3. Time constant of RC circuit 4. Resonance in LCR circuit 5. Magnetic field along the axis of a coil (Stewart-Gees Method) 6. Study of characteristics of LED and LASER Sources 7. Evaluation of Numerical Aperture of a given fiber 8. Energy Gap of a material of p-n junction 9. Diode Characteristics 10. Transistor Characteristics 11. Characteristics of Solar cell 12. Logic Gates 13. Hall Effect	

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.

INSTITUTE 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 share human and academic resources with industries, schools and public agencies through partnerships and outreach activities.

VISION OF THE DEPARTMENT

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 OF THE DEPARTMENT

M1: 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.

M2: 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.

M3: To develop the interaction with the Industry experts to gain practical knowledge.

M4: To provide best teaching & learning practices as well as creating opportunities for Research, maximise student results and placements.

M5: To inculcate and promote lifelong learning skills, problem solving skills, leadership qualities and team work.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)	
PEO 1:	A strong foundation to access, analyze, plan and implement their knowledge in basic sciences & mathematics, core and interdisciplinary courses.
PEO 2:	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.
PEO 3:	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
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Specific
	PROGRAMME SPECIFIC OUTCOMES
PSO1	Solve engineering problems in the area of Robotics and Automation.
PSO2	Design, Simulate and Analyze using CAD/CAM/CAE tools.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA ANANTAPURAMU)
SPSR NELLORE 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 2017-2018)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks		Duration In Hours	Max. Marks	100
1	17SH2101	Engineering Mathematics-II	2	2	-	3	2	40	2	40	0.8*Best of two+0.2*least of two	3	60	100
2	17ME2101	Fluid Mechanics	2	2	-	3	2	40	2	40		3	60	100
3	17ME2102	Strength of Materials	2	2	-	3	2	40	2	40		3	60	100
4	17ME2103	Basic Manufacturing Processes	3	-	-	3	2	40	2	40		3	60	100
5	17ME2104	Basic Thermodynamics	2	2	-	3	2	40	2	40		3	60	100
6	17EE2104	Electrical Machines & Control Engineering	3	-	-	3	2	40	2	40		3	60	100
		PRACTICALS												
7	17ME21P1	Computer Aided Machine Drawing Laboratory	-	-	3	2	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	17ME21P2	Fuels & Lubricants Laboratory	-	-	3	2	-	-	-	40		3	60	100
9	17ME21P3	Production Engineering Laboratory	-	-	3	2	-	-	-	40		3	60	100
		TOTAL	17	08	09	24	-	-	-	360		-	540	900
		MANDATORY COURSE -1												
1	17MC2102	Technical English and soft skills	3	-	-	3	2	40	2	40	**0.8*Best of two+0.2*least of two**	3	60	100

17SH2101- ENGINEERING MATHEMATICS-II
(Common to all Branches)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre-requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ The concepts of First shifting theorem, Change of scale property, Laplace transformation of multiplied by t and division by t and transformation of derivatives and integrals. ❖ The application of Solutions of Ordinary Differential Equations. ❖ The determination of Fourier coefficients, Fourier series, Even and Odd Functions and Change of intervals. ❖ The concepts of Fourier Transforms. ❖ The Properties of Z- Transforms, Shifting properties, initial value and final value theorems. ❖ The applications of difference equations and To develop the basic mathematical knowledge and computational skills of the students in the areas of applied mathematics.

Course Outcomes	On successful completion of this course students will be able to:	
	CO1	Acquire basic knowledge in Laplace transforms and their applications.
	CO2	Develop analytical skills in solving the Ordinary Differential Equations by using the Laplace transform technique.
	CO3	Develop analytical skills in solving the problems involving Fourier Series.
	CO4	Understand effectively Fourier Sine and Cosine integral,Fourier Transforms, Fourier Sine and Cosine transforms.
	CO5	Attains skills in analyzing the Z-Transforms and their applications.
	CO6	Understand effectively Inverse Z- Transforms and Applications to difference equations.

Course Content	**UNIT – I** Laplace Transformation: Laplace Transformations of standard functions - First shifting theorem - Change of scale property - Laplace transformation of multiple by t and division by t - Transformation of derivatives and integrals. **UNIT – II** Inverse Laplace Transformation: Inverse transforms - Method of partial fractions - Shifting property - Inverse Laplace transform of a multiple by s and division by s - Inverse Laplace transform of derivatives and integrals - Convolution theorem - Application to Solutions of Ordinary Differential Equations. **UNIT-III** Fourier Series: Determination of Fourier coefficients - Fourier series - Even and Odd functions - Change of intervals (0,2l). **UNIT-IV** Fourier Transforms:Fourier Integral Theorem (Without proof)-Fourier Sine and Cosine integrals - Fourier integral in complex form - Fourier Transforms - Fourier Sine and Cosine transforms. **UNIT-V** Z-Transforms:Z-Transform of some standard functions - Properties of Z-Transforms - Shifting Properties - Initial value theorem and final value theorem. **UNIT-VI** Inverse Z- Transform and Difference Equations:Inverse Z-Transform - Convolution theorem-Inversion by partial fractions - Applications to difference equations. **TEXT BOOKS:** 1. Higher Engineering Mathematics - B.S.Grewal, Kanna Publishers, New Delhi. 2. Engineering Mathematics - B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd, New Delhi. **REFERENCES:** 1. Higher Engineering Mathematics - H.K. Dass, Er. Rajnish Verma, S.Chand Publication, New Delhi. 2. Advanced Engineering Mathematics - N.P. Bali & M. Goyal, Lakshmi Publishers, New Delhi. 3. Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India

17ME2101-FLUID MECHANICS

Course Category:	Programme Core	**Credits**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre-requisite:	Engineering physics and Engineering Mathematics.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ Provide basic knowledge in fluid properties and statics. ❖ Provide understanding on the fundamental laws related to the static and dynamic behavior of fluid and also to develop the equations for pressure flow and momentum analysis. ❖ Make the students to explain pressure, discharge measurement devices. ❖ Analyze and evaluate the fluid flows of laminar and turbulent.	
Course Outcomes	On successful completion of this course students will be able to:	
	CO1	Understand the definition, principles and laws related to fluid mechanics.
	CO2	Solve problems to find fluid properties and static parameters.
	CO3	Understand information related to kinematics and dynamics aspects in fluid flow.
	CO4	Understand working of pressure and discharge measurement devices.
	CO5	Classify the flow of fluid under different flow conditions.
	CO6	Use suitable methods to handle problems related to laminar and turbulent flow conditions.

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, Vapour pressure and Capillary. **UNIT – II** **Fluid statics:** 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. **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 Measurement**: Piezometer, manometer-differential manometers, micro manometers, velocity measurements- Pitot tube. **UNIT –V** **Discharge Measurement**: Orifice and mouthpiece, Venturi meter, Orifice meter and Nozzle meter. Notches and weirs. **UNIT –VI** **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. **Introduction to Boundary Layer Theory.** **TEXT BOOKS:** 1. Fluid Mechanics with Engg. Applications :Daugherty R.L and J.B. Franzini, TMH, 10th ed. 2. Fluid Mechanics and Fluid Machinery :Rajput R.K.;S.Chand Publications 3. Fluid Mechanics and Fluid Machinery :Bhansal R.K.;Laxmi Publications, 9th ed. **REFERENCES:** 1. Hydraulics and Fluid Mechanics:Modi and Sethi,Standard Book House, 2002 2. Theory and applications of Fluid Mechanics :Subramanyam K.,Tata McGraw-Hill

17ME2102-STRENGTH OF MATERIALS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre – requisite:	Engineering Mechanics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ Provide the basic concepts and principles of strength of materials. ❖ Calculate stresses and deformations of objects under external loadings. ❖ knowledge of strength of materials on engineering applications and design problems. ❖ Describe and derive the expressions for deflections in beams under various conditions and expression for torsion used for basic design of shafts. ❖ Describe and demonstrate thoroughly the concepts of principal stresses applied to solid structural numbers and drawing Mohr's circle diagram and study of theories of failures and deflections of fixed beams. Analyze slender, long columns subjected to axial loads and having knowledge on basic design concepts for spherical shells.

Course Outcomes	After completing the course the student will be able to	
	CO1	Understand the concepts and principles of strength of materials.
	CO2	Illustrate the concept of shear force and bending moment diagrams.
	CO3	Solve the problems on bending stress distribution for various cross sections of the beam.
	CO4	Demonstrate the problems on deflection of beams for different types of beams.
	CO5	Solve the problems on torsional stress distribution in circular shafts, longitudinal and circumferential stresses on cylinders.
	CO6	Use concept of principal stresses and methods of theories of failure to solve problems of different states of stress.

Course Content	**UNIT-I** **Shear Force and Bending Moments :** Beam - Types of loads, types of support, shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – point of contra flexure – Relation between S.F., B.M. and rate of loading at the section of the beam. **UNIT-II** **Theory of Simple Bending:** Assumptions – Derivation of bending equation – Determination of bending stresses and section modulus of rectangular, circular, triangular, I, and T-sections. **Shear Stresses**: Shear stress distribution across various cross section of the beam like rectangular, circular, triangular, I and T-sections. **UNIT -III** **Deflection of Beams**: Relation between curvature slope and deflection, Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, uniformly varying load– Double integration, Macaulay's methods. **UNIT- IV** **Torsion of Circular Shafts:** Theory of pure torsion – Assumptions, Derivation of torsion equations, polar section modulus, Torsion rigidity, Analysis of torsional stresses, power transmitted. **Thin Cylinders:** Thin seamless cylindrical shells, longitudinal and circumferential stresses - hoop, longitudinal and volumetric strains – change in diameter and volume of thin cylinders, Thin spherical shells. **Introduction to Thick cylinders.** **UNIT -V** **Columns and Struts:** Introduction, Euler's theory of long columns for different cases - Effective length of a column – Assumptions – limitation of Euler's formula, Rankine's formula. **UNIT -VI** **Principal Stresses:** Stresses on an inclined plane under different uniaxial, biaxial conditions, principal planes and principal stresses – Mohr's circle method. **Theories of Failure**: Various theories of failure – Maximum Principal Stress Theory, Maximum Principal Strain Theory, Maximum Shear Stress Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).
Text Books and	1. Strength of Materials by R.K.Bansal, Lakshmi Publications House Pvt. Ltd. 2. Strength of Materials by S.Ramamrutham, Dhanpat Rai Publishing Company Pvt. Ltd.
Reference Books	1. Strength of Materials by S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd. 2. Mechanics of Structures Vol –I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd. 3. Strength of Materials by S.S.Rattan, Tata McGraw Hill Education Pvt. Ltd. 4. Mechanics of Materials by Pytel, Cengage Learning Pvt. Ltd. 5. Strength of Materials by R.K Rajput, S.Chand & Company Ltd. 6. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd. 7. Fundamentals of Solid Mechancis by M.L.Gambhir, PHI Learning Pvt. Ltd 8. Strength of Materials and Structures by John Case et al., Butterworth-Heinemann.

17ME2103-BASIC MANUFACTURING PROCESSES

<table>
<tr><td>Course Category:</td><td>Programme Core</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td>Theory</td><td>Lecture – Tutorial – Practical:</td><td>3-0-0</td></tr>
<tr><td>Prerequisite:</td><td>Basics in Engineering physics and Engineering Workshop practice</td><td>Sessional Evaluation:
External Exam Evaluation:
Total Marks:
External Exam:</td><td>40
60
100
3 hrs</td></tr>
<tr><td>Objectives</td><td colspan="3">Students undergoing this course are expected to understand:

❖ Examine the principles associated with basic operations of casting and interpret its advantages as well as limitations.
❖ Variety of welding processes including their typical use in our daily life.
❖ Common mechanical working of metals to aid in appropriate process section for the material.
❖ Various sheet metal operations as well as other cold working processes.
❖ The characteristics of various extrusion and forging processes along with their defects.</td></tr>
<tr><td rowspan="5">Course Outcomes</td><td colspan="3">Upon the successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="2">Understand the concept of casting techniques, methodology, procedures and theories in the field of casting.</td></tr>
<tr><td>CO2</td><td colspan="2">Demonstrate sand properties and design principles of gating system.</td></tr>
<tr><td>CO3</td><td colspan="2">Summarize the concept of welding techniques, methodology, procedures and theories in the field of welding.</td></tr>
<tr><td>CO4</td><td colspan="2">Understand methodology, procedures and theories in the field of metal working processes.</td></tr>
<tr><td>Course Content</td><td colspan="3"><u>UNIT – I</u>
CASTING: Introduction-Steps involved in making a casting; Pattern– Types of patterns, Materials and their allowances; Core and Core prints.
Moulding sands-ingredients, types, properties, and its testing.
Moulding Processes: Green sand moulding, dry sand moulding, CO_2 moulding, Shell moulding.
Special Casting Processes: Centrifugal, Die and Investment casting.
<u>UNIT – II</u>
Gating: Elements, types of gates, Design of Gating systems-pouring time, choke area, gating ratio.
Risers: Types, functions and its location, direction of solidification, Design-size and shape. Chills and chaplets.Casting defects.
Melting Furnaces: Crucible melting and cupola operation.
<u>UNIT – III</u>
Welding: Classification of welding processes, types of welds and welded joints, Heat affected zones in welding, Oxy-acetylene gas welding – principle, types of flames, welding techniques, Acetylene Gas cutting; ARC welding –principle of arc generation, power source – DCSP, DCRP, AC. Electrodes - types, functions, coatings,</td></tr>
</table>

	Manual Metal Arc welding, Submerged arc welding, Plasma arc welding, Plasma arc cutting; Resistance welding – Principle, types. **UNIT – IV** **Advanced welding Processes:** Inert Gas welding –TIG, MIG, atomic hydrogen welding; EBW, LBW, USW, Explosive welding, Forge welding, Friction welding, Induction welding, Thermit welding. Welding defects – causes and remedies. **UNIT – V** **Mechanical Working of Metals:** Hot working, Cold working, Warm working, Strain hardening. Recovery, Recrystallisation and grain growth. **Sheet Metal Working Processes:** Shearing action, Cutting process - blanking, piercing; Forming process - Bending, forming, Drawing – shallow and deep; embossing and coining, cold spinning. Explosive forming and Electro-Magnetic pulse forming. **UNIT – VI** **Rolling:** Principle, Types of Rolling mills, Forces in rolling. **Extrusion of Metals:** Hot extrusion and cold extrusion, Forward extrusion, Backward extrusion, Impact extrusion, Hydrostatic extrusion. **Wire drawing and tube drawing** **Forging Processes:** Basic forging operations, forging processes - open die and closed die forging, Types of Forging - Drop Forging, press forging, forging defects.
Text Books and References	**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 : 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., KhannaPublishers, 1997. 4. Manufacturing Technology : R.K. Rajput,1st ed.,Laxmi Publications, 2007.

17ME2104-BASIC THERMODYNAMICS (SI UNITS)

Course Category	Programme core	Credits	3
Course type	Theory	Lecture- Tutorial-Practical	2-2-0
Prerequisite	Engineering physics, chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ A comprehensive and rigorous treatment of classical thermodynamics while retaining an engineering perspective. ❖ The groundwork for subsequent studies in such fields as fluid mechanics, heat transfer and to prepare the students to effectively use thermodynamics in the practice of engineering. ❖ An intuitive understanding of thermodynamics by emphasizing the physics and physical arguments. ❖ A wealth of real world engineering examples to give students a feel for how thermodynamics is applied in engineering practice.	
Course Outcomes	At the end of the course, the student will be able to:	
	CO1	Understand the basic principles, laws, gas power cycles and applications of thermodynamics.
	CO2	Demonstrate non flow processes.
	CO3	Solve problems related to first and second law of thermodynamics.
	CO4	Determine entropy changes in various thermodynamic processes.
	CO5	Calculate efficiencies for various thermodynamic cycles.
Course Content	**UNIT – I** **Basic Concepts and Scope of Thermodynamics**: Basic concepts of Thermodynamics, Macroscopic and Microscopic properties, Thermodynamic system, Control Volume, Thermodynamic Properties, Process and Cycle, Thermodynamic Equilibrium, Quasi-static process, Zeroth Law of Thermodynamics, measurement of temperature - Gas Thermometers, Thermocouple, Work transfer, pdv work, Network done by a system, Specific heats and latent heat. **UNIT – II** **First Law of Thermodynamics:** Energy, Different forms of stored energy, closed systems and steady flow systems – First Law, First law applied to steady flow engineering devices – Mass balance and energy balance in steady flow process – Perpetual motion machine of first kind. **UNIT – III** **Gas Laws:** Boyle's Law, Charles Law, Characteristic equation of gas, Avagadro's Law, Joule's Law, Non- flow Processes: Constant volume, Constant Pressure, Isothermal, Hyperbolic, Adiabatic, Free expansion and Polytropic process. Real gases, Dalton's Law of Pressures, Avogadro's Law,	

	Gibb's Dalton's Law of mixture of gases. **UNIT – IV** **Second Law of Thermodynamics:** Limitations of first law, Heat engines and Heat reservoirs, Kelvin Planck statement of second law, Claussius inequality,Claussius theorem, Refrigeration and heat pump, reversibility and irreversibility, Carnot cycle, Reversible heat engine, Carnot Theorem, Corollaries, Efficiency of reversed heat engine. **UNIT – V** **Entropy and Availability:** Property of entropy, Temperature entropy plot, Principle of increase of entropy, Entropy changes in various thermodynamic processes. **Availability:** Availability energy referred to a cycle, Helmholtz function and Gibb's functions, T-ds equations, energy equation, Joules Kelvin effect. **UNIT – VI** **Gas Power Cycles:** Carnot cycle, Air standard cycles , Otto cycle, Diesel cycle, Mixed cycle or dual cycle, Comparison of cycles, Atkinson cycle and Brayton cycle.
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 4. Thermodynamics : An engineering approach, Yunus A. Cengel Michael A. Boles,(2005), Tata McGraw-Hill, 2013
REFERENCE BOOKS	1. Applied Thermodynamics : Thomas Deas Eastop, Allan Mc Conkey. Longmans, 2002 2. Thermal Engineering : Kurmi R.S , Gupta J.K, S.Chand & Co, 2010 3. Thermal Engineering : Domakundwar, Kodandaraman, Dhanapat Rai & Co, 2010

17EE2104-ELECTRICAL MACHINES & CONTROL ENGINEERING

Course Category	Engineering Science	Credits	3
Course type	Theory	Lecture- Tutorial-Practical	3-0-0
Prerequisite	The knowledge of principal of Electro Mechanical Energy Conversion , Fundamental concepts of magnetically coupled electric circuits, Logic circuit design, Basic knowledge of differentiation, integration, Laplace and inverse Laplace transformation techniques required.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives

Students undergoing this course are expected to understand:

- Clearly understand the basic concepts of the Electrical Machines working in the modern Power System.
- The characteristics, operation and underlying theories of DC Machines.
- The characteristics, operation and underlying theories of Transformers.
- The history and need of different types of microprocessor.
- Practical knowledge about linear systems and their control techniques for open loop and closed loop systems.
- The concepts of PLC and SCADA.

Course Outcomes

At the end of the course, the student will be Able to:

CO1	understand the constructional details and principle of operation of DC machines
CO2	understand starting and speed control methods of DC Motors
CO3	Understand the construction, principle of operation and analyze the performance of Single phase transformers.
CO4	Understand the evaluation of different types of microprocessors.
CO5	Gain knowledge of Feedback control and controller design.
CO6	Understand the PLC and SCADA

Course Content

UNIT-I

DC Generators: Constructional details-Principle of Operation-Types of Excitation,Generated EMF, Characteristics of various types of generators and applications.

UNIT-II

DC Motors: Torque developed in a motor, Characteristics of different types of motor and applications, Motor starters, losses and efficiency calculations.

UNIT-III

Transformers: Single phase transformers-Principle of operations-Construction, EMF equation, regulation, losses and efficiency, OC and SC test.

UNIT-IV

INTRODUCTION TO MICROPROCESSORS: Advantages and disadvantages of microprocessor , Architecture of 8085 microprocessor, pin configuration, Instruction set, Addressing modes.

	UNIT-V **Introduction to control systems:** Open loop and closed loop control systems, Transfer function ,Electrical analogy of mechanical systems, Introduction to proportional, derivative and integral controllers. **UNIT-VI** **Programmable Logic Controller And SCADA:** CPU,memory,I/O modules, power supplies, programming device and system buses and remote I/Os, counter, timer -Different PLC's available in market -Selection of a PLC, SCADA-Concept and Applications
Text Books	**Text Books:** **Reference Books:** 1."Theory and performance of Electrical machines" by J.B Gupta, SK Kataria publishers. 2."Electrical Machines" by Ashfaq Hussain ,Dhanpatrai& co. 3. "Electrical Machinery" by Dr. P.S Bimbhra, khanna publishers. 4."Control system Engineering" by I.J.Nagrath and M.Gopal, Wiley Eastern Ltd. 5."Control Systems" by A. Nagoor kani RBA publishers 6."Control Systems" by A. Anand kumar PHI publishers 7.Douglas V. Hall, " Microprocessors and interfacing: Programming and hard ware", TMH, 2nd edition. **Reference Books:** 1. "Performance of DC Machines" by M.G.Say, Second edition,CBS publishers 2."Electrical machines" byI.J.Nagarath and D.P.Kothari second edition, Tata McGraw-Hill. 3 "Control system Engineering" by NISE, Wiley, 2000. 4.A.K. Ray and K.M. Bhurchandi, " Advanced Microprocessors and Peripherals", TMH
Reference Books	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

17MC2102- TECHNICAL ENGLISH AND SOFT SKILLS

(Common to ME and Civil Branches)

Course Category:	Basic Sciences – Mandatory Course	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-2
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ Their basic technical writing skills in English. ❖ Specific technical verbal competence. ❖ Acquire soft skills and work efficiently in a realistic professional working environment. ❖ Develop soft skills including problem solving skills, working in groups and leadership skills.	
Course Outcomes	Upon successful completion of the course, the students will able to:	
	CO1	Present technical papers and equip technical verbal proficiency.
	CO2	Develop group discussion skills and summarizing skills.
	CO3	Write effective resumes and job applications.
	CO4	Develop soft skills and effective non-verbal communication skills.
	CO5	Develop motivational skills and problem solving skills.
	CO6	Develop professionals with idealistic, practical and moral values.
Course Content	**UNIT –I** **Introduction to Technical English :**Writing simple descriptions and explanations on scientific/technical nature - Technical presentations - Communicating technical topics- Jargon **UNIT-II** **Group Discussion:** Dynamics of Group Discussion – Intervention- Summarizing-Modulation ofvoice - Body Language – Relevance - Fluency and Coherence. **UNIT-III** **Resumes and Job Applications:** Writing resumes – Resume design – Parts of a resume – Resume styles – Cover letter	

	UNIT-IV **Introduction to Soft Skills & Hard Skills**: Non Verbal communication- Haptics – Proxemics - kinesics - Chronemics – Oculesics -Vocalics **UNIT-V** **Personality Development Skills**: Assertiveness - Positive Attitude - Self Confidence- Problem Solving Skills- Leadership Skills **UNIT-VI** **Etiquette & Manners**: Corporate etiquette-Dinning etiquette - Goal Setting- Career Planning -Time Management
REFERENCES:	1.A Textbook of English for Engineers and Technologists (combined edition, Vol. 1 &; Orient Black Swan 2010. 2. Effective Technical Communication, M. Ashraf Rizvi, Tata Mc Graw- Hill, 2011 3.Soft Skills, Dr K. Alex, S. Chand Publications, New Delhi

17ME21P1-COMPUTER AIDED MACHINE DRAWING LABORATORY

<table>
<tr><td>Course Category:</td><td>Programme Core</td><td>Credits:</td><td>2</td></tr>
<tr><td>Course Type:</td><td>Practical</td><td>Lecture-Tutorial-Practical:</td><td>0-0-3</td></tr>
<tr><td>Pre-requisite:</td><td>Computer Aided Engineering Drawing</td><td>Sessional Evaluation:
External Exam Evaluation:
Total Marks:
External Exam:</td><td>40
60
100
3 hrs</td></tr>
<tr><td>Course Objectives</td><td colspan="3">Students undergoing this course are expected to understand:
❖ Make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using standard CAD packages.
❖ Familiarize the students with Indian Standards on drawing practices and standard components.
❖ Handle design problems in a systematic manner.
❖ Gain practical experience in handling 2D drafting and 3D modeling software systems.
❖ Apply CAD in real life applications.
❖ Enhance the employability skills that improves placement opportunities.</td></tr>
<tr><td rowspan="4">Course Outcomes</td><td colspan="3">At the end of the course, the student will be able to:</td></tr>
<tr><td>CO1</td><td colspan="2">Understand the conventions and methods of machine drawings.</td></tr>
<tr><td>CO2</td><td colspan="2">Illustrate various simple machine components.</td></tr>
<tr><td>CO3</td><td colspan="2">Use modern CAD software tools to draw sectional views of simple machine elements.</td></tr>
<tr><td>Course Content</td><td colspan="3">Machine Elements
1. Introduction to BIS, Drawing of simple components - Bolt, Nut, Thread profile, Keys, Cotter Joint, Riveted joints, Knuckle Joint, Shaft coupling.
Assembly and Part Drawings
2. Sectional Views of simple Machine elements
3. Plummer block
4. Stuffing Box
5. Screw Jack
6. Connecting rod
7. Clapper block
8. Eccentric
9. Revolving centre</td></tr>
</table>

Text Books	1. Machine Drawing including AutoCAD by Ajeet Singh, McGraw hill publications 2. A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum. 3. 'Machine Drawing', N.D.Bhat & V.M.Panchal, Published by Charotar Publishing House, 1999 4. 'Machine Drawing', N.Siddeshwar, P.Kannaih, V.V.S. Sastri, published by Tata Mc.Grawhill, 2006 5. "A Text Book of Computer Aided Machine Drawing", S. Trymbakaa Murthy, CBS Publishers, New Delhi, 2007. **6.** 'Machine Drawing', K.R. Gopala Krishna, Subhash publication.

17ME21P2-FUELS AND LUBRICANTS LABORATORY

Course Category:	Program Core	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Engineering Chemistry and Basic Thermodynamics	**Sectional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: fuel properties and their behaviour with respect to changes in temperature and also to determine the viscosity of lubricants against different temperatures.	
	At the end of the course, the student will be able to:	
Course Outcomes	**CO1**	Examine various properties of different fuels.
	CO2	Determine viscosity of various lubricants.
Course Content	Minimum of 8 experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Test on Abel's Flash Point Apparatus. 2. Test on Junker's Gas Calorimeter. 3. Test on Cleve land Flash and Fire Point Apparatus. 4. Test on Pensky Marten Flash and Fire Point Apparatus. 5. Test on Saybolt Viscometer. 6. Test on Redwood Viscometer – 1. 7. Test on Redwood Viscometer -2. 8. Test on Aniline point apparatus. 9. Ash content and carbon residue test. 10. Drop point of grease and mechanical penetration of grease. 11. Study on cloud and pour point apparatus.	

17ME21P3-PRODUCTION ENGINEERING LAB

<table>
<tr><td>Course Category</td><td colspan="2">Program Core</td><td>Credits</td><td>2</td></tr>
<tr><td>Course type</td><td colspan="2">Practical</td><td>Lecture- Tutorial-Practical</td><td>0-0-3</td></tr>
<tr><td>Prerequisite</td><td colspan="2">Engineering Workshop Practice</td><td>Sessional Evaluation:
External Exam Evaluation:
Total Marks:
External Exam:</td><td>40
60
100
3 hrs</td></tr>
<tr><td>Course Objectives</td><td colspan="4">Students undergoing this course are expected to:
❖ Prepare mixing of sand for metal casting processes.
❖ Test and correct sand mixture for metal casting processes
❖ Prepare sand moulds for different kinds of patterns.
❖ Inculcate various kinds of metal joining processes.
❖ Shape the given metal rod into desired shape by using forging process.</td></tr>
<tr><td rowspan="4">Course Outcomes</td><td colspan="4">At the end of the course, the student will be able to :</td></tr>
<tr><td>CO1</td><td colspan="3">Develop and implement the pattern making design.</td></tr>
<tr><td>CO2</td><td colspan="3">Analyze the properties of green sand.</td></tr>
<tr><td>CO3</td><td colspan="3">Demonstrate casting, molding, welding, forging through simple models.</td></tr>
<tr><td>Course Content</td><td colspan="4"><u>LIST OF EXPERIMENTS:</u>
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
PLASTIC MOULDING
Model 15: Plastic Injection Moulding</td></tr>
</table>

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA ANANTAPURAMU)
SPSR NELLORE 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 2017-2018)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks		Duration In Hours	Max. Marks	100
1	17SH2202	Statistics and Partial differential Equations	2	2	-	3	2	40	2	40	0.8*Best of two+0.2*least of two	3	60	100
2	17ME2201	Hydraulic Machinery	2	2	-	3	2	40	2	40		3	60	100
3	17ME2202	Kinematics of Machinery	2	2	-	3	2	40	2	40		3	60	100
4	17ME2203	Machine Tools	3	-	-	3	2	40	2	40		3	60	100
5	17ME2204	Applied Thermodynamics-I	2	2	-	3	2	40	2	40		3	60	100
6	17ME2205	Materials Science and Metallurgy	3	-	-	3	2	40	2	40		3	60	100
		PRACTICALS	Computer Programming Laboratory											
8	17ME22P1	Machine Tools Laboratory	-	-	3	2	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
9	17CE22P3	Strength of Materials Laboratory	-	-	3	2	-	-	-	40		3	60	100
10	17EE22P2	Electrical & Electronics Engineering Laboratory	-	-	3	2	-	-	-	40		3	60	100
		TOTAL	14	08	09	24	-	-	-	360		-	540	900
		MANDATORY COURSE - 2												
2	17MC2202	Environmental Studies	3	-	-	3	2	40	2	40		3	60	100

17SH2202- STATASTICS AND PARTIAL DIFFERENTIAL EQUATIONS
(Only for ME)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre-requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ Various descriptive statistics including the mean, variance and standard deviation for a given data set. ❖ Binomial, Poisson and Normal distributions. ❖ The basic concepts of Sampling Distribution. ❖ Construction of $\bar{X}$, Range chart, C - chart and P chart. ❖ The basic concepts of Partial Differential Equations. ❖ The applications of Partial Differential Equations.	
Course Outcomes	Upon successful completion of the course, the students will able to:	
	CO1	Understand effectively the basic concepts of probability, random variables and statistical parameters of distribution functions.
	CO2	Have a well-founded knowledge of standard distributions (Binomial Poisson and Normal distributions) which can describe real life phenomena.
	CO3	Have a good grasp of Sampling distribution of the mean proportions, Sums and differences, Point Estimation and Interval Estimation.
	CO4	Develop skills in constructing the $\bar{X}$ chart, Range chart, C-chart and P-chart.
	CO5	Acquire knowledge in solving partial differential equations by using the appropriate techniques.
	CO6	Have a sound knowledge in analyzing one dimensional wave equation, Heat flow equation and Two dimensional Laplace equations.

Course Content	**UNIT – I** Probability and Random Variables: Introduction - Random experiments - Random variables - Discrete and continuous distributions - Statistical Parameters (Mean, Variance and Standard Deviation) of distribution functions. **UNIT – II** Probability Distributions: Binomial distribution - Poisson distribution - Normal distribution. **UNIT – III** Sampling Distributions: Population and Samples - Sampling distribution of the mean proportions, Sums and differences. Estimation: Point Estimation - Interval Estimation. **UNIT – IV** Statistical quality control: Introduction to Quality Control - Construction of $\bar{X}$- Range chart – C-chart and P chart. **UNIT – V** Partial Differential Equations: Formation of Partial differential equations - Solutions of Partial differential equations - Equations solvable by direct integration - First order linear partial differential equations - Lagrange's linear equations. **UNIT – VI** Applications of Partial Differential Equations: Methods of Separation of Variables - One dimensional Wave equation - One dimensional Heat flow equation - Two dimensional Laplace equations.
Text Books	1. Probability and for engineers- G. S. S. Bhishma Rao, Scitech Publications (India) Pvt. Ltd., New Delhi. 2. Probability and statistics- Dr.T.K.V. Iyengar, Dr.B. Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N. Prasad, S. Chand Publication, New Delhi. 3. Probability and statistics for engineers and scientists – Ronald E. Walpole, Sharon L. Myers and Keying Ye, Pearson 8th edition **4.** Higher Engineering Mathematics-B.S. Grewal, Kanna Publishers, New Delhi.
References	**1.** Engineering Mathematics- B. V. Ramana, TMH, New Delhi. 2. J. L. Devore, Probability and Statistics for engineering and sciences, 8th edition, Ceneage Learning, (2011). **3.** Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher. 4. Probability & Statistics for Engineers- Miller and John Freund. E, Pearson Education, New Delhi

17ME2201-HYDRAULIC MACHINERY

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre-requisite:	Engineering mechanics and Fluid Mechanics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to: Gain knowledge, handle and analyse problems related to impact of jets, impulse and reaction turbines, centrifugal and reciprocating pumps and hydraulic systems.	
Course Outcomes	Upon successful completion of the course, the students will able to:	
	CO1	Recall classifications, theories and working principles of hydraulic machinery.
	CO2	Demonstrate the method to find the work done and efficiency of impact of jets for different configurations.
	CO3	Solve problems on impulse and reaction turbines using analytical and graphical approach.
	CO4	Evaluate performance characteristics of centrifugal and reciprocating pumps.

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** **Impulse Turbines:** Classification of turbines, Pelton Wheel - working principle, Velocity triangle, work done and efficiency, conditions for maximum efficiency. **UNIT –III** **Reaction Turbine:** Francis and Kaplan turbines - Working principle, Velocity triangle, work done and efficiency. degree of reaction, Draft tube, Specific speed, unit quantities, performance characteristics. **UNIT –IV** **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 –V** **Reciprocating Pumps:** Classification of Reciprocating Pumps, Working of a reciprocating pump, Coefficient of discharge and slip, Single acting and double acting reciprocating pumps. **UNIT –VI** **Hydraulic Systems:** Hydraulic devices - Hydraulic accumulator, Hydraulic intensifier, Hydraulic press, Hydraulic ram, Hydraulic crane and Hydraulic lift, Hydraulic coupling, Hydraulic torque converter.
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. Hydraulic and Fluid mechanics: Modi and Seth, Standard Book House, 2002 2. Theory and applications of Fluid Mechanics: Subramanyam k.; Tata Mcgraw-Hill

17ME2202-KINEMATICS OF MACHINERY

Course Category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre – requisite:	Engineering Mechanics-Statics and Dynamics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to: ❖ Understand Kinematic links, Pairs, chains and mechanisms. ❖ Construct velocity and acceleration diagrams for simple mechanisms. ❖ Synthesize the simple mechanisms. ❖ Understand the gear terminology and apply for different gear trains.	
Course Outcomes	After completing the course the student will be able to:	
	CO1	Grasp knowledge on basic terminology and working of simple mechanisms.
	CO2	Generate velocity and acceleration diagrams for simple mechanisms.
	CO3	Dimensional analysis of simple mechanisms using synthesis technique.
	CO4	Demonstrate law of gearing for involute gear teeth profile.
	CO5	Design a gear train for the stated torque.
Course Content	**UNIT – I** **Kinematic Links & Pairs:** Element, link, types of links – rigid link, flexible link, fluid link. Constrained relative motions –completely, successfully and incompletely type. Kinematic pair, classification of kinematic pairs – lower, higher, sliding, turning, rolling, screw, spherical, Degrees of freedom- Grubler's criteria. **UNIT – II** **Kinematic Chain:** Kinematic chain, types- four bar chain, single slider-crank chain and double slider-crank chain. Grashoff's law, inversions of four bar chain, single slider-crank chain and double slider-crank chain. **Mechanisms:** Introduction, mechanism, machine, Crank & Slotted lever quick return motion mechanism, condition for correct steering, Davis steering gear. **UNIT – III** **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, overlay method. Frudenstein method for four bar linkage.	

	Mechanism defects – branch defect, order defect, Greshoff defect. **UNIT – IV** **Velocity Analysis:** Absolute and Relative Motions, motion of a link, velocity of rubbing, velocity diagrams for four bar mechanism, single slider mechanism and quick return motion mechanisms, Instantaneous Center, Kennedy's theorem. **Acceleration Analysis:** Acceleration diagrams for four bar and single slider mechanism, Coriolis component of acceleration, acceleration diagrams for crank and slotted lever mechanism. **UNIT – V** **Gears:** Classification of Gears, gear terminology, law of gearing, velocity of sliding, path of contact, arc of contact, number of pairs of teeth in contact, forms of teeth, interference in involute gears and minimum number of teeth to avoid interference **UNIT – VI** **Gear Trains:** Simple gear train, compound gear train, reverted gear train, planetary or epicyclic gear train, velocity ratio of epicyclic gear train (tabular method) and torques in epicyclic trains. Simple problems on gear trains
Text Books and Reference Books	**TEXTBOOKS:** 1. S. S. Rattan, Theory of Machines, TMH Publishers, New Delhi. 2. Sadhu Singh[2012], Theory of Machines, Pearson Education, New Delhi. 3 C.S.Sharma and K.Purohit [2010],Theory of Mechanisms and Machines , PHI publishers. **REFERENCE:** 4. Ashok G Ambekar, Mechanism and Machine Theory, PHI Publichers. 5. Ballaney [2005], Theory of Machines, Khanna Publishers, New Delhi. 6. Thomas Bevan[2005], Theory of Machines, CBS Publishers, New Delhi. 7. J.S. Rao and R.V.. Dukkipati [2008], Mechanisms and Machine Theory, NAI Publishers. 8. J.E. Shigley [2010], Theory of Machines and Mechanisms, McGraw Hill Publishers.

17ME2203-MACHINE TOOLS

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Engineering Workshop, Basic manufacturing processes.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives:	Students undergoing this course are expected to understand: ❖ The constructional details and working of various machine tools such as Lathe, Shaper, Slotter, Drilling, Boring, Milling, Grinding, Broaching. ❖ The principle and applications of Non-Conventional machining processes such as AJM, WJM, USM, CM, ECM, EDM, LBM and EBM. ❖ Apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc.,	
Course Outcomes:	After completing the course the student will be able to:	
	CO1	Understand the classifications, specifications, working and functionalities of various machine tools.
	CO2	Demonstrate the fundamentals of machining processes and machine tools.
	CO3	Develop knowledge and importance of metal cutting parameters.
	CO4	Develop knowledge on tool geometry, tool holding devices, work holding devices, abrasives.
	CO5	Understand the mechanism of metal removal in Non-Conventional machining process.
	CO6	Grasp the knowledge on Automated systems.
Course Content:	**UNIT I** **Lathe:** Specification of lathe, types of lathes, work holders, tool holders, Lathe operations and attachments for Lathes, Machining Time calculations. **Turret and capstan lathes** – Comparison with engine lathe, difference between turret and capstan lathes, work holding devices and tool holding devices. **UNIT II** **Shaping, Slotting and Planing:** Principles of working, Principal parts, specification, classification, Operations performed. Shaper Mechanism, Machining time calculations. **Drilling and Boring:** Specifications, types, operations performed, tool holding devices, twist drill terminology, 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, Machining Time calculations. **UNIT IV** **Grinding:** Classification of grinding machines, Cylindrical and surface grinding machines, Tool and cutter grinding machines, Grinding wheel-Different types of abrasives, bonds, designation, selection of a grinding wheel. **Broaching**: Classification, constructional features, broaching operations. **Lapping and Honing operations** **UNIT V** **Non-conventional Machining processes:** Principle and applications of AJM, WJM, USM,CM, ECM, EDM, LBM, EBM. **UNIT VI** **Automation:** Need, types and basic elements of an automated system. Levels of automation. Hardware components for automation. **Automatic lathes:** Classification, Single spindle and multi-spindle automatic lathes.
Text Books & Reference Books:	**Text Books:** 1. Production Technology :R.K. Jain and S.C. Gupta, New Delhi, 5th ed., Khanna Publishers, 2010 2. Workshop Technology – Vol II : Hazra Chowdary, S.K. Bose & A.K. Bose, Media publishers,2005 3. Automation, production systems and CIM : M.P.Groover, pearson Education, 2008 **Reference Books:** .Manufacturing Engineering Technology : Kalpakjian, 2nd edition ,New Jersey, USA. Pearson Stores, Prentice hall Publication,2010 2. Production Technology, H.M.T. : 2nd edition Tata Mc.graw Hill, Noida-India,1986. 3. Introduction to Manufacturing Technology: Prashant T. Data, 2nd ed., JaicoPublication House,2010. 4. Workshop Technology – Vol II : B.S. Raghuwanshi, New Delhi, 10thed.,Dhanpathrai&Co, 2010.
E-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

17ME2204-APPLIED THERMODYNAMICS - I

Course Category	Programme core	**Credits**	3
Course type	Theory	**Lecture- Tutorial-Practical**	2-2-0
Prerequisite	Basic knowledge in physics, Basic thermo dynamics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ The steam formation and properties of steam. ❖ Explain the working of steam generators. ❖ Explain the working of steam turbines, nozzles and condensers. ❖ Analyze the performance of steam turbines, nozzles, condensers. ❖ Explain, analyze and design the steam turbines.	
Course Outcomes	At the end of the course the student will be able to:	
	CO1	Understand steam formation, properties, generation and boiler accessories.
	CO2	Grasp knowledge on steam nozzles, condensers and turbines.
	CO3	Solve problems on steam nozzles and condensers using relevant principles.
	CO4	Use methods and concepts to construct velocity diagrams of steam turbines.
	CO5	Determine the performance of 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. **Basic Steam Power cycles:** Carnot cycle, Rankine cycle and modified Rankine cycle.	
	UNIT – II **Steam Generators:** Classification of boilers, Cochran, Babcock and Wilcox, Lamont, Benson boilers. **Boiler mountings:** Water level indicator, pressure gauge, safety valve, fusible plug **Boiler accessories:** Air pre-heater, economiser, super heater.	
	UNIT – III **Steam Nozzles:** Types, isentropic flow of steam through nozzles, velocity & enthalpy drop, variation of velocity, area & specific volume, critical pressure ratio for maximum discharge, effect of friction, supersaturated flow. **Steam Condensers:** Functions of a condenser, classification, jet condenser – parallel flow arrangement and counter flow arrangement, surface condenser, vacuum efficiency – loss of vacuum & air leakage, air removal.	
	UNIT – IV **Impulse Turbine:** 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.
	UNIT – V **Reaction Turbine:** Introduction, Parson's reaction turbine, pressure and velocity in a reaction turbine, comparison between impulse and reaction turbine, velocity triangles for moving blades of a reaction turbine, combined velocity triangle for moving blades, power produced and degree of reaction.
	UNIT – VI **Performance of Steam Turbines**: Introduction, efficiencies of steam turbine, condition for maximum efficiency of an impulse turbine and reaction turbine, compounding of steam turbines - velocity compounding, pressure compounding & pressure - velocity compounding, governing of steam turbines - throttle governing. Reheating of steam - advantages of reheating, reheat cycle, reheat factor. Regenerative cycle, bleeding, multi-stage turbine, efficiencies of multi-stage turbines.
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) : Ballaney P.L., Khanna Publishers, 5th ed., 2010
Reference Books **e-resources**	1. A course in Thermal Engineering : Domukundwar & Kothandaraman, Dhanapat Rai and Co. 2010 2. Thermal Engineering : R.K. Rajput, Laxmi Publications, 3. Text book of Thermal Engineering: R.S. Khurmi, J.K.,Gupta, S.CHAND Publications. 1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

17ME2205-MATERIAL SCIENCE AND METALLURGY

Course Category	Programme core	**Credits**	3
Course type	Theory	**Lecture-Tutorial-Practical**	3-0-0
Prerequisite	Basic knowledge in Physics, chemistry and Basic manufacturing processes.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives	Students undergoing this course are expected to understand: ❖ Crystal structure, engineering materials, equilibrium diagrams, extractive metallurgy, heat treatment, powder metallurgy and advanced materials. ❖ Introduce the concept of structure property relations. ❖ Lay the groundwork for studies in fields such as solid-state physics, mechanical behaviour of materials, phase & phase diagram, heat treatment, failure of materials & their protection, applications of recent materials.	
Course Outcomes	At the end of the course, the student will be able to:	
	CO1	Recall methodology and theories in the field of material science and metallurgy.
	CO2	Understand various material testing methods.
	CO3	Use methods to draw equilibrium diagrams.
	CO4	Describe extraction procedure for ferrous and non-ferrous materials.
	CO5	Summarize the applications of Powder metallurgy and Advanced materials.
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 –p oint, 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. **UNIT – II** **Testing of Engineering materials:** Tensile & Compressive testing. Hardness – Brinell and Rockwell tests. Impact testing. Creep – creep test, creep curve, Mechanism of creep. Fatigue – fatigue stress cycles, fatigue test, S-N curve. Ductile fracture and brittle fracture - Griffith's criterion. **NDT :** Fluorescent Inspection, Radiography, Magnetic particle Inspection, Ultrasonic Inspection. **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 iron:** grey, white, malleable and SG irons. **Non-Ferrous Materials:** Introduction- Extraction of Aluminum and Copper, Properties and applications of Aluminum and copper alloys. **UNIT –V** **Heat Treatment:** Construction of TTT diagram. Heat treatment of steels – Annealing, Normalizing, Hardening, Tempering, Austempering, Mar tempering. Surface hardening of steels – Carburizing, Nitriding, Cyaniding, Flame Hardening and Induction Hardening. **UNIT –VI** **Powder Metallurgy:** Production of metal powders, basic steps in powder metallurgy, advantages limitations and applications of powder metallurgy. **Advanced materials:** Introduction and applications to super alloys, Smart materials and Nano materials
Text Books	1. Introduction to Physical Metallurgy: Avner, 2nd ed., Tata McGraw-Hill ducation, 2010. 2. Materials Science and Metallurgy : Kodgire V.D. 25th ed., Everest ublishing 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., Dhanpat Rai and Sons, 2009.

17MC2202 - ENVIRONEMNTAL STUDIES

(For ME and CE Branches)

Course category:	Mandatory Course	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-0-0
Prerequisite:	Basic knowledge in Social Sciences and chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

<table>
<tr><td>Course Objective</td><td colspan="2">Students undergoing this course are expected to understand:
❖ The multidisciplinary nature of environmental studies and features of ecosystem and bio-diversity.
❖ The management of major natural resources.
❖ Recognize the causes, effects and remedial measures of environmental pollution and outline the disaster management.
❖ Various environmental cases-studies and classify different environmental acts.</td></tr>
<tr><td rowspan="7">Course Outcomes</td><td colspan="2">At the end of the course the student will be able to:</td></tr>
<tr><td>CO1</td><td>Understand multidisciplinary nature of environmental studies.</td></tr>
<tr><td>CO2</td><td>Understand the features of ecosystem and bio-diversity.</td></tr>
<tr><td>CO3</td><td>Understand the management of major natural resources.</td></tr>
<tr><td>CO4</td><td>Understand the causes, effects and remedial measures of environmental pollution.</td></tr>
<tr><td>CO5</td><td>Understand effectives of elements on environment and disaster management.</td></tr>
<tr><td>CO6</td><td>Familiar with environmental acts and must be able to apply the knowledge of environmental studies to certain case studies.</td></tr>
<tr><td>Course Content</td><td colspan="2"><u>UNIT- I</u>
Introduction:
Definition, Scope and Importance of Environmental Studies. Various Components of Environment-Atmosphere, Biosphere, Hydrosphere and Lithosphere. Multidisciplinary nature of Environmental Studies and public awareness.
<u>UNIT- II</u>
Ecosystems: Concept, Structure and function, Producers composers and decomposers, Energy flow, Ecological succession, Food chains, webs and ecological pyramids, Characteristics structures and functions of ecosystems such as Forest, Grassland, Desert, Aquatic ecosystems.
<u>UNIT- III</u>
Natural Resources and associated problems
Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.
Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people.
Water resources: Use and over-utilization of surface and groundwater, conflicts over water sharing and watershed management.</td></tr>
</table>

	Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources. **Food Resources**: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, **Energy Resources**: Growing energy needs renewable and non-renewable energy sources use of alternate energy sources. **UNIT- IV** **Biodiversity and Conservation**: Definition, Genetic, Species, and Ecosystem diversity, Value of biodiversity at global, national, local levels, Hot spots of biodiversity, Threats to Biodiversity, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity. **Case Studies**: Silent Valley Project, Mathura Refinery and Tajmahal, Tehri Dam, Kolleru Lake Aquaculture, Fluorosis in Andhra Pradesh. **UNIT- V** **Environmental Pollution**- Definition, Causes, effects and control of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards, Ozone layer depletion, Global Warming and Acid Rains. Solid waste management methods-Composting, Vermi composting, Landfill. Disaster management, floods, earthquake, cyclone and landslides. **UNIT- VI** **Environmental Problems in India:** Effect of Urbanization, Industrialization and Transportation on quality environment and public health. Drinking water, Sanitation for good health. Green revolution. Social, Economic and Environmental interaction for sustainable development. **Environmental Acts:** Water act, Air act, Environment protection act, Wildlife protection act, Forest conservation act. Coastal Regulation Zones (CRZ), Special Economic Zones (SEZ). **Field Work**: Visit to a local area having river / forest / grassland / hill/ mountain to document and environmental assets. Study of local environment-common plants, insects, birds. Study of simple ecosystems-pond, hill slopes, etc. Visits to Industries, water treatment plants, effluent treatment plants.
Text Books and reference Books:	***Text Books:*** 1. Bharucha Erach, *Biodiversity of India*, Map in Publishing Pvt. Ltd., Ahmadabad, 2002. 2 .Environmental Science by Anubha Kaushik and C.P. Kaushik ***Reference Books:*** 1. Introduction to Environmental science by Y. Anjaneyulu. 2. Environmental Studies by Dr. B.S. Chauhan. 3.Environmental Science by M. Chandra Sekhar.

17ME22P1-MACHINE TOOLS LABORATORY

Course Category	Program Core	**Credits**	2
Course type	Practical	**Lecture-Tutorial-Practical**	0-0-3
Prerequisite	Machine Tools Theory	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100
		External Exam Duration:	3 hrs

Course Objective	Students undergoing this laboratory are expected to: ❖ Prepare models using lathe, shaper, milling and drilling machines. ❖ Calculate force & power measurement on Lathe. ❖ Produce single point cutting tool.	
Course Outcomes	At the end of the laboratory the student will be able to:	
	CO1	Understand various machine tools and cutting tools.
	CO2	Understand various operations on machine tools.
	CO3	Demonstrate various machine tools and cutting tools through simple models.
	CO4	Measure force and power of a lathe during turning operation.
	CO5	Demonstrate alignment test on Lathe.
Course Content	**LIST OF EXPERIMENTS** 1. Internal and External Taper Fitting 2. External Thread cutting 3. Fit Exercise on Capstan lathe 4. Indexing using Universal Dividing Head 5. Spur Gear Cutting on Milling Machine 6. Shaping Job 7. Production of Single Point Cutting Tool 8. Alignment Tests on Lathe 9. Force Measurement in Turning 10. Power Measurement in Turning	

17CE22P3–STRENGTH OF MATERIALS LABORATORY

Course category:	Program core	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practical:**	0 - 0 - 3
Prerequisite:	Knowledge on Strength of materials	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objective	Students undergoing this laboratory course are expected to: ❖ Understand the mechanical testing procedures for evaluation of engineering properties of materials and to present a detailed technical report on the same.	
	At the end of the laboratory course the student will be able to:	
Course Outcomes	CO1	Conduct test on mild steel for tension, direct shear, hardness, torsion and impact load.
	CO2	Conduct test on HYSD bar for tension, hardness and wood for compression test.
	CO3	Conduct test on springs and rolled steel joist for bending.
	CO4	Conduct test on beams for deflection and elastic modulus.
	CO5	Document results in detailed technical report.
Course Content	**LIST OF EXPERIMENTS** 1. Tension test on Mild Steel bar. 2. Tension test on HYSD bar. 3. Compression test on wood. 4. Direct shear test on Mild Steel. 5. Rockwell and Brinell Hardness tests. 6. Charpy and Izod Impact tests. 7. Bending test on Rolled Steel Joist. 8. Bending test on carriage springs. 9. Torsion test-Determination of Rigidity modulus (G). 10. Deflection test on simply supported beam-Determination of Elastic modulus (E). 11. Deflection test on fixed beam- Determination of Elastic modulus (E). 12. Deflection test on close-coiled helical springs. 13. Deflection test on over hanging beam - Determination of Elastic modulus (E).	

17EE22P2-ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY

Course Category:	Professional core	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Basic concepts of Kirchhoff's Laws, Electronic Devices & controllers. Fundamentals of DC machines.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:** **External Exam:**	40 60 100 3 hrs

Course Objectives:	Students undergoing this laboratory course are expected to: ❖ Learn design and analysis of electrical circuits. ❖ Learn the basic concepts of the Electrical Machines. ❖ Learn the characteristics &operation of 1- φ Transformer. ❖ Learn the characteristics of various Electronic Devices. ❖ Learn the basic concepts of the Controllers.	
Course Outcomes:	At the end of the laboratory course the student will be able to:	
	CO1	Analyze and design electrical circuits using circuit elements.
	CO2	Understand power and power factor concepts practically.
	CO3	Conduct load test and determine the efficiency of single phase transformer.
	CO4	Obtain performance characteristics of DC Motors and Generators.
	CO5	Understand the concepts of semiconductor devices.
Course Content:	Minimum of 10 experiments to be conducted out of the following **LIST OF EXPERIMENTS** 1. Verification of Kirchhoff's Laws 2. Measurement of Power using Wattmeter 3. Open Circuit and Short Circuit test on 1-φTransformer 4. Load test on 1- φ Transformer 5. Load test on DC Shunt Motor 6. Excitation Characteristics of a. Separately Excited DC Generator b. Self-Excited DC Shunt Generator 7. P-N Junction Diode Characteristics (Ge & Si) 8. Zener Diode Characteristics 9. Bipolar Junction Transistor Characteristics (CE Configuration) 10. Full Wave Rectifier without Filter 11. Full Wave Rectifier with Filter 12. Design of P, PI & PID Controllers	

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 JNTUA ANANTAPURAMU)
SPSR NELLORE DIST
III YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION (With effect from the academic year 2017-2018)

S. No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks	0.8*Best of two+0.2*least of two	Duration In Hours	Max. Marks	100
1	17ME3101	Industrial Engineering and Management	3	0	0	3	2	40	2	40		3	60	100
2	17ME3102	Dynamics of Machinery	2	2	0	3	2	40	2	40		3	60	100
3	17ME3103	Design of Machine Elements–I	2	2	0	3	2	40	2	40		3	60	100
4	17ME3104	Applied Thermodynamics–II	2	2	0	3	2	40	2	40		3	60	100
5	17ME3105	Mechanical Measurements	3	0	0	3	2	40	2	40		3	60	100
6	17ME31EX	Core Elective – I	3	0	0	3	2	40	2	40		3	60	100
		PRACTICALS												
7	17ME31P1	Materials Science & Metallurgy Laboratory	-	-	3	2	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	17CE31PX	Fluid Mechanics and Hydraulic Machinery Laboratory	-	-	3	2	-	-	-	40		3	60	100
9	17ME31P2	Thermal Engineering Laboratory	-	-	3	2	-	-	-	40		3	60	100
10	17ME31MP	Mini Project	0	0	0	2				40			60	100
		TOTAL	**15**	**06**	**09**	**26**	**-**	**-**	**-**	**400**		**-**	**600**	**1000**

17ME3101- INDUSTRIAL ENGINEERING AND MANAGEMENT

Course category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 - 0
Prerequisite:	Economics and accountancy	**Sessional Evaluation :**	40M
		Univ. Exam Evaluation:	60M
		Total Marks:	100M

Course Objectives	1. identify and implement effective solutions to real problems by applying. 2. contemporary industrial engineering tools and cutting-edge technology in production. 3. Graduates will be able to formulate problems accurately, alternatives, and decision makers in a fashion that facilitates decision-making processes. 4. Graduates will be able to assume leadership roles with strong communication skills and will be able to work competently and ethically alone and as team members	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	apply knowledge of science & engineering in industrial management
	CO2	to take the right decisions to optimize resources utilization by improving productivity of the Lands, Buildings, People, Materials, Machines, Money, Methods and Management effectively.
	CO3	to eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes
	CO4	to use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.
	CO5	to improve the processes and find the Standard Time.
	CO6	to design the Man – Machine System to improve Human Efficiency and reduce the effort of the workers.
Course content	**UNIT – I** **MANAGEMENT CONCEPT:** Administration, management and organization. Scientific management, functions of management, principles of management, types of organizations, principles of organization, Fayol's and Taylor's contributions to management. **UNIT – II** **SALES FORECASTING:** Need, classification. Methods - moving average, exponential smoothing and linear regression. Measures of forecast accuracy. **MARKETING:** Definition, principles and functions, marketing management, marketing research. **UNIT – III** **PLANT LOCATION:** Influencing factors, Weber's theory. Choice of city, suburban and country locations. **PLANT LAYOUT:** Definition, objectives. Types – Product, process and fixed position layouts.	

	PLANT MAINTENANCE: Importance, Types – Preventive, predictive and breakdown maintenance. Introduction to total productive maintenance (TPM). **UNIT – IV** **WORK STUDY:** Basic procedure. Method study – definition, objectives and procedure. **WORK MEASUREMENT:** Objectives. Techniques of work measurement – Time study, work sampling, analytical sampling and Predetermined Motion Time Systems (PMTS). Determination of standard Time. **UNIT – V** **PERSONNEL MANAGEMENT:** Functions of personnel management. Methods of Job evaluation. 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 – VI** **QUALITY CONTROL:** Introduction to inspection and quality control. Variables and Attributes. Acceptance sampling for attributes – description, advantages and disadvantages of sampling, types of sampling plans, OC curve for single and double sampling plans. Design of sampling plans. **TOTAL QUALITY MANAGEMENT:** Introduction, Six Sigma concept, tools for continuous quality improvement.
Text Books and reference Books:	**TEXT BOOKS:** Industrial Engineering and Management : Khanna O P, Dhanpat Rai & Sons, 2018 Principles of Motion and Time Study : Ralph Barnes, John Wiley, 2003 Quality control : Dale H Besterfield, Pearson Education, 2009 **REFERENCES:** Production and Operations Management : R. Panneerselvam, PHI Publications, 2012 Modern Production/Operations Management: Buffa E S, John Wiley & Sons. 2007
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME3102 -DYNAMICS OF MACHINERY (SI UNITS)

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

Course Objectives	1 .To equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations. 2. Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses. 3. Develop understanding of vibrations and its significance on engineering design. 4. Develop understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand free and forced vibrations of single degree freedom systems
	CO2	Analyze balancing problems in rotating and reciprocating machinery
	CO3	Characterize and design flywheels
	CO4	Understand the gyroscopic effects in ships, aero planes and road vehicles
	CO5	Analyze and design centrifugal governors
	CO6	Explain the principles in mechanisms used for speed control and stability control
Course content	**UNIT – I** **FRICTION:** Inclined planes, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis. Lubricated surfaces- boundary friction, film lubrication. **CLUTCHES:** Single disc or plate clutch, multiple disc clutches, cone clutch and centrifugal clutch. **UNIT – II** **BRAKES:** Simple shoe brake, block brake, band brake and disc brake. **DYNAMOMETERS**: Absorption- rope, belt. Transmission - torsion and epi-cyclic. **UNIT – III** **GOVERNORS:** Introduction, Watt, Porter and Proell governors, spring loaded governors - Hartnell governor. Sensitiveness, isochronism, stability, hunting, effort and power.	

	UNIT – IV **TURNING MOMENT DIAGRAMS AND FLYWHEEL:** Turning moment diagrams for steam engine, I.C. engine and multi cylinder engine. Crank effort - fluctuation of energy, coefficient of fluctuation of speed – flywheel of a punching press. **UNIT – V** **GYROSCOPIC COUPLE AND PROCESSIONAL MOTION:** Gyroscopic couple, effect of precession on stability of moving vehicles- motor cycles, motor cars, aero-planes and ships. **UNIT – VI** **CAMS**: Classifications of cams and followers, displacement, velocity & acceleration diagrams when the followers move with uniform velocity, S.H.M., uniform acceleration & retardation, construction of cam profiles for radial cam with knife edge follower, roller follower. Cams with specified contours-tangent cam.
Text Books and reference Books:	**TEXT BOOKS:** 1. Theory of Machines: R.S.Khurmi and J K Gupta., S.Chand, 2015 2. Theory of Machines: Thomas Bevan, 3rd ed., Pearson Education India, 2010. 3. Theory of Machines: S. S. Rattan, 4th ed., Mc Graw Hill India Pvt. Ltd., 2014 **REFERENCES:** 1. Mechanisms and Machine Theory : Rao J. S. and Dukkipati R. V., 2nd ed., New Age, 2006 2. Theory of Machines: John J. Uicker, G. R. Pennock, Joseph Edward Shigley, Oxford University Press, 2003
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME3103 -DESIGN OF MACHINE ELEMENTS–I

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2- 2 - 0
Prerequisite:	Engineering mechanics, SOM, KOM.	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1: To apply the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components. 2: To illustrate the variety of mechanical components available and emphasize the need to continue learning. 3: To apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.	
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	Understand component behavior subjected to loads and identify the failure criteria
	CO3	Analyze the stresses and strains induced in a machine element
	CO4	Design a machine component using theories of failure
	CO5	Analyses and apply design procedure for welded joints.
	CO6	Design knuckle and cotter joints for various engineering applications.
Course content	**UNIT – I** **Engineering Design:** What is designing? The process of design, Design by evolution, morphology of design, Identification of need, true need, brain storming, economic and financial feasibility. **Machine Design:** Basic procedure of machine design– Design considerations and standards; Engineering materials- classification and selection, mechanical properties of materials. **UNIT – II** **Design For Static Strength:** Modes of failure; factor of safety; Simple stresses in machine parts- Stresses due to bending moment, Stresses due to torsional moment – Eccentric axial loading- Design for impact loads.. **UNIT – III** **Design For Fatigue Strength:** Stress concentration – Stress concentration factors - Reduction of stress concentration- Fluctuating stresses – Fatigue failure – Endurance limit – Notch sensitivity– Soderberg, Goodman and modified Goodman diagrams – Design for infinite life.	

	UNIT-IV **Riveted Joints**: Types of riveted joints - efficiency of riveted joint – eccentrically loaded riveted joints. **Welded Joints:** Types of welded joints; stresses in butt and fillet welds; strength of welded joints; eccentricity welded joint; weld joint subjected to bending moment. **UNIT – V** **Threaded Joints:** Terminology of screw threads, Bolted joint -Eccentrically loaded bolted joints in shear - Eccentric load perpendicular to axis of bolt -Bolts of uniform strength. **UNIT – VI** **Shafts:** Introduction-Design of solid and hallow shafts for strength and rigidity, Shaft materials, Shaft sizes- BIS Codes. Design of shafts for combined bending and axial loads.
Text Books and reference Books:	**TEXT BOOKS:** 1. Design of Machine Elements: Bhandari V. B., 4th ed.McGraw Hill education,2017 2. Machine Design: Khannaiah P., Scitech Publications. 4th edition, 2010 3. Machine Design: Sharma P.C. & Aggarwal D.K., S. K. Kataria & Sons, 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. Balaveera Reddy & Mahadevan, Design Data Handbook for Mechanical Engineers, CBS publishers, 4th Edition, 2013. NOTE: Balaveera Reddy & Mahadevan, Design Data Handbook for Mechanical Engineers, CBS publishers, 4th Edition, 2013
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME3104 -APPLIED THERMODYNAMICS–II

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

Course Objectives	Students undergoing this course are expected to 1. Understand operation of IC engines. 2. Perform theoretical calculations to obtain thermodynamic efficiencies and then asses operating losses. 3. Familiarize with the types of air compressors, working principle and operating characteristics. 4. Describe basic working principle of gas turbine plant. Define the performance characteristics. 5. Establish understanding of propulsion systems in aircraft that are essential to graduate. engineers who are intended to work in aircraft system/component manufacturing/maintenance environments.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Differentiate the internal combustion engines based on the classification parameters.
	CO2	Analyze the internal combustion engine cycles and performance parameters.
	CO3	Describe the working of reciprocating air compressors along with their performance parameters.
	CO4	Discuss the operation of centrifugal and axial flow compressors.
	CO5	Express the basic cycles and calculations involved in the operation of gas turbines.
	CO6	Gain skills in problem solving for aircraft propulsion systems, in particular gas turbine engines.
Course content	**UNIT – I** **INTERNAL COMBUSTION ENGINES:** Classification, SI and CI engines - principles of operation, methods of fuel supply, ignition, cooling, lubrication and methods of governing. **UNIT – II** **PERFORMANCE OF IC ENGINES:** Valve and port time diagrams, indicator diagrams. Testing of engines – indicated power, brake power, efficiencies, air-fuel ratio and heat balance. **UNIT – III** **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, multi-stage compression - optimum pressure condition in two-stage compression, inter coolers and after coolers.	

	UNIT – IV **ROTARY COMPRESSORS:** Classification – positive displacement and rotary dynamic (non-positive displacement) compressors, fans and blowers. static and total head. **CENTRIFUGAL COMPRESSORS**: Velocity diagrams, type of impeller vanes, slip factor, diffuser isentropic efficiency. **AXIAL FLOW COMPRESSORS**: Velocity diagrams, degree of reaction, isentropic efficiency. **UNIT – V** **GAS TURBINES :** Simple gas turbine cycle, open and closed cycle, constant volume cycle, constant pressure cycle, efficiency and work output, inter coolers, reheat and regeneration cycles, losses in turbine. **UNIT – VI** **JET PROPULSION:** Specific thrust, thermal efficiency, propulsion efficiency, turbo prop, turbo jet, rocket propulsion, performance evaluation.
Text Books and reference Books:	**TEXT BOOKS:** 1. Heat Engineering : Vasandani V.P & Kumar D.S., Metropolitan book Co Pvt Ltd , 2000 2. Heat Engines : Ballaney P.L., Khanna Publishers, 2005 3. Thermal Engineering : R.K. Rajput., Laxmi Publications, 2018 **REFERENCES:** 1. I.C. Engines : V. Ganesan, Tata McGraw Hill Publication, 4th ed., 2012 2. Applied Thermodynamics : Eastop and Mckankey, Pearson Publication, 5th ed., 2002 3. Engineering Thermodynamics : Nag P. K., McGraw Hill Publication, 5th ed., 2013
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME3105 -MECHANICAL MEASUREMENTS

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

Course Objectives		
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. **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. **UNIT – III** **MEASUREMENT OF PRESSURE AND VACUUM:** Pressure measurement – Bourdon pressure gauge, Bellows and Diaphragm gauge. High vacuum measurement – McLeod gauge, Pirani gauge and Thermocouple vacuum gauge. **UNIT – IV** **MEASUREMENT OF FLOW**: Ultrasonic flow meters, Rotameters, turbine flow meter and magnetic flow meter, measurement of fluid velocities – hot wire anemometer. **UNIT – V** **MEASUREMENT OF TEMPERATURE:** Electrical thermometers, resistance thermometers and pyrometers. non-contact devices. **MEASUREMENT OF FORCE AND TORQUE:** Basic force measurement methods-hydraulic and pneumatic load cells, Electric Dynamometers, Eddy-current Dynamometers. **UNIT – VI** **STRAIN MEASUREMENT:** Strain measurement by Electrical Resistance. Strain gauges for

	bending, compressive and tensile strains. **VIBRATION AND ACCELERATION MEASUREMENT:** Seismic instruments–Principle, application in the measurement of vibration **ACCELERATION:** Piezoelectric accelerometers, Strain gauge accelerometer.
Text Books and reference Books:	**TEXT BOOKS:** 1. Mechanical measurements and Control: Kumar D.S., Metropolitan Book Company, 2006. 2. Mechanical measurements: Beckwith T.G. & Lewis Buck N., Addison-Wesley Longman, 2002. 3. Control systems: A Nagoor Kani, RBA Publishers, 2006 **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**

17ME31E1 - COMPOSITE MATERIALS (CE-1)

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -0 - 0
Prerequisite:	Metallurgy& material science	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. Explain the behavior of constituents in the composite materials. 2. Enlighten the students in different types of reinforcement. 3. Develop the student's skills in understanding the different manufacturing methods available for composite material. 4. Illuminate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials. 5. To know the industrial applications of composite materials.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Recall of information like, technical terms, classifications, categories, and criteria
	CO2	Explain the mechanical behavior of composites compared to isotropic materials
	CO3	Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro levels.
	CO4	Determine stresses and strains relation in composites materials.
	CO5	Demonstrating correct usage of a method or procedure for producing different composites.
	CO6	Identify the industrial applications of composite materials in various fields.
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, advantages of composites. **UNIT – II** **REINFORCEMENTS: classification of reinforcements-** Fibers reinforcements, - Glass Fibers, Boron Fibers, Carbon Fibers, Organic Fibers, Ceramic Fibers, Metallic Fibers, Comparison of Fibers.. Particulate reinforcements, fabrication and properties **UNIT – III** **Metal Matrix Composites:** Fabrication of MMCs-Solid State Fabrication, Liquid State Fabrication, In Situ Fabrication Techniques. Interface in Metal Matrix Composites- Mechanical Bonding, Chemical Bonding, Interfaces in Situ Composites. Discontinuous Reinforcement of MMCs. **UNIT-IV** **Polymer Matrix Composites:** Fabrication of PMCs, Autoclave, tape production, moulding methods, filament winding, manual layup, pultrusion, RTM. Properties of PMCs, Interface in PMCs.	

	Ceramic Matrix Composites: Fabrication of CMCs, Properties of CMCs, Interface in CMCs, Toughness of CMCs. **UNIT – V** **Interfaces:** Wettability and Bonding, Types of Bonding, Interface in Composites, Interactions, Tests and measurement of Interfacial Strength. **Strength and stiffness of single layer fiber reinforced composite-** Voight's rule for volume and weight fraction, longitudinal strength and stiffmness, transverse modules, in plain shear modules, poisons ratio. **UNIT – VI** **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 and case studies composite material applications.
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. 3. Mechanics of composite materials and structures, madhujit mukhopadhyay, universities pres,2017. **References:** 1. B. D. Agarwal, L.J. Broutman and K. Chandrashekhara, Analysis and performance of fibre Composites, 3rd ed., John Wiley and Sons,New York, 2006. 2. 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**

17ME31E2- INTERNAL COMBUSTION ENGINES (CE-1)

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

Course Objectives	1. To understand the operation of internal combustion engines. 2. To perform theoretical calculations to obtain thermodynamic efficiencies and then assess operating losses. 3. To calculate engine operating parameters. 4. To understand the implications of a tradeoff between performance, efficiency, emissions. 5.To assess the relation between engine power output to the required power for vehicle propulsion.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand working and performance of IC Engines through thermodynamic cycles
	CO2	Understand combustion phenomena in SI and CI engines and factors influencing combustion chamber design.
	CO3	Outline emission formation mechanism of IC engines, its effects and the legislation standards
	CO4	Describe the properties of various alternative fuels, engine modification required and emission characteristic of alternative fuels.
	CO5	Evaluate methods for improving the IC engine performance
	CO6	Understand the latest developments in IC Engines and alternate fuels
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, working of four stroke engines, valve and port timing diagrams **UNIT – II** **COMBUSTION IN SI ENGINES**: Stages of combustion in SI engines, abnormal combustion and knocking in SI engines, factors affecting knocking, control of knocking and combustion chambers for SI engines, engine emissions. **UNIT – III** **COMBUSTION IN CI ENGINES**: Stages of combustion in CI engines, detonation in CI engines, factors affecting detonation, controlling of detonation, importance of proper air movements, combustion chambers for CI engines, engine emissions. .**UNIT – IV** **SUPERCHARGING**: Objectives of supercharging, supercharged S.I. engines, supercharged C.I. engines, effects of supercharging on engine performance, methods of supercharging, superchargers,	

	turbo charging – method of turbo charging, limitations of turbo charging. **UNIT – V** **FOSSIL FUELS**: Requirements of I.C. engine fuels – Hydrocarbon fuels their nature and properties, calorific value, volatility and vapour lock, fuel ratings for S.I engines and C.I. engines, additives. **ALTERNATIVE FUELS**: Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel – Properties, Suitability, Merits and Demerits. **UNIT – VI** **DEVELOPMENTS IN I.C. ENGINES**: Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles, MPFI.
Text Books and reference Books:	**TEXT BOOKS:** 1. A course in Internal Combustion Engines: Mathur, M.L.& Sharma, R.P., Dhanpat Rai, 1999 2. Internal Combustion Engines Fundamentals: Heywood, J.V., McGraw-Hill, 1988 3. Internal Combustion Engines :V.Ganeshan, 5th edition, TMH Publication, 2012 4. Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002. **REFERENCES:** 1. Internal Combustion Engines : Maleev, V.L., McGraw-Hill, 1945 2. Internal Combustion Engines& Air Pollution : ObertE.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**

17ME31E3- METAL FORMING PROCESSES (CE-1)

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -0 - 0
Prerequisite:	Basic manufacturing process	**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 extrusion and types of extrusion 4. Understand the fundamentals of forging and types of forging 5. Understand the fundamentals of high energy rate forming process.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Determine major process/processes of manufacturing used for given application.
	CO2	Explain when and why metal forming is chosen compared to other compatible methods.
	CO3	Analyze effect of parameters influencing metal forming and compare hot working and cold working with applications.
	CO4	Explain capabilities and applications of bulk metal forming processes and sheet metal work.
	CO5	Outline tooling and equipment required for important metal forming processes.
	CO6	Examine effects of friction & lubrication and causes of common defects in metal forming.
Course content	**UNIT – I** **THEORETICAL BASIS FOR METAL FORMING**: Engineering stress-strain curve, true stress-strain curve, general state of stress at a point, yielding under complex stresses. Flow rules: levy-mises equations and Prandtl - Reuss equations. Strain hardening, recovery, recrystallisation and grain growth. Hot working, cold working and warm working. Comparison of properties of cold and hot worked parts, methods used in forming. **UNIT – II** **ROLLING**: Principles and theory of rolling, types of rolling mills and products. Forces in rolling and power requirements, process variables in rolling, roll camber, defects in rolled products, automatic gauge control. **UNIT – III** **FORGING PROCESSES**: Principles of forging, types of forging – smith forging, drop forging, press forging, roll forging. Forging hammers, analysis of plane strain forging, forging defects. **UNIT – IV** **WIRE DRAWING**: Wire drawing die, preparation of wire, lubrication, wire drawing bench. Tube drawing processes. **EXTRUSION PROCESSES**: Basic extrusion process and its characteristics. Forward extrusion and backward extrusion, impact extrusion, hydrostatic extrusion, calculation of extrusion load, flow pattern in extrusion, defects in extruded parts.	

	UNIT – V **SHEET METAL WORKING:** Press working operations, blanking and piercing – forces and centre of pressure, strip layout. **Bending**: Terminology, bending methods, bend allowance, Spring back and bending pressure. Cup drawing, simple die, progressive die compound die and combination die. **UNIT – VI** **OTHER FORMING METHODS**: Hot and cold spinning, coining, embossing, rubber pad forming, stretch forming. **HIGH ENERGY RATE FORMING METHODS:** Explosive forming method, electro hydraulic forming, electromagnetic forming.
Text Books and reference Books:	**TEXT BOOKS:** 1. Manufacturing Technology, Foundry forming and welding, Vol I : P.N. Rao, TMH, 5th ed., 2018 2. Metal forming technology, Dr. R.Narayana Samy. Ahuja Book Company, 2000. **REFERENCES:** 1. Process and Materials of Manufacturing : Lindberg, Pearson India, 2015 2. Manufacturing Technology : Schmid and Kalpakiian, Pearson Education, 2014 3. Fundamentals Metal Forming Processes : B.L.Juneja New age International publishers, 2018 4. Manufacturing Technology : M. Adithan, A.B.Gupta New Age International Publishers, 2012.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME31E4-NON - DESTRUCTIVE TESTING (CE-1)

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -0 - 0
Prerequisite:	Fundamentals of Materials Science and Engineering.	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To introduce the basic principles, techniques and equipment of NDT methods 2. applications and limitations of NDT methods. 3. To enable selection of appropriate NDT methods. 4. To identify advantages and limitations of nondestructive testing methods 5. To make aware the developments and future trends in NDT.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	apply scientific and technical knowledge to the field of non-destructive testing.
	CO2	use the relevant non-destructive testing methods for various engineering practice.
	CO3	differentiate various defect types and select the appropriate NDT methods for the specimen.
	CO4	View and evaluate the test specimen.
	CO5	recognize and achieve high levels of professionalism in their work.
	CO6	Recognition of the need and ability to engage in lifelong learning, thought process and development
Course content	**UNIT – I** **NON-DESTRUCTIVE TESTING:** Introduction, 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. **UNIT – VI** **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 Narosa publishing house 1997. 2. Hand Book of Nondestructive Evaluation: Charles Hellier, McGraw Hill Publishing House, 2003. **REFERENCES:** 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**

17ME31P1- MATERIALS SCIENCE & METALLURGY 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 recognize the process of specimen preparation for testing of materials 2. To acquire knowledge on basic elements of materials microstructures 3. To know various testing methods for materials	
Course Outcomes		On successful completion of the course, the student will be able to,
	CO1	Prepare specimen for metallographic observation.
	CO2	Identify the microstructure of various metals.
	CO3	Explain the various testing methods for materials.
Course content	List of Experiments: 1. Study on Bravais lattices with the help of models. 2. Preparation of specimen for Metallographic examination of different Engineering materials. 3. Study on microstructures of ferrous metals/ alloys. 4. Study on microstructures of Non-Ferrous metals/ alloys. 5. Determination of Harden ability of steel by Jominy end Quench Test. 6. Non-destructive testing: Dye penetration testing. 7. Non-destructive testing: Magnetic particle testing. 8. Study of Iron carbon equilibrium diagram. 9. Study on heat treatment processes (hardening and tempering) of steel specimen. 10. Construct Binary phase diagram for given problems. 11. Study and capture the following of given specimens using Image acquisition software. a) Grain Size b) Phase Analysis. c) Inclusion Rating 12. Study and capture the following of given specimens using Image acquisition software.	

	a) Nodularity b) porosity measurements c) Graphite flake analysis
Text Books and reference Books:	**TEXT 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., Dhanpat Rai and Sons, 2009
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME31P2 -THERMAL ENGINEERING LAB

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

Course Objectives	Students undergoing this course are expected to 1. Demonstrate and conduct experiments, interpret and analyze data and report results of IC Engine testing 2. Study and performance testing of air compressor and air blower. 3. Impart training to draw valve timing diagrams & port timing diagrams on IC engine models. 4. Demonstrate and conduct experiments, interpret and analyze data and report results of Computerized VCR IC Engine testing	
Course Outcomes		
	CO1	Upon successful completion of the course , the students will able to:
	CO2	conduct performance test on I.C. Engines
	CO3	Compare various methods used to determine frictional horse power of the engine
	CO4	identify parts, mechanisms of an IC Engine and the significance of IC Engines
	CO5	conduct performance test on reciprocating compressor
	CO6	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., Dhanpat Rai, 2. Internal Combustion Engines Fundamentals: Heywood, J.V., McGraw-Hill, 1988 3. Internal Combustion Engines :V.Ganeshan, 4th edition, 2005
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17CE31PX- FLUID MECHANICS AND HYDRAULIC MACHINERY LABORATORY

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

Course Objectives		
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	List of Experiments: 1. Discharge Measurements: (a) Small Orifice (b) Venturi Meter (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 and reference Books:	**TEXT BOOKS: Fluid mechanics and hydraulic machines : R.K. Bansal, Lakshmi Publications,2015**	

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17ME31MP -MINI PROJECT

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

Course Objectives	1. To offer students a glimpse into real world problems and challenges that need technical based solutions. 2. To enable students to create and design very precise specifications in the field of mechanical engineering. 3. To introduce students to the vast array of literature available of the various research challenges in the field. 4. To create awareness among the students of the characteristics of several domain areas. 5. To enable students to use all concepts of creating a solution for a problem 6. To improve the team building, communication and management skills of the students	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Discover potential research areas in the field of mechanical engineering.
	CO2	Conduct a survey of several available literature in the preferred field of study.
	CO3	Compare and contrast the several existing solutions for research challenge.
	CO4	Demonstrate an ability to work in teams and manage the conduct of the research study.
	CO5	Formulate and propose a plan for creating a solution for the research plan identified.
	CO6	To report and present the findings of the study conducted in the preferred domain.
Text Books and reference Books:	**TEXT BOOKS:** **REFERENCES:**	
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**	

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY :: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA ANANTAPURAMU)
SPSR NELLORE DIST
III YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION (With effect from the academic year 2017-2018)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks		Duration In Hours	Max. Marks	100
1	17ME3201	Operations Research	2	2	0	3	2	40	2	40	0.8*Best of two+0.2*least of two	3	60	100
2	17ME3202	Machine Dynamics and Vibration	2	2	0	3	2	40	2	40		3	60	100
3	17ME3203	Design of Machine Elements-II	2	2	0	3	2	40	2	40		3	60	100
4	17ME3204	Heat Transfer	2	2	0	3	2	40	2	40		3	60	100
5	17ME3205	Engineering Metrology	3	0	0	3	2	40	2	40		3	60	100
6	17ME32EX	Core Elective – II	3	0	0	3	2	40	2	40		3	60	100
		PRACTICALS												
7	17ME32P1	Dynamics Laboratory	-	-	3	2	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	17ME32P	Heat Transfer Laboratory	-	-	3	2	-	-	-	40		3	60	100
9	17ME32P2	3D Modeling laboratory	-	-	3	2	-	-	-	40		3	60	100
		TOTAL	**14**	**08**	**09**	**24**	**-**	**-**	**-**	**360**		**-**	**540**	**900**
10	17ME32AC	Audit Course	2	0	0	0				40			60	100

17ME3201 - OPERATIONS RESEARCH

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 -2 - 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		
	CO1	Understand the basic operations research concepts and terminology involved in optimization techniques
	CO2	Formulate a real-world problem as a mathematical programming model
	CO3	Understand how to model and solve problems using Simplex method for linear programming and perform iterations of it by hand
	CO4	Understand the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances.
	CO5	Evaluate the Problems using queuing theory
	CO6	Model a dynamic system as a queuing model and compute important performance measures
Course content	**UNIT – I** **LINEAR PROGRAMMING-1:** Introduction to general nature of operations research models, types of OR models. Linear programming – Formulation, graphical method, simplex method, degeneracy in LPP. **UNIT – II** **LINEAR PROGRAMMING-2:** Artificial variable techniques **–** Big M method, two-phase method. Dual simplex method. **NON-LINEAR PROGRAMING:** Introduction to non-linear programming – Lagrangean multiplier technique. Introduction to Dynamic Programming. **UNIT – III** **TRANSPORTATION PROBLEMS**: Formulation, different methods of obtaining initial basic feasible solution – North-West corner rule, least cost method, Vogel's approximation method. Optimal solution using MODI method. Special cases – Unbalanced transportation problem, degenerate problem. **ASSIGNMENT PROBLEMS**: Formulation, optimal solution, unbalanced assignment problem. Travelling salesman problem.	

	UNIT – IV **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-two machines, n jobs-m machines and 2 jobs-m machines. **UNIT – V** **INVENTORY MODELS:** Costs used in inventory models, basic inventory models without shortages. Quantity discounts (price breaks)- Purchasing models with one price, two price and three price breaks. Single period models with probabilistic demand and without set up cost. ABC and VED analysis. **UNIT – VI** **QUEUING THEORY:** 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 arithmatic methods (2x2 Games), principle of dominance, graphical method. **SIMULATION**: Definition, steps in a simulation study, advantages, disadvantages and application of simulation.
Text Books and reference Books:	**TEXT BOOKS:** 1. Introduction to Operations Research : Hamdy A Taha, Prentice Hall, 10th ed., 2017 2. Introduction to Operations Research : S.D. Sharma, Kedar Nath, Ram Nath and Co., 2002 3. Introduction to Operations Research : D.S Hira and P. K. Gupta, S. Chand, 7th Revised ed., 2014 **REFERENCES:** 1. Introduction to Operations Research : Hillier and Lieberman, McGraw-Hill, 10th ed., 2018 2. Operations Research : Panneerselvam R., 2nd ed., PHI, 2011
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME3202- MACHINE DYNAMICS AND VIBRATION

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 -2- 0
Prerequisite:	EM,KOM, DOM.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	At the end of this course, the student will 1. fully understand and appreciate the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions. 2. be able to obtain linear vibratory models of dynamic systems with changing complexities. 3. be able to write the differential equation of motion of vibratory systems. 4. be able to make free and forced (harmonic, periodic, non-periodic) vibration analysis of single and multi degree of freedom linear systems.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Appreciating the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions
	CO2	analyze the mathematical model of a linear vibratory system to determine its response
	CO3	obtain linear mathematical models of real life engineering systems
	CO4	use Lagrange's equations for linear and nonlinear vibratory systems
	CO5	determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation
	CO6	General notion on frequency and time response of vibratory systems
Course content	**UNIT – I** **FORCE ANALYSIS:** **STATICS:** Applied and constraints forces, Two, three and four force members, forces on reciprocating parts of engines. **DYNAMICS:** Inertia force analysis-determination of equivalent dynamical system, inertia forces in a reciprocating engine considering the weight of connecting rod. **UNIT – II** **BALANCING OF ROTATING MASSES**: Static and dynamic balance. Balancing of single rotating mass in the same plane, single rotating mass using two masses rotating in different planes, several masses rotating in the same plane and different planes - using analytical and graphical methods. **UNIT – III** **BALANCING OF RECIPROCATING MASSES**: Partial balancing of locomotives, variation of tractive effort, swaying couple and hammer blow, balancing of single cylinder. **UNIT – IV** **LONGITUDINAL AND TRANSVERSE VIBRATIONS**: Introduction – Single degree of freedom system, differential equation of motion – free longitudinal vibrations, transverse vibrations	

	of beams with concentrated and distributed loads- energy method, Dunkerly's method Whirling of shafts. **UNIT – V** **DAMPED VIBRATIONS**: Introduction, types, free damped vibrations- under, critical and over damped systems, frequency, damping ratio and logarithmic decrement. **UNIT – VI** FORCED VIBRATIONS: Equations of motion, vibration analysis on one dof and two dof systems (simple treatrment). **TORSIONAL VIBRATIONS:** Single, two and three rotor systems and torsionally equivalent shaft.
Text Books and reference Books:	**TEXT BOOKS:** 1. Theory of Machines: R.S.Khurmi and J K Gupta, S.Chand publication, 2015 2. Theory of Machines: Thomas Bevan, 3rd ed., Pearson Education India, 2010. 3. Theory of Machines: S S Rattan, 4th ed., McGraw Hill Education., India Pvt. Ltd., 2014 **REFERENCES:** 1. Mechanisms and Machine Theory : Rao J. S. and Dukkipati R. V., 2nd ed., New Age, 2006 2. Theory of Machines : John J. Uicker, G. R. Pennock, Joseph Edward Shigley, Oxford University Press, 2003
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17ME3203- DESIGN OF MACHINE ELEMENTS-II

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

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Develop an ability to apply knowledge of mathematics, science, and engineering
	CO2	To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
	CO3	To develop an ability to identify, formulate, and solve engineering problems
	CO4	To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course content

UNIT – I

Keys and Couplings: Introduction-Types of keys- Design of square and flat keys; Design of splines. Types of couplings- Rigid couplings**:** Muff, split muff and Flange couplings.

UNIT – II

Bearings: Introduction, Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design.

Ball and roller bearings: Static and dynamic loading of ball and roller bearings, bearing life and reliability, selection of ball bearings.

Introduction to magnetic and ceramic bearings.

UNIT – III

Mechanical Springs: Introduction - Classification of springs; Stress and deflections of helical springs; Springs for fatigue loading; Concentric springs; Design of multi-leaf springs.

UNIT – IV

Spur & Helical Gears : Types of gears and their applications, gear materials, allowable stresses, 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

Bevel & Worm Gears: Bevel gears - Terminology, types of bevel gears, force analysis, design of bevel gears.

	Worm gears: Terminology, materials for gearing, force analysis, design of worm gears, check for wear and lubrication. **UNIT-VI** **I.C. Engine Parts**: Pistons, Forces acting on piston – Construction Design and proportions of piston. Connecting rod: Thrust in connecting rod – stress due to whipping action on Connecting rod ends.
Text Books and reference Books:	**TEXT BOOKS:** 1. Design of Machine Elements : Bhandari V. B., 3rd ed., Tata McGraw-Hill Education 2. Machine Design: Khannaiah P., Scitech Publications. **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 4. Balaveera Reddy & Mahadevan, Design Data Handbook for Mechanical Engineers, CBS publishers, 4th Edition, 2013. **NOTE:** Balaveera Reddy & Mahadevan, Design Data Handbook for Mechanical Engineers, CBS
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME3204 - HEAT TRANSFER

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 2 - 0
Prerequisite:	BTD,ATD-!, ATD-2	**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. To measure heat transfer through different types of heat exchangers	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Recall modes of heat transfer, dimensionless numbers and classifications of heat exchangers
	CO2	Understand laws of conduction, convection, radiation and predict the losses in heat exchange components
	CO3	Apply laws and concepts of conduction for 1D steady state heat conduction problems
	CO4	Apply laws and concepts of convection for simple geometries
	CO5	Analyze and identify problems related to heat transfer in heat exchangers
	CO6	Choose proper heat exchanger for heat exchange applications
Course content	**UNIT – I** **INTRODUCTION:** Modes of heat transfer, basic laws of heat transfer, general heat conduction equation in cartesian, cylindrical and spherical coordinate systems. **STEADY STATE HEAT CONDUCTION** (without internal heat generation and for 1D, Isotropic)**:** Electrical analogy of heat conduction- Expressions for heat flow rate, temperature distribution- Plane slab, hollow cylinder and sphere, composite wall, cylinder and sphere. Overall heat transfer coefficient, critical thickness of insulation. **UNIT – II** **FINS:** Fins of uniform cross section, governing equation, temperature distribution and heat dissipation rate for long fin, short fin-with insulated tip and convective off condition. Efficiency and effectiveness of fins. **TRANSIENT HEAT CONDUCTION FOR 1D:** Lumped heat analysis, significance of Biot and Fourier numbers, heat flow in an infinitely thick plate and chart solutions of transient conduction systems. **UNIT – III** **Forced convection:**	

	EXTERNAL FLOWS: Concepts of hydrodynamic and thermal boundary layer, use of empirical correlations for convective heat transfer - flat plates and cylinders. **Internal Flows:** Concepts of hydrodynamic and thermal entry lengths, use of empirical relations for horizontal pipe flow and annulus flow. **UNIT – IV** **DIMENSIONAL ANALYSIS:** Buckingham's π-theorem, Reynolds Number, Prandtl Number, Nusselt Number, Grashoff Number and Stanton Number - their definition and significance. **FREE CONVECTION:** Development of hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for vertical plates and pipes. **UNIT – V** **HEAT EXCHANGERS:** Introduction, classification of heat exchangers, logarithmic mean temperature difference (LMTD), area calculation for parallel and counter flow heat exchangers, effectiveness of heat exchangers, NTU method of heat exchanger design. **UNIT – VI** **RADIATION:** Theories of thermal radiation- absorption, reflection and transmission. Monochromatic and total emissive power, black body concept, Planck's distribution law, Wien's displacement law, Stefan Boltzmann law, Lambert's cosine law, Kirchhoff's law. Shape factor, heat transfer between black and grey surfaces, radiation shields.
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. Heat and Mass Transfer : D S Kumar, S. K. Kataria & Sons, 2009 **REFERENCES:** 1. Principles of Heat Transfer : Frank kreith, Cengage Learning, 2010 2. Fundamentals of Heat & Mass Transfer : F.P. Incropera & D.P Dewitt, 5th ed., John Wiley and Sons, New York,2002. 3. Heat and Mass Transfer : Yonus Cengel, Tata McGraw-Hill Education, 2014.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME3205 - ENGINEERING METROLOGY

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

Course Objectives	1. To develop in students the knowledge of basics of Measurements, Metrology and Measuring devices. 2. To understand the concepts of various measurement systems & standards with regards to realistic applications. 3. The application of principle of metrology and measurements in industries. 4. To develop competence in sensors, transducers and terminating devises with associated parameters 5. To develop basic principles and devices involved in measuring surface textures.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Explain the basics of standards of measurement, limits, fits & tolerances industrial applications.
	CO2	Identify the uses of gauges and comparators.
	CO3	Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices.
	CO4	Interpret measurement of field variables like force, torque and pressure.
	CO5	Comprehend the fundamentals of thermocouple and strain measurement.
	CO6	Demonstrating correct usage of a method or procedure in metrology.
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- Taylor's principles, Gauge tolerance and wear allowance. **UNIT – II** **ANGLE MEASUREMENT:** Angle gauges, protractors, spirit level, clinometer, sine bar, profile projector, autocollimator, angle dekkor and tool makers microscope. **SLIP GAUGES:** Measurement of internal taper of blind hole and taper ring. Straightness, flatness, squareness and roundness testing. **UNIT – III** **COMPARATORS:** Mechanical, optical, electrical and pneumatic comparators. **INTERFEROMETRY:** Interference of light, optical flat and sources of light, lasers, NPL flatness and gauge length interferometers. **UNIT – IV**	

	SCREW THREAD MEASUREMENT: Pitch and angle errors, concept of Virtual Effective Diameter (VED), measurement of major, minor and effective diameters (wire methods). **GEAR MEASUREMENT**: Nomenclature, involute form tester, rolling gear tester. Tooth thickness measurement - Chordal thickness and base tangent method. **UNIT – V** **SURFACE FINISH:** Importance, elements of surface texture- R_a, R_t & R_z and sampling length. Bearing area curve and form factor. Instruments for measuring surface roughness– Tomlinson surface meter, Talysurf, piezoelectric instruments. Plastic replica method. **UNIT- VI** **ALIGNMENT TESTS:** Lathe, radial drilling machine and milling machine. **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., Dhanpat Rai publishers, 2008. 3. Metrology for Engineers : John Frederick Wise Galyer, Charles Reginald Shotbolt, Cassell P L C, 1990. **REFERENCES:** 1. Engineering Metrology : Mahajan Dhanpat Rai Publishers, 2009. 2. Production Technology : HMT Tata McGraw-Hill Education, 2001.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME32E1 - FLEXIBLE MANUFACTURING SYSTEMS (CE-2)

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 - 0
Prerequisite:	Industrial engineering, production systems	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems.
	CO2	Explain processing stations and material handling systems used in FMS environments.
	CO3	Design and analyze FMS using simulation and analytical techniques.
	CO4	Understand tool management in FMS.
	CO5	Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.
	CO6	

Course content

UNIT – I

INTRODUCTION TO FMS: Definition of FMS, types and configuration concepts, types of flexibility and performance measures. Functions of FMS host computer, FMS host and area controller function distribution.

UNIT – II

DEVELOPMENT AND IMPLEMENTATION OF FMS: Planning phases, integration, system configuration, FMS layouts, simulation, FMS project development steps. Project management, equipment development, host system development, planning, hardware and software development.

UNIT – III

DISTRIBUTED NUMERICAL CONTROL: DNC system – communication between DNC computer and machine control unit – hierarchical processing of data in DNC system – features of DNC system.

UNIT – IV

AUTOMATED MATERIAL HANDLING: Function, types, analysis of material handling equipment. Design of conveyor and AGV systems.

AUTOMATED STORAGE: Storage system performance, AS/RS, carousel storage system, WIP storage, interfacing handling storage with manufacturing.

UNIT - V

PROGRAMMABLE LOGIC CONTROLLERS: Components of PLC, PLC operating cycle, additional capabilities of a PLC, programming the PLC, Ladder logic diagrams, counters etc. Industrial process control using PLC.

UNIT-VI

	FMS RATIONALE: Economic and technological justification for FMS, GT, JIT, operation and evaluation, personnel and infra structural aspects, typical case studies and future prospects.
Text Books and reference Books:	**TEXT BOOKS:** 1. Automation, production systems and computer integrated manufacturing : Groover M. P, Prentice Hall India (P) Ltd., 2002. 2. Flexible manufacturing system : Shivanand H. K., Benal M. M and Koti V, New Age International (P) Limited. Publishers, 2006 **REFERENCES:** 1. Flexible manufacturing : Parrish D. J, Butterworth – Heinemann Ltd, 1990 2. Intelligent manufacturing systems : . Kusiak A., Prentice Hall, Englewood Cliffs, NJ, 1990 3. Performance modelling of automated manufacturing systems : Viswanadhan N. and Narahari Y, Prentice Hall India (P) Ltd., 1992 4. The design and operation of FMS : Ranky P. G, IFS Pub, U. K, 1998
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME32E2 – SOLAR ENERGY ENGINEERING (CE-2)

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 - 0
Prerequisite:	Physic, heat transfer, BTD	**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	Understand the outline and fundamentals of the Sun and its energy transport and Solar radiation geometry
	CO2	Understand the overview of the Flat Plate Collectors and their applications
	CO3	Elucidate the knowledge of focusing type collectors for reducing the disadvantages of flat plat collectors
	CO4	Analyze and compare the different energy storing modes of solar energy
	CO5	Evaluate the suitability of various storage of solar energy modes for different applications
	CO6	Summarize and operational characteristics for the applications of solar energy
Course content	**UNIT – I** **THE PHYSICS OF SOLAR ENERGY:** 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 and materials. **UNIT – III** **CONCENTRATING COLLECTORS:** Importance, types, performance analysis of cylindrical parabolic concentrating collector, advantages and disadvantages of concentrating collectors over flat plate collectors. **UNIT – IV** **SOLAR ENERGY STORAGE**: Types, thermal- sensible, latent, phase change materials. **PHOTOVOLTAIC SYSTEMS**: Semiconductors, Photovoltaic panels. Types of photovoltaic technologies; Equipment related to photovoltaic technology, batteries, invertors, charge controllers, peak power trackers.	

	UNIT – V **SOLAR HEATING**: Solar Water heating, Passive solar water heating systems, Thermal siphon systems, Integrated collector storage systems. **SOLAR COOKERS AND SOLAR DRIERS:** Types of solar cookers - Solar box type solar cooker, SK type solar cooker (parabolic), Solar steam cooking system. Classification of solar dryers - Active and passive solar energy dryers. **UNIT – VI** **SOLAR APPLICATIONS:** Solar pumping, solar distillation, solar green houses, solar production of hydrogen, space cooling. **SOLAR THERMAL POWER SYSTEMS**: Solar thermal power generation schemes, parabolic trough solar power generating systems, central receiver power plants (solar power towers), chimney power plants.
Text Books and reference Books:	**TEXT BOOKS:** 1. Solar Energy Utilization : G.D. Rai, Khanna Publishers, 2004. 2. Principles of Solar Engineering : Frank Kreith and Jan F Kreider, Taylor & Francis, 2000. **REFERENCES:** 1. Solar Energy Thermal Process : Dufice & Beckman, John Wiley & Sons, 1991 2. Solar Energy and Non-conventional Energy Sources : Domakundwar, Dhanpat Rai & Co., Pvt. Ltd., 2018
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17ME32E3 – TOOL DESIGN (CE-2)

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	Machine drawing, metrology, DME	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Calculate the values of various forces involved in the machining operations.
	CO2	Design various single and multipoint cutting tools.
	CO3	Demonstrate the inter-relationship between cutting parameters and machining performance measures like power requirement, cutting time, tool life and surface finish.
	CO4	Analyze economics of machining operations.
	CO5	Identify press tool requirements to build concepts pertaining to design of press tools.
	CO6	Demonstrate various press working operations for mass production of sheet metal parts.

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, velocity relations, forces acting on a tool, Merchant circle diagram, 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, machinabilty, heat distribution in metal cutting, measurement of temperature in metal cutting. Force measurement - lathe tool dynamometer.
Selection and applications of cutting fluids.

UNIT – III

CUTTING TOOL MATERIALS: Requirements of tool materials, advances in tool materials, HSS, Coated HSS, Carbides, Coated Carbides, Ceramics, Ceramic Composites, CBN and Diamond properties, advantages and limitations, specifications for inserts and tool holders.

UNIT – IV

ECONOMICS OF MACHINING: Costs associated with machining operations- Optimum cutting speed for minimum cost and maximum production rate in turning.
DESIGN OF CUTTING TOOLS: Design of single point cutting tool shanks, design of plane milling cutter and broaching tool.

UNIT – V

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 – VI

JIGS & FIXTURES - Uses, Locating devices, 3-2-1 principle of location, pin location, radial

	location, 'V' location, 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.
Text Books and reference Books:	**TEXT BOOKS:** 1. Fundamental of Tool Design : ASTME, PHI, 2010 2. A Text Book of Production Engineering: P.C. Sharma, S. Chand & Co. 11th ed., 2005 3. Fundamental of Metal Cutting and Machine Tools: B.L.Juneja and G.S.Sekhon, 2nd ed., New Age International 2017. **REFERENCES:** 1. Metal Cutting Principles: Milton C.Shaw, Oxford University Press, 2012. 2. Introduction to Jig and Fixture Design: Kempster, Hodder and Stoughton Publishers, 2004 3. Metal cutting (Theory and Practice): A. Bhattacharya, New central book agency, 2012. 4. Tool Design : Donaldson, Tata Mc Graw Hill, 3rd ed., 2010
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME32E4 – TRIBOLOGY (CE-2)

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	MSM, Metrology	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To provide overview of tribology and practical implications in machine elements. 2. To understand the material properties, nature of surfaces, their topography and surface characterization techniques. 3. To understand the genesis of friction, the theories/laws. 4. To learn about wear, wear mechanisms, wear theories applied in machine elements.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Apply the principles of lubrication, lubrication regimes, and theories of hydrodynamic, elasto hydrodynamic and mixed / boundary lubrication.
	CO2	Explain essentials of tribotesting and experimental techniques in Tribology.
	CO3	Discuss and formulate tribological modelling and simulation.
	CO4	Design of mechanical components against wear.

Course content

UNIT – I

INTRODUCTION: Elements of tribology, viscosity, flow of fluids, viscosity and its variation, absolute and kinematic viscosity, temperature variation, viscosity index, determination of viscosity, different types of viscometers.

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, Sommerfield number, heat balance, practical consideration of journal bearing design considerations.

UNIT – V

AIR LUBRICATED BEARING: Advantages and disadvantages, application to hydrodynamic journal bearings, hydrodynamic thrust bearings, hydrostatic thrust bearings, hydrostatic bearing analysis including compressibility effect.

UNIT – VI

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. Majumdar Newdelhi, 2nd edition, S.Chand & Co Publishers, 2012. 2. Engineering Tribology : Pransanta Sahoo, PHI Pvt.Ltd, 2005
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME321 - DYNAMICS LABORATORY

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

Course Objectives	1. To study the mathematical simulation software for analysis of single and multi degree freedom problem. 2. To study the finite element analysis software for different analysis and active control vibration. 3. Perform experimentation and processing the data and demonstration of condition based maintenance tool. 4. To give understanding various aspects of mechanical vibrations and their control.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Apply and analyze different systems using mathematical simulation software.
	CO2	Apply FEA software for different analysis techniques.
	CO3	Demonstrate acquiring and processing of data.
	CO4	Have understanding about the effect of vibration and vibration control
Course content	**List of Experiments:** 1. Test on gyroscopic unit. 2. Test on critical speed analyzer. 3. Test on vibration test rig. 4. Study balancing of reciprocating masses 5. Study on balancing of rotating masses 6. Test on Proell Governors 7. Test on Porter Governors 8. Test on Hartung Governors 9. Study on reciprocating mechanism. 10. Test on CAM apparatus 11. Study on crank and slotted mechanism 12. Estimation of CG of connecting rod using Trifilar system	
Text Books and reference Books:		

17ME32P - HEAT TRANSFER LABORATORY

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

Course Objectives	1. To experimentally determine thermal conductivity of various materials 2. To experimentally measure heat transfer coefficients of forced and natural convection 3. To experimentally measure emissivity of grey surface 4. To experimentally measure effectiveness of heat exchangers 5. To conduct performance tests on refrigeration & air conditioning systems	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Practically relate to concepts discussed in the Heat Transfer course.
	CO2	Conduct various experiments to determine thermal conductivity of various materials.
	CO3	Determine heat transfer coefficients of forced and natural convection
	CO4	conduct performance tests and thereby improve effectiveness of heat exchangers
	CO5	conduct performance tests and thereby improve performance of refrigeration and air conditioning systems
	CO6	experimentally investigate emissivity of grey surface
Course content	**List of Experiments:** 1. Test on Conduction in Composite Wall. 2. Test on Emissivity Measurement Apparatus. 3. Test on Lagged Pipe Apparatus. 4. Test on Stefan-Boltzmann Apparatus. 5. Test on Natural Convection Apparatus. 6. Test on Forced Convection Apparatus. 7. Test on Drop-wise Condensation Apparatus. 8. Test on Vapour Compression Refrigeration System. 9. Test on Air-Conditioning Test Rig. 10. Test on thermal conductivity of insulating powder 11. Test on pin fin apparatus	

	12. Test on critical heat flux 13. Test on heat pipe apparatus 14. Test on Thermal Conductivity of a Metal Rod.
Text Books and reference Books:	

17ME32P2 - 3D MODELING LABORATORY

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

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Develop components using design software
	CO2	Assemble and animation of working 3D model
	CO3	Developing and drawing surface and sheet metal modelling
	CO4	Design piping and wire harnessing
Course content	List of Experiments for 3D Modelling Laboratory 1. Part Modelling 2. Drawing & Detailing 3. Assemble 4. Surface Modelling 5. Sheet Metal Modelling 6. Piping Design 7. Wire Harness Routing Design Minimum one exercises from each above module and maximum 8 exercises	
Text Books and reference Books:		

17ME32AC- PROFESSIONAL ETHICS & LIFE SKILLS

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

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	To prepare them on problem solving skills
	CO2	To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
	CO3	To create an awareness on Engineering Ethics and Human Values.
	CO4	To instill Moral and Social Values, Loyalty and also to learn to appreciate the rights of others
	CO5	To learn leadership qualities and practice them

Course content

UNIT-1

QUANTITATIVE APTITUDE

Number System-L.C.M & H.C.F- Find the Unit digit-Remainder Theorem- Problems on Ages-Problems on Averages-Percentages-Simple Interest-Compound Interest-Profit and Loss, Permutations and Combinations, Probability, Boats and Streams- Pipes and Cisterns- Data Interpretation-Table Graph-Bar Graph- Line Graph- Pie Chart.

UNIT-2

REASONING

Number and Letter Series- Coding and Decoding, Directions, Classifications-Venn Diagrams-Syllogism-Seating Arrangement-Analogy-Blood Relation-Clocks-Calendars- Puzzle Test-Coded Inequality- Data Sufficiency.

UNIT-3

PROFESSIONAL ETHICS AND HUMAN VALUES

Human Values: Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Cooperation – Commitment – Empathy – Self-Confidence – Character – Spirituality

UNIT-4

BUSINESS ETIQUETTE AND PERSONAL GROOMING

Making a Great First Impression: How to present yourself to people, Greetings, Introductions The art of small talk - How to make proper introductions, Paying & Receiving Compliments, Small Talk & Networking ,Developing Professional and Personal Image, Personal Hygiene & Polish interpersonal skill.

Etiquette of Dressing: The do's and don'ts in dressing**,** Understanding various dress codes, Clothes and Corporate Culture

UNIT -5

ACCENT NEUTRALIZATION - P – Pitch, **I** – Inflection, **C** – Courtesy, **T** – Tone,
U – Understanding, **R** – Rate of speech & E – Enunciation

Identifying and dealing with Mother Tongue Influence (MTI)

	Preparation for interviews: Conducting Research & Commonly asked questions, speaking up during interviews, GDs, Debate & Resume Building. **UNIT - 6** **VERBAL ABILITY** Essay Writing, Comprehension, Email writing, Correction of Sentences, Synonyms & Antonyms
Text Books and reference Books:	**References:** 1. R.S.Agarwal, Quantitative Aptitude 2. R.S.Agarwal, Non-Verbal Reasoning 3. Dr. Alex,"Soft Skills"- Know Yourself & Know the World 4. Meenakshi Raman and Sangeeth Sarma- Communication 5. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint)

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 JNTUA ANANTAPURAMU)
SPSR NELLORE DIST
IV YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION (With effect from the academic year 2017-2018)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks	0.8*Best of two+0.2*least of two	Duration In Hours	Max. Marks	100
1	17ME4101	Finite Elements Method	2	2	0	3	2	40	2	40		3	60	100
2	17ME4102	Refrigeration and Air-conditioning	2	2	0	3	2	40	2	40		3	60	100
3	17ME4103	CAD/CAM	3	0	0	3	2	40	2	40		3	60	100
4	17ME4104	Robotics	3	0	0	3	2	40	2	40		3	60	100
5	17ME41EX	Core Elective – III	3	0	0	3	2	40	2	40		3	60	100
6	17YE41OX	Open Elective – I	3	0	0	3	2	40	2	40		3	60	100
		PRACTICALS												
7	17ME41P1	Metrology and Instrumentation Laboratory	-	-	3	2	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
8	17ME41P2	Automation and Robotic Laboratory	-	-	3	2	-	-	-	40		3	60	100
9	17ME41P3	CAE/CAM Laboratory	-	-	3	2	-	-	-	40		3	60	100
		TOTAL	**16**	**04**	**09**	**24**	**-**	**-**	**-**	**360**		**-**	**540**	**900**

17ME4101- FINITE ELEMENTS METHOD

Course category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2- 2 - 0
Prerequisite:	Engineering mathematics, SOM, HT.	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40M 60M 100M

Course Objectives	1. To provide the student with some knowledge and analysis skills in applying basic laws in mechanics 2. Integration by parts to develop element equation for a spring element 3. Steps used in solving the problem by finite element method.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Formulate simple types of finite elements and apply appropriate boundary conditions.
	CO2	Apply finite element method for obtaining solutions to problems in solid mechanics, Static, transient bulking analysis to be conducted.
	CO3	Discuss variation and Galerkin method for Stiffness Matrix formulation.
	CO4	Assess stresses and strains in complex mechanical systems and interpret structural behavior of components by analyzing post processor result.
	CO5	Formulate and solve simple heat transfer and fluid mechanics problems
	CO6	Identify significant applications of FEM in Manufacturing.

Course content

UNIT – I

INTRODUCTION

EQUATIONS IN SOLVING A STRUCTURAL PROBLEM: Stress at a point, Equations of equilibrium, Strain-Displacement relations, Stress-Strain Relations and Compatibility conditions.

Need for FEM, Comparison with finite difference method, general procedure for finite element analysis, evaluation of circumference and area of circle. Boundary value, initial value problems and scalar field problems.

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WEIGHTED RESIDUAL METHODS: Simple, collocation, Rayleigh-Ritz and Galerkin's methods for bars.

UNIT – II

FINITE ELEMENT FORMULATION FROM WEAK FORM: Derivation of element equations for 1-D bar and 1-D heat conduction elements.

FINITE ELEMENT FORMULATION BASED ON PSTP: Concept of functional, PSTP,finite element formulation of 1-D bar element from PSTP,meaning of finite element equation.

UNIT – III

1-DFINITE ELEMENT ANALYSIS: General form of total potential in 1-D for structural problems,generic form of FE equations,linear bar element, quadratic bar element, derivation of shape functions and element matrices from generic form.

TRUSSES: Global & element coordinate systems, transformation matrices.

	UNIT – IV **APPLICATIONS OF 1-D FINITE ELEMENT ANALYSIS:** Element equations for discrete systems, linear elastic springs, torsion of circular shafts and flow through pipes,heat transfer element with lateral heat loss (fins), 1-D beam element – degrees of freedom, shape functions and element matrices. **UNIT – V** **2-DFINITE ELEMENT ANALYSIS:** Dimensionality of a problem-plane stress, plane strain and axis-symmetric simplification of structural problems. Approximation of geometry and field variable- simple 3-node triangular element, 4-node rectangular element. Natural coordinates for 4-node quadrilateral element.Generic relations for 4-node rectangular element. **UNIT – VI** **2-D FINITE ELEMENT ANALYSIS:**Numerical integration, Gaussian quadrature in two dimensions. Imposition of boundary conditions and solution of static equilibrium equations.**DYNAMIC ANALYSISUSING FEM:** Formulation for axial vibration of a bar and transverse vibration of a beam. **COMPUTER IMPLEMENTATION:** Outline of aFinite element program.
Text Books and reference Books:	**TEXT BOOKS:** 1.A Text Book of Finite Element Analysis: P.Seshu, PHI, 2009 2.An Introduction to Finite Element Method: Reddy J.N. McGraw HillEdition, 3rd ed., 2005. 3.Introduction to Finite Element in Engineering : Tirupati Chandrupatla and Belegundu, Pearson Education, 4th Revised, 2012. **REFERENCES:** 1.Applied Finite Element Analysis : Larry J Segerlind–John Wiley& Sons., 1976. 2.Finite Element Method : S. S. Rao,Butterworth Heinemann publisher, 2005. 3. Fundamentals of Finite Element Analysis : David V. Hutton TMH Publishers, 2003.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME4102 - REFRIGERATION AND AIR-CONDITIONING

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 2 - 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	Explain the principle of refrigeration, cycles, properties and its environment effects.
	CO2	Explain vapor compression systems and different processes, equipment.
	CO3	Describe the working principle of various types of refrigeration systems.
	CO4	Discuss psychrometric properties and processes, and air conditioning process.
	CO5	Estimate cooling load factor, winter and summer air conditioning load and human comfort condition.
	CO6	Compare refrigeration and air conditioning systems and make choices for a required application

Course content

UNIT – I

REFRIGERATION: Introduction, methods of refrigeration, thermodynamic analysis of air cycle and vapor compression refrigeration systems. Vapor absorption system – working of NH_3 - water and LiBr – water systems, working of steam jet and thermoelectric refrigeration systems.

UNIT – II

REFRIGERANTS: Properties, classification, nomenclature and selection of refrigerants, alternative refrigerants.

COMPONENTS: Compressors – classification, working of reciprocating and rotary compressors. Condensers – air cooled, water cooled, evaporative condensers, economical water rate, cooling towers, evaporators.

UNIT – III

DEFROSTING OF EVAPORATORS: Introduction, methods of defrosting- automatic periodic defrosting, defrosting by reversing cycle, automatic hot gas defrosting, thermo bank defrosting and electric defrosting.

REFRIGERATION CONTROL: Automatic and thermostatic expansion valve, capillary tube, compressor controls, miscellaneous controls. Testing and charging of refrigeration units.

	UNIT – IV **AIR CONDITIONING:** Fundamental functions of air conditioning, psychrometric properties and processes, sensible heat factor, analysis of air conditioning processes and cycles with psychometric chart, cooling load calculations. **UNIT – V** **AIR CONDITIONING SYSTEMS:** Summer, winter, year-round and central systems. **COMFORT AIR CONDITIONING:** Physiological reactions to cooling, the effective temperature and its use in the determination of standards of comforts, comfort chart. **CONTROLS:** Automatic control of air conditioning systems, air cleaning, ducts, fans. **UNIT – VI** **CRYOGENICS:** Introduction, cascade system, liquefaction of gases- air, H_2, applications of low temperature. **APPLICATIONS OF REFRIGERATION:** Walk-in-cooler, water coolers, refrigerators, transportation, food processing & preservation. **APPLICATIONS OF AIR CONDITIONING:** Domestic, industrial and commercial applications.
Text Books and reference Books:	**TEXT BOOKS:** 1. A Course in Refrigeration and Air Conditioning : Arora S.C. & Domkundwar S., Dhanpat Rai & Company, 2006 2. Refrigeration and Air Conditioning : C.P. Arora, Tata McGraw Hill, 2000 **REFERENCES:** 1. Refrigeration and Air Conditioning : Jordan & Priester, Constable and Company Ltd., 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**

17ME4103- CAD/CAM

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

Course Objectives	The general objectives of the course are to enable the students to 1. Understand the basic analytical fundamentals that are used to create and manipulate geometric models in computer programs. 2. To visualize how the components looks like before its manufacturing or fabrication 3. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc 4. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. 5. To understand the different types of curves like Bezier curve, B-Spline curve & Graphics Standards 6. To understand different Algorithms for optimization of drawing of basic entities	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces
	CO2	use parametric 3D CAD software tools in the correct manner for making geometric part models and different wireframe primitives using parametric representations
	CO3	create surface primitives using parametric modeling and solid primitives using the different representation schemes.
	CO4	apply the concepts of machining for the purpose of selection of appropriate machining centers, machining parameters, select appropriate cutting tools for CNC and programming.
	CO5	perform design and analysis of automatic storage and retrieval system to solve the design problems of different type of transfer mechanism
	CO6	Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.
Course content	**UNIT – I** **INTRODUCTION TO CAD**: Design process, product cycle, applications of computers for design, benefits of CAD. **COMPUTER GRAPHICS**: 2D Transformations, points and lines transformation - translation, rotation, scaling, mirror, reflection. Introduction to 3D transformations, windowing and clipping. **UNIT – II** **GEOMETRY MODELING:** Modeling concepts - 2D and 3D, comparison between wire frame modeling, surface modeling and solid modeling. **WIRE FRAME MODELING**: parametric and non-parametric representation of curves - line, circle, ellipse, cubic spline, B-splines, Bezier curve. Hidden line algorithm.	

	UNIT – III **SURFACE MODELING:** Surface description, parametric representation of cylindrical surface, ruled surface, surface of revolution, cubic, B-Splines and Bezier surfaces. **SOLID MODELING:** CSG and B-Rep methods. **UNIT – IV** **CNC:** Numerical control, numerical control modes, numerical control elements, DNC, CNC **PART PROGRAMMING**: Manual part programming, Computer Aided part programming (APT) **UNIT – V** **CIM**: Definition, divisions of CIM, advantages and disadvantages. **GROUP TECHNOLOGY**: Introduction, concepts of GT, classification and coding System-OPTIZ, application of GT **FMS**: Definition, need, flexibilities, components, advantages. **COMPUTER AIDED PROCESS PLANNING**: Variant and Generative CAPP systems. U**NIT – VI** **AUTOMATIC IDENTIFICATION METHODS:** Bar code Technology, QR code, contact & non-contact type, concepts and uses. **BASIC CONCEPTS OF SHOP FLOOR DATA**: Types of factory data and collection systems. **AUTOMATED MATERIAL HANDLING SYSTEMS**: AS/RS, Conveyers – types, RGVS, AGVS and their applications.
Text Books and reference Books:	**TEXT BOOKS**: 1. Automation Production System & CIM : Groover M.P., Pearson, 4th ed., 2016 2. CAD / CAM : Ibrahim Zeid, Tata McGraw Hill, 5th Reprint, 2010 3. Mathematical Elements of Computer Graphics: Rogers and Adams, McGraw Hill, 2017. **REFERENCES:** 1. CAD/CAM : Groover M.P., Pearson, 2003. 2. Computer Graphics : Steven Harrington, McGraw Hill, 2nd ed., 2014. 3. CAD/CAM : Besant and Lui, E. Horwood publisher, 1986
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME4104- INDUSTRIAL ROBOTICS

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 - 0
Prerequisite:	Mathematics, mechanics, robotics	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	The course shall give knowledge about the importance of robotics in today and future and robot configuration and subsystems
	CO2	The course shall give knowledge about robotic accessories such as sensors grippers
	CO3	The course shall give knowledge about robot path planning
	CO4	The course shall develop skills in develop skills in kinematics of robot motion
	CO5	The course shall give competence in Design and implementation programming of robot systems
	CO6	The course shall give knowledge about Industrial robots applications.

Course content

UNIT – I

INTRODUCTION: Definition of robot, necessity, advantages and disadvantages of robots, basic components of a robotic systems, robot joints, degrees of freedom, configurations of robots – cartesian, cylindrical, spherical, articulated, SCARA, work volume, specification of a robot- load carrying capacity (pay load), reach, stroke, speed of motion, speed of response, stability, repeatability, resolution and Accuracy.

UNIT – II

DRIVES/ACTUATORS: Hydraulic, pneumatic and electrical. Stepper motors, brushless motors, servo motor, comparison of drives.

ROBOT GRIPPERS: Types of end-effectors/grippers, mechanical grippers.

ROBOT SENSORS: Position, velocity, force, tactile, range, proximity sensors, machine vision - elements of machine vision.

UNIT – III

ROBOT CLASSIFICATION: Servo and non-servo controlled robots, limited sequence, Point to point, continuous and intelligent robots

TRAJECTORY PLANNING: Path vs trajectory, joint space and cartesian space schemes, basics of trajectory planning, Joint space trajectory including via points - cubic polynomials, cartesian straight-line trajectory.

UNIT – IV

KINEMATIC ANALYSIS OF ROBOTS: Homogeneous transformation matrices, inverse of transverse transformation, forward and inverse kinematics of robot, DH matrix, HT of robot coordinate system, 2R and 3R robot manipulators.

DYNAMICS: Introduction to robot dynamics.

	UNIT – V **ROBOT PROGRAMMING:** Importance, types, manual setup, lead through programming, textual programming languages, commands for elementary operations - RAPID. **UNIT – VI** **APPLICATIONS OF ROBOT:** Material handling, machine loading/unloading, assembly, inspection etc., robot work cells. Safety aspect and economic analysis.
Text Books and reference Books:	**TEXT BOOKS:** 1. Saeed B. Niku, Introduction to Robotics : Analysis, Systems, Applications, Pearson Education Inc., 2001 2. Industrial Robotics, Technology, Programming and Applications: Groover M.P., Weiss M. and Odrey N.G., McGraw Hill Higher Education, 2nd ed., 2012. 3. Robotics, Fundamental Concepts and analysis : Ashitave Ghosal, Oxford Press, 1st ed., 2006. **REFERENCES:** 1. Robotics and Control : R.K.Mittal and I J. Nagarath, McGraw Hill, 2015 2. Robotics : Fu K S, R.C. Gonazalez and C.S.G Lee, McGraw Hill, 2008 3. Introduction to Robotics, Mechanics and Control: John J.Craig, Pearson Education, 3rd ed., 2009.
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17ME41EX - POWER PLANT ENGINEERING (CE-3)

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -0 - 0
Prerequisite:	BTD, ATD-1	**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 and analyze different sources of energy, types of power plants and layouts.
	CO2	Discuss and analyze the working and layout of steam power plants.
	CO3	Discuss and analyze working principle of diesel and hydro power plant.
	CO4	Describe the working principle and basic components of the nuclear power plant and safety.
	CO5	Discuss the working principle and basic components of renewable energy based plants.
	CO6	Discuss and analyze the economic aspects and compare it with plants of other types.
Course content	**UNIT – I** **COAL BASED THERMAL POWER PLANTS:** Introduction, layout of modern steam power plant-components, fuel and ash handling, draught system, feed water treatment, Rankine cycle-improvisations. **UNIT – II** **HYDRO ELECTRIC POWER PLANTS:** Layout - dams- selection of water turbines- types, pumped storage hydel plants, site selection and safety. **UNIT – III** **DIESEL ENGINE AND GAS TURBINE POWER PLANTS:** Diesel engine power plant layout – components, various operating systems, merits, demerits and applications. Gas turbines – working, types, methods to improve power output and efficiency, layout with inter-cooling, reheating and regeneration. **UNIT – IV** **NUCLEAR POWER PLANTS:** Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium Uranium reactor (CANDU), breeder, gas cooled and liquid metal cooled reactors. Safety measures for Nuclear Power plants.	

	UNIT – V **RENEWABLE ENERGY BASED PLANTS AND MHD PLANTS:** Power from wind – wind turbine working and types. Solar thermal power plants – low medium and high power generation, power from wave, tidal, geothermal sources, OTEC system, MHD power plants – working, types, merits and demerits. **UNIT – VI** **ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS:** Power tariff types, load distribution parameters, load curve, comparison of site selection criteria, relative merits & demerits, capital & operating cost of different power plants. Pollution control technologies including waste disposal options for coal and nuclear power plants.
Text Books and reference Books:	**TEXT BOOKS:** 1. Power Plant Engineering : Nag. P.K., Tata McGraw Hill Publishing Company Ltd., 3rd ed., 2008. 2. A Course in Power Plant Engineering : Arora and Domkundwar, Dhanpat Rai and Co. Pvt.Ltd., 2014. 3. Power Plant Engineering: Rajput R.K. Laxmi Publications, 5th ed., 2016. **REFERNCES:** 1. Renewable Energy : Godfrey Boyle, Open University, Oxford University Press in association with the Open University, 2004. 2. Power Plant Technology : El-Wakil. M.M., Tata McGraw Hill Publishing Company Ltd.,2010. 3. Power Plant Engineering : Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of McGraw Hill, 2nd ed., 1998. 4. Power Plant Engineering : Black & Veatch, Springer, 1996. 5. An Introduction to Power Plant Technology : G.D. Rai, Khanna Publishers, 3rd ed., 1987
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME41E1 - PRODUCTION SYSTEMS (CE-3)

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 -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 the outline and fundamentals of the production systems
	CO2	Solve routing and scheduling problems
	CO3	Recognize the importance of facility location models
	CO4	Solve operational problems in the areas of aggregate production planning.
	CO5	Apply the principles and techniques for planning and control of the production and service systems to optimize/make best use of resources
	CO6	Summarize various aggregate production planning techniques.
Course content	**UNIT – I** **PRODUCTION**: Systems concept of production, types of Production – Continuous production (mass production, process production and assembly lines) and Intermittent production (job type and batch type), Lean and Agile Manufacturing, Just-in-time (JIT), KANBAN systems. **UNIT – II** **PRODUCTIVITY**: Introduction, types of productivity, factors affecting productivity, techniques for improving productivity. **PRODUCT DESIGN AND ANALYSIS**: Introduction, steps of product design, process planning and design, responsibilities of process planning engineer, steps in process planning. **UNIT – III** **SINGLE FACILITY LOCATION MODEL**: Rectilinear minimum, Rectilinear minimax, Squared Euclidean distance location problem and Euclidean distance location problem. **MULTI FACILITY LOCATION MODEL** – Squared Euclidean distance location problem. Travel chart and REL chart.	

	UNIT – IV **ASSEMBLY LINE BALANCING**: RPW method, COMSOAL method. **MATERIALS REQUIREMENT PLANNING:** Introduction, Lot sizing in MRP – EOQ method, minimum cost per period method, period order quantity method, least unit cost method and part period balancing method. MRP–II. **UNIT – V** **VALUE ANALYSIS**: Types of values, aim of value analysis, technique and procedure of value analysis, and advantages. **AGGREGATE PLANNING**: Introduction, Aggregate Planning Strategies – varying work force, changing inventory level and subcontracting. Transportation model for Aggregate planning. **UNIT – VI** **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.
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, PHI Publications, 2nd ed., 2003. **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**

17YE41O2 - QUALITY CONTROL AND RELIABILITY (CE-3)

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

Course Objectives	• Demonstrate the approaches and techniques to assess and improve process and/or product quality and reliability. • Introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring • Illustrate the basic concepts and techniques of modern reliability engineering tools.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand the basic techniques of quality improvement, fundamental knowledge of statistics and probability
	CO2	Categorize the process in control or out of control using various types of charts (p, np, C, U charts).
	CO3	Use control charts to analyze for improving the process quality
	CO4	Describe different sampling plans and identify the sampling plan suitable for the process.
	CO5	Discuss the various parameters of life testing of components such as MTTF,MTBF
	CO6	Understand the concepts of reliability and maintainability
Course content	**UNIT – I** **QUALITY CONTROL**: Introduction to inspection and quality control, objectives of statistical quality control, chance and assignable causes of variation, control chart basic principles. **CONTROL CHARTS FOR VARIABLES**: $\bar{X}$ and R charts, interpretation of control charts. **UNIT – II** **PROCESS CAPABILITY ANALYSIS**: Specification limits and control limits, natural tolerance limits, specifications and process capability, process capability indices, setting tolerances on assemblies and components. **UNIT – III** **CONTROL CHARTS FOR ATTRIBUTES**: P chart, C chart, U chart, sensitivity analysis of P charts, quality Rating System.	

	UNIT – IV **ACCEPTANCE SAMPLING PLANS FOR ATTRIBUTES**: Types of sampling plans, advantages and disadvantages of sampling plans, evaluation of sampling plans – OC curve, characteristics of OC curve, producer risk and consumer risk, AOQ, AQL, ATI, ASN. Double sampling plan – OC curve. **UNIT – V** **RELIABILITY**: Concepts of reliability, scope, Importance of reliability, reliability data collection. Failure data analysis: MTTF, MTBF, failure rate, hazard rate. **SYSTEM RELIABILITY**: Series, parallel and mixed configurations. **RELIABILITY IMPROVEMENT**: Active and standby redundancies, introduction to fault tree analysis. **UNIT – VI** **QUALITY COSTS**: Prevention, appraisal, internal failure and external failure costs, total quality management, quality function deployment, tools for continuous quality improvement. **QUALITY CIRCLES**: Concepts, objectives and advantages. Introduction to six sigma concept. Features of ISO 9000 quality system - Classification, need, advantages and limitations.
Text Books and reference Books:	**TEXT BOOKS:** 1. Quality Control : Dale H Besterfield, Pearson Education, 2006. 2. Statistical Quality Control : Gupta R.C., Khanna Publishers, 2008. 3. Statistical Quality Control : M. Mahajan.,Dhanpat rai & Co., 2009. **REFERENCES:** 1. Fundamentals of Quality Control and Improvement : Amitava Mitra, PHI, 2009 2. Concepts in Reliability Engineering : Srinath L.S., East West Press, 2009.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME31E3- RAPID PROTOTYPING (CE-3)

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

Course Objectives	1. Advanced prototyping and fabrication skills useful in the construction of physical objects. 2. Sketching, drawing, and CAD as a medium to communicate and iterate initial prototype ideas. 3. Chaining together multiple manufacturing processes to convert an idea to a physical part.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Describe product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications.
	CO2	Explain direct metal laser sintering, LOM and fusion deposition modeling processes.
	CO3	Demonstrate solid ground curing principle and process.
	CO4	identify, characterize and select the ideal materials for a given Rapid Prototyping system.
	CO5	Discuss LENS, BPM processes; point out the application of RP system in medical field define virtual prototyping and identify simulation components
	CO6	Rapidly prototype, via models or sketching, rough ideas to communicate a project idea.
Course content	**UNIT – I** **INTRODUCTION:** Need for time compression in product development, history of RP system, Survey of applications, classification of RP system, reverse engineering, design process and rapid prototyping cycle, additive manufacturing Vs CNC. **UNIT – II** **STEREOLITHOGRAPHY:** Principle, apparatus, build materials, machine details, process parameters, dimensional accuracy, advantages, limitations and applications. **SOLID GROUND CURING:** Principle of operation, advantages, limitations and applications. **UNIT – III** **FUSION DEPOSITION MODELING:** Principle, build and support materials, system parameters, basic operating techniques, applications. **LAMINATED OBJECT MANUFACTURING**: Principle of operation, LOM materials, process details, applications. **UNIT – IV** **SELECTIVE LASER SINTERING:** Introduction to laser, laser generation methods, selective laser process – principle, materials for SLS, process parameters, applications, comparison with SLA. **CONCEPTS MODELERS:** Principle, thermal jet printer, Sander's model maker, Multi-Jet Modeller, 3-D printer, Genisys Xs printer, JP system, object quadra system.	

	UNIT – V **RAPID TOOLING:** Indirect rapid tooling, silicon rubber tooling, aluminum filled epoxy tooling, spray metal tooling, direct rapid tooling, direct quick cast process, rapid tool, DMLS, prometal, sand casting tooling, laminate tooling, soft tooling vs hard tooling. **UNIT – VI** **ALLIED PROCESS:** Laser Engineering Net Shaping (LENS), vacuum casting. **SOFTWARE ISSUES:** STL format and slicing, surface digitizing, surface generation from point cloud, surface modification- data transfer to solid models, factors influencing accuracy.
Text Books and reference Books:	**TEXT BOOKS:** 1. Rapid Prototyping Technology, Kenneth G. Cooper, Marcel Dekker, INC., 2001 2. Rapid Manufacturing, Pham D.T & Dimov S.S, Verlog London 2001. 3. Rapid Prototyping and Tooling : Hari Prasad & K S Badarinarayan – Surya Infotainment products, Pvt. Ltd, Bangalore, 2013. **REFERENCES:** 1. Third National Conference on Rapid Prototyping, Tooling & Manufacturing – CRDM – Professional Engineering Publishing Co. 2. Rapid Prototyping and Engineering Applications –Frank W Liou – CRC Press – Taylor & Francis Group, 2007.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17YE41O1 - BUILDING TECHNOLOGY (OE-1)

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

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Identify and use correctly a wide variety of hand and power tools associated with the construction industry
	CO2	Understand current construction industry trends and become familiar with standards for quality construction and trends in building technology
	CO3	Demonstrate proper techniques associated with residential and commercial construction
Course content		

UNIT – I

BUILDING MATERIALS -I: Stones: Properties of building stones, relation to their structural requirements, classification of stones, stone quarrying, precautions in blasting, dressing of stone. **Bricks:** Composition of good brick earth, various methods of manufacturing of bricks.
Tile: Characteristics of good tile, manufacturing methods, types of tiles.

UNIT – II

BUILDING MATERIALS–II: Lime: Various ingredients of lime, constituents of lime stone, classification of lime, various methods of manufacture of lime. **Cement:** Portland cement, chemical composition, hydration, setting and fineness of cement, various types of cement and their properties, various field and laboratory tests for cement, various ingredients of cement concrete and their importance, various tests for concrete.

UNIT – III

BUILDING MATERIALS–III: Wood: Structure, properties, seasoning of timber, classification of various types of woods used in buildings, defects in timber. Alternative materials for wood - Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials.
BUILDING STRUCTURES–I: Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls

UNIT – IV

BUILDING STRUCTURES–II: Building Components: Lintels, arches, vaults, stair cases - types. **Floors:** Different types of floors - Concrete, Mosaic and Terrazzo floors. **Roofs:** Pitched roofs- Lean to roof, Coupled Roofs, Trussed roofs - King and Queen post Trusses. Flat roofs - R.C.C Roofs, Madras Terrace and Pre fabricated roofs. Form Works and Scaffoldings. Doors and windows.

UNIT – V

BUILDING FINISHES: Damp Proofing and water proofing materials and uses. Plastering, Pointing, white washing and distempering. Paints: Constituents of paint, types of paints. Painting of new/old wood - varnish.

	UNIT – VI **BUILDING PLANNING :** Introduction, terms used in building drawing as per NBC, Factors affecting in selection of site, Functional requirements of a residential building, Minimum size requirements as per NBC, standard sizes of door, windows and ventilators. **PLANNING:** Principles of planning, factors to be considered in planning - planning of residential, buildings - preliminaries of vaastu. Municipal bye-Law, list of documents to be submitted for building plan approval.
Text Books and reference Books:	**TEXT BOOKS:** 1. Engineering Materials : S.C. Rangwala. 2. Building Construction : B.C. Punmia. 3. Building Planning and Drawing : Dr. N. Kumara Swamy & A. Kameswara Rao **REFERENCES:** 1. Building Materials : S.K. Duggal. 2. A Text Book of Building Construction : S.K. Sharma & B.K.Kaul. 3. Building Construction : Sushil Kumar. 4. Building Materials : Gurucharan Singh. 5. Indian Standard Institution, National Building Code of India, ISI, 1984, New Delhi
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17YE41O2 - DISASTER MANAGEMENT AND MITIGATION

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

Course Objectives		
Course Outcomes	Upon successful completion of the course , the students will able :	
	CO1	To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
	CO2	To increase the knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
	CO3	To ensure skills and abilities to analyse potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
	CO4	To ensure skills and ability to design, implement and evaluate research on disasters
Course content	**UNIT – I** Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches. **UNIT – II** Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters Planetary Hazards- Endogenous Hazards - Exogenous Hazards Endogenous Hazards - Volcanic Eruption, Earthquakes, Landslides; Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Environmental impacts of volcanic eruptions Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of earthquakes - Human adjustment, perception & mitigation of earthquake. **UNIT – III** Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events; Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms - causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters; Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood control measures (Human adjustment, perception & mitigation); Droughts:- Impacts of droughts- Drought control measures; Extra Planetary Hazards/ Disasters **UNIT – IV** Soil Erosion- Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters - Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population Explosion. **UNIT – V**	

	Emerging approaches in Disaster Management- Pre- disaster stage (preparedness), Emergency Stage, Post Disaster stage-Rehabilitation **UNIT – VI** Case study of - Bhuj earthquake, Gujarat 2001, Indian Ocean earthquake and Tsunami, 2004, Chernobyl disaster, Ukraine 1986, Bhopal Gas tragedy, 1984, Kerala Floods, 2018.
Text Books and reference Books:	**TEXT BOOKS:** 1. Disaster Management by Rajib Shah, Universities Press, India, 2003 2. Disaster Science and Management by Tushar Bhattacharya, TMH Publications, 2012 3. Disaster Mitigation: Experiences And Reflections by PardeepSahni 4. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning **REFERENCES:** 1. The Environment as Hazards by Kates, B.I & White, G.F, Oxford Publishers, New York, 1978 2. Disaster Management by R.B. Singh (Ed), Rawat Publication, New Delhi, 2000. 3. Disaster Management by H.K. Gupta (Ed), Universiters Press, India, 2003. 4. Space Technology for Disaster Mitigation in India (INCED) by R.B. Singh,, University of Tokyo,1994.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17YE41O3 -ECONOMICS AND ACCOUNTANCY (OE-2)

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

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 organisation.
	CO5	Able to demonstrate the principles of financial and management accounting
Course content	**UNIT – I** **BASIC CONCEPTS OF ECONOMICS**: Definition of economics and basic micro and macro-economic concepts (including GDP/GNP/NI/Disposable income). The concept of demand, law of demand, elasticity of demand, types and measurement, consumer's equilibrium, marginal utility analysis. **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. **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 proprietorship, partnership and joint stock company – Shares and debentures. **BANKING SYSTEM**: Central bank, commercial banks and their functions. Impact of technology in banking sector. **UNIT – V** **FINANCIAL ACCOUNTING**: Concepts and principles, journal and ledger, trial balance. **FINANCIAL ACCOUNTS:** Trading account, profit and loss account and balance sheet -simple problems.	

	UNIT – VI **FUNDAMENTAL CONCEPTS OF CAPITAL BUDGETING AND WORKING CAPITAL:** Meaning, process and methods (payback period, NPV, ARR & IRR- simple problems), working capital, operating cycle, factors and sources.
Text Books and reference Books:	**TEXT BOOKS:** 1. Managerial Economics : Varshney & Maheswari, S. Chand Publishers 2. Business Organisations: C.B.Gupta , S.Chand Publishers 3. Managerial Economics and Financial Accounting: A.R.Arya Sri, Tata Mcgraw Hills publishers. **REFERENCES:** 1. Economic Analysis: S.Sankaran, Margham Publications. 2. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas Publishers. 3. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17YE41O4- ELECTRICAL ENERGY CONSERVATION & AUDITING
(OE-1)

Course category:	Program core	**Credits:**	3
Course Type:	Practical	**Lecture - Tutorial - Practical:**	3-0-0
Prerequisite:	E&A	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To impart basic knowledge to the students about current energy scenario, energy conservation, audit and management. To inculcate among the students systematic knowledge and skill about assessing the energy efficiency, energy auditing and energy management.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	apply the knowledge of the subject to calculate the efficiency of various thermal utilities.
	CO2	design suitable energy monitoring system to analyz and optimize the energy consumption in an organization
	CO3	improve the thermal efficieny by designing suitable systems for heat recovery and co-generation.
	CO4	use the energy audit methods learnt to identify the areas deserving tighter control to save energy expenditure
	CO5	carry out the cost- benefit analysis of various investment alternatives for meeting the energy needs of the organization
	CO6	guide the employees of the organization about the need and the methods of energy conservation
Course content	**UNIT – I** **ENERGY SCENARIO:** Global & Indian Energy Scenario-Classification of energy sources, energy needs of growing economy, energy sector reform. Energy and Environment - Global environmental concerns, basics of energy and its various forms. **UNIT – II** **ENERGY CONSERVATION:** Power factor and energy instruments power factor, methods of improvement, location of capacitors, power factor with non-linear loads, effect of harmonics on power factor, numerical problems. Energy Instruments - Watt-hour meter, Data loggers, Thermocouples, Pyrometers, Lux meters, Tong testers, Power analyzer. **UNIT – III** **ELECTRIC ENERGY MANAGEMENT:** Principles of electric energy management, energy management control systems, Energy systems maintenance. Energy management in water and waste water treatment – solid waste treatment, Electricity Act, Energy Conservation Act. **UNIT – IV** **ENERGY AUDIT:** Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.	

	UNIT – V **ENERGY EFFICIENCY IN LIGHTING SYSTEMS:** Lighting modification of existing systems, replacement of existing systems – Priorities, Definition of terms and units, Luminous efficiency, Polar curve, Calculation of illumination level, Illumination of inclined surface to beam, Luminance or brightness - Types of lamps, Types of lighting, Electric lighting fittings (luminaries), Flood lighting, White light LED and conducting Polymers, Energy conservation measures **UNIT – VI** **ENERGY EFFICIENCY IN HEATING AND AIR CONDITIONING** : Space Heating and Ventilation, Air-Conditioning (HVAC) and Water Heating: Introduction, Heating of buildings, Transfer of Heat-Space heating methods. Ventilation and air-conditioning – Insulation, Cooling load, Electric water heating systems, Energy conservation methods.
Text Books and reference Books:	**TEXT BOOKS:** 1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012 2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995 3. General Aspects of Energy Management and Audit, National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management) **REFERENCES:** 1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi. 2. Energy Management Handbook, W.C. Turner, 5th Edition, Marcel Dekker, Inc, New York, 2005. 3. Guide to Energy Management, B. L. Capehart, W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005. **E- Resources** 1. http://nptel.ac.in/courses 2. http://iete-elan.ac.in 3. http://freevideolectures.com/university/iitm
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17YE41O5 -NANO SCIENCE AND TECHNOLOGY (OE-1)

Course category:	Program core	**Credits:**	3
Course Type:	Practical	**Lecture - Tutorial - Practical:**	3-0-0
Prerequisite:	Material science, physic	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To foundational knowledge of the Nanoscience and related fields. 2.To make the students acquire an understanding the Nanoscience and Applications 3. To help them understand in broad outline of Nanoscience and Nanotechnology	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Learn about the background on Nanoscience
	CO2	Understand the synthesis of nanomaterials and their application and the impact of nanomaterials on environment
	CO3	Apply their learned knowledge to develop Nanomaterial's
Course content	**UNIT – 1** **INTRODUCTION, PROPERTIES AND CLASSIFICATION OF NANOMATERIALS:** Definition of Nano Science & Technology, emergence and challenges of Nano Science and technology, influence of nano over micro/macro: large surface to volume ratio and quantum confinement effects, Classifications of nanomaterials into One-dimensional, Two-dimensional and Three-dimensional structures. Size effect on thermal (thermal conductivity, thermal expansion and thermal expansion coefficient), electrical (electrical conductivity, band gap tuning), mechanical (tensile strength, micro hardness, wear resistance, and corrosion resistance), optical (photoconductivity, electroluminescence, photoluminescence) and magnetic properties (hysteresis, super paramagnetism). **UNIT – II** **SYNTHESIS OF NANO MATERIALS:** Production of nano structures by top down and bottom up approaches, Methods of production: Ball mill, Plasma arcing, Laser ablation, Chemical vapour deposition, Spin coating, Atomic layer deposition, Sol-Gel technique. **UNIT – III** **CHARACTERIZATION OF NANO STRUCTURES:** Characterization of nano structured materials using techniques X-ray diffraction (XRD), Scanning electron microscope (SEM), Transmission electron microscope (TEM), Atomic force microscope (AFM), Elemental mapping, FTIR & UV-Visible spectrophotometer, Laser Raman spectroscopy, Nano mechanical characterization using Nano indentation, Differential scanning calorimeter (DSC), Differential Thermal Analyzer (DTA), Thermo Gravimetric Analysis (TGA), X-ray Photoelectron pectroscopy (XPS), Electro-chemcial characterization measurements. **UNIT – IV** **CARBON NANOTUBES:** Fullerences, Graphene, Carbon nanotubes(CNT), Structure and types of CNTs, Single and multi walled CNTs, Control of size, Precursors and catalysts, Doping in CNTs, Growth and properties (electronic, vibrational, mechanical and optical) of CNTs, properties of CNT and applications of CNTs. **UNIT – V** **NANOSENSORS:** Introduction to sensors, Characteristics and terminology, Static and dynamic characteristics, Micro and nano sensors, fundamentals of sensors, packaging and characterization of sensors. Organic and inorganic nano sensors. Gas sensors, biosensors, thermal sensors, temperature sensors, heat sensors. Electromagnetic sensors - electrical resistance sensors, electrical current sensors, electrical voltage sensors, electrical power sensors, magnetism sensors. Mechanical sensors - pressure sensors, liquid flow sensors, position sensors, Chemical sensors, Optical and Radiation sensors.	

	UNIT – VI **NANOTECHNOLOGY APPLICATIONS:** Applications of Nano technology in electrical and electronic industry, textile and cosmetics, defence and space, agriculture and food technology, environment and health, medical diagnosis and drug delivery systems, energy capture and storage, computing, sports and entertainment, water treatment, structure and engineering, automotive industry. Recent breakthroughs in Nano technology.
Text Books and reference Books:	**TEXT BOOKS**: 1. Naostructures and Nanomaterials: Synthesis, properties and applications, G. Cao, Imperical College Press, 2004. 2. Applied Physics of Carbon Nanotubes : Fundamentals of Theory, Optics and Transport Devices - S. Subramony & S.V. Rotkins, 2006. 3. "A Textbook of Nanoscience and Nanotechnology", Pradeep T., Tata McGraw Hill Education Pvt. Ltd., 2012. **REFERENCES:** 1. A Text Book of Nano Science and Technology : B.S.Murthy et.al., Universities press, 2012. 2. Nanotechnology - The Science of Small : Shah & Shah, Wiley, 2013.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME41P1 - METROLOGY AND INSTRUMENTATION LABORATORY

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

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Calibrate the linear dimensions of different mechanical components.
	CO2	Calibrate the angular dimensions of different mechanical components.
	CO3	Calibrate the errors in surface flatness and straightness.

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:	
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME41P2 -AUTOMATION AND ROBOTIC LABORATORY

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

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Upon successful completion of the course , the students will able to:
	CO2	Design the industrial robotic work cell
	CO3	Define Path of the industrial robot
	CO4	Generate Program for operation
	CO5	Simulate Graphically & Verify the robotic work cell
Course content	List of Experiments: 1. DEMONSTRATION & ASSIGNMENT ON INTRODUCTION TO Industrial ROBOT 2. Write PROGRAMs on creating and defining the path target THE industrial ROBOT 3. To perform the Robot programming exercise for Pick and Place operation. 4. Study and selection of Gripper. 5. Write a rapid program for Linear Movements, Non Linear Movements using robostudio 6. Create a mechanism in Robostudio simulation software 7. Create a Auto path in Robostudio simulation software 8. Create the type of joints in Robostudio simulation software 9. Write the mat lab code to control the servomotor, DC Motor using microcontroller 10. Write a program to start and stop the DC motor using IR Sensor 11. Analog Sensor interfacing with PLC. 12. Encoder interfacing with PLC. 13. Stepper motor / Servo motor control using PLC Software: 1. Robostudio 2. IRB 1600 Industrial Robot	
Text Books and reference Books:		
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**	

17ME41P3-CAE/CAM LABORATORY

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

Course Objectives	1. To study the basics of CAD. 2. Fluent application of engineering techniques, tools and resources. 3. To study Geometric modeling and assembling of any mechanical system. 4. To make appropriate selection of CAD functionality to use as tools in the design process.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Apply knowledge of CAD for generation of curves.
	CO2	Generate and interpret engineering technical drawings of parts and assemblies according to engineering design standards.
	CO3	Demonstrate skill of modeling and assembling of any mechanical system.
	CO4	Prepare to be an effective user of a CAD/CAM system.
Course content	List of Experiments for CAD/CAE Lab 1. FEA of a Simple supported beam with different loadings 2. FEA of a Bimetallic rod 3. Static Analysis of a 2D truss 4. Stress distribution in a plate with circular hole 5. Heat transfer in a composite wall 6. Analysis of an aluminium bracket 7. Dynamic analysis of truss. 8. Simulation of simple machining operations 9. Modelling and simulation of a revolute joint 10. Creation of a manufacturing cell 11. Virtual production system to track real-time production activities, perform schedule changes, launch new programs Experiments 1 to 7 are using ABAQUS and 8-11 are using DELMIA	
Text Books and reference Books:		
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**	

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY :: VIDYANAGAR (AUTONOMOUS)
(AFFILIATED TO JNTUA ANANTAPURAMU)
SPSR NELLORE DIST
IV YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER
MECHANICAL ENGINEERING
SCHEME OF INSTRUCTION AND EVALUATION (With effect from the academic year 2017-2018)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation							
							Sessional Test-I		Sessional Test-II		Total Sessional Marks (Max. 40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Duration In Hours	Max. Marks	Duration In Hours	Max. Marks		Duration In Hours	Max. Marks	100
1	17YE42OX	Open Elective – II	3	0	0	3	2	40	2	40	0.8*Best of two+0.2*least of two	3	60	100
2	17ME42EX	Core Elective – IV	3	0	0	3	2	40	2	40		3	60	100
3	17ME42MO	MOOCS	0	0	0	3	-	-	-	-		-	-	100
		PRACTICALS												
4	17ME42IN	Internship	-	-	0	2	-	-	-	-		-	-	100
5	17ME42PR	Project	-	-	3	11	-	-	-	80		3	60	120
		TOTAL	**06**	**-**	**03**	**22**	**-**	**-**	**-**	**160**		**-**	**180**	**520**

17YE42OX - ENGINEERING DESIGN (OE)

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

Course Objectives		
Course Outcomes		
	CO1	The course shall give knowledge in generic concepts of design process
	CO2	The course shall develop skills to solve unstructured creativity design problem
Course content	**UNIT 1** Introduction: Example of different kinds of designs and designers, Good and bad designs, Design problems, Definition of Design, engineering design and design research- their Importance. Product life cycle, Morphology of design, Introduction to system design process, Stage models. **UNIT 2** Introduction to Task Clarification: overall process and steps, Methods for Data collection and collation including patent analysis, Methods for identification of requirements: Role Playing, Checklists, Solution neutral problem statements, etc. Quantifying requirements and Assigning importance to requirements **UNIT 3** Linking Customer requirements to engineering requirements: Quality Function Deployment techniques. Introduction to conceptual design: Identification of functions, Ideation, Simulation and Consolidation into solution proposals **UNIT 4** Methods for Identification of functions such as functional decomposition techniques. Methods for Ideation, such as Brainstorming, Synectics, etc. **UNIT 5** Methods for consolidation into solution proposals, such as Morphological charts, Morphological matrix, etc. . Methods for simulation: analytical, virtual and physical simulations **UNIT 6** Methods for improvement of solution proposals, such as contradiction analysis, various other TRIZ techniques, etc, Systematic evaluation of concepts: ordinal methods and cardinal methods	
Text Books and reference Books:	**TEXT BOOKS** 1.Chakrabarti, A (ed.). Engineering Design Synthesis: Understandign, Approaches and Tools, Springer, 2002. 2.Ulrich, K., and Eppinger, S. Product Design and Development, 4th Edition, McGraw-Hill/Irwin, 2007.	

	3.Otto, K., and Wood, K. Product Design, Prentice Hall, 2000. **REFERENCES:** 1. Pahl, G, and Beitz, W. Engineering Design: A Systematic Approach, 3rd Ed., Springer, 2007. 2. Cross, N. Engineering Design Methods: Strategies for Product Design (4th edition), John Wiley and Sons Ltd., Chichester, 2008. 3. Roozenburg, N.F.M., Eekels, J. Product Design, Fundamentals and Methods, Wiley, Chichester, 1995. 4. Jones, J.C. Design Methods, 2nd Edition, John Wiley and Sons Ltd., Chichester, 1992. **WEB RESOURCES** 1. NPTEL http://nptel.iitm.ac.in Engineering Design.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17YE42OX - ENTREPRENEURSHIP (OE-2)

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

Course Objectives	The students develop and can systematically apply an entrepreneurial way of thinking that will allow them to identify and create business opportunities that may be commercialized successfully.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Have the ability to discern distinct entrepreneurial traits
	CO2	Know the parameters to assess opportunities and constraints for new business ideas
	CO3	Understand the systematic process to select and screen a business idea
	CO4	design strategies for successful implementation of ideas
	CO5	write a business plan

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.

UNIT – VI

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, 5th ed., TMH., 1986 2. Entrepreneurship : Dollinger, Pearson, 4th ed., 2004. **REFERENCES:** 1. Dynamics of Entrepreneurial Development and Management, Vasant, 2009. 2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999. 3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004. 4. Essential of Entrepreneurship and small business management, Thomas W. Zimmerer & Norman M. Scarborough, 4th ed., PHI, 2005 5. Industrial Relations & Labour Laws, Srivastava, Vikas, 2005.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

IOT(OE-1)

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

Course Objectives	1.To assess the vision and introduction of IoT. 2. To Understand IoT Market perspective. 3. To Implement Data and Knowledge Management and use of Devices in IoT Technology. 4. To Understand State of the Art - IoT Architecture. 5. To classify Real World IoT Design Constraints, Industrial Automation in IoT.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Interpret the vision of IoT from a global context.
	CO2	Determine the Market perspective of IoT.
	CO3	Compare and Contrast the use of Devices, Gateways and Data Management in IoT
	CO4	Implement state of the art architecture in IoT.
	CO5	Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints.
Course content	**UNIT – I** **INTRODUCTION & CONCEPTS:** Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels. **UNIT – II** **DOMAIN SPECIFIC IOTs:** Home automation, cities, environment, energy, retail, logistics, agriculture, industry, health & life style. **UNIT – III** **M2M:** M2M, Difference between IOT and M2M, SDN and NFV for IOT, software defined networking, network function virtualization, need for IOT systems management, simple network management protocol, limitations of SNMP, and network operator requirements. **UNIT – IV** **CLOUD COMPUTING BASICS:** Cloud computing basics, terminology, characteristics, services, cloud deployment – public, private environments, secure communication, cloud security. **UNIT – V** **DEVELOPING INTERNET OF THINGS & LOGICAL DESIGN USING PYTHON:** Introduction, IOT design methodology, installing python, python data types & data structures, control flow, functions, modules, packages, file handling, date/ time operations, classes, python packages.	

	UNIT-VI **IOT PHYSICAL DEVICES & ENDPOINTS:** What is an IOT Device, exemplary device, board, Linux on raspberry pi, interfaces, and programming & IOT devices.
Text Books and reference Books:	**TEXT BOOKS:** 1. Internet of Things A Hands-On- Approach : Vijay Madisetti, Arshdeep Bagha, 2014, **REFERENCES:** 1. Designing the Internet of Things : Adrian McEwen, Wiley Publishers, 2013. 2. The Silent Intelligence - The Internet of Things : Daniel Kellmereit, 2013.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17CS42O3 – WEB DESIGN AND MANAGEMENT(OE)

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

Course Objectives	Will gain the skills and project-based experience needed for entry into web design and development careers. Will be able to use a variety of strategies and tools to create websites. Will develop awareness and appreciation of the many ways that people access the web, and will be able to create standards-based websites that can be accessed by the full spectrum of web access technologies.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Designing and Planning Web Pages
	CO2	Creating Web Pages with HTML
	CO3	Formatting Web Pages with Style Sheets, Graphics
	CO4	Overall Site Design and Management
	CO5	Introduction to Web Authoring Software
	CO6	Culminating Project(s)
Course content	**UNIT-I** **Internet Overview**: Basics of Internet, Addresses and Names for the Internet, Web Objects, and Sites, E-Mail, World Wide Web, File Transfer. **Introduction To Web Technologies**: Web pages-types and issues, tiers, the concept of a tier, web pages, static web pages. **UNIT-II** **SITE ORGANIZATION AND NAVIGATION** (8 hours): User centred design – Web medium– Web design process –Introduction to software used for web design – DOBE IMAGE READY, DREAM WEAVER, FLASH etc. – Evaluating process – Site types and architectures – Navigation theory – Basic navigation practices –Search – Sitemaps. **UNIT-III** **ELEMENTS OF PAGE DESIGN** (7 hours): Browser compatible design issues – Pages and Layout – Templates – Text – Color –Images – Graphics and Multimedia – GUI Widgets and Forms – Web Design patterns – STATIC pages: Slice – URL in ADOBE IMAGEREADY. Creation and Editing of sitemap – layer, tables, frameset - CSS style – Forms –tools like insert, rollover etc., in DREAMWEAVER **UNIT-IV** **SCRIPTING LANGUAGES AND ANIMATION USING FLASH** (10 hours): Client side scripting - XHTML – DHTML – JavaScript – XML Server side scripting: Perl –PHP – ASP / JSP Designing a Simple web application - Introduction to MACROMEDIA FLASH, importing other file formats to Flash – saving and exporting Flash files, Frame by frame animation – Motion Tweening – Shape Tweening **UNIT-V** **PROJECT MANAGEMENT** (7 Hours): Principles of Project Management – Web Project Method – Project Road Map – Project Clarification – Solution Definition – Project Specification – Content – Writing and Managing content.	

	UNIT-VI **CASE STUDY** (7 Hours): Testing, Launch and Handover – Maintenance – Review and Evaluation – Case Study:- Using the skills and concepts learnt with the ADOBE IMAGEREADY, DREAMWEAVER, FLASH, and scripts.
Text Books and reference Books:	**Text Books:** 1. Thomas A. Powell, "The Complete Reference – Web Design", Tata McGraw Hill, Third Edition, 2003. 2. Ashley Friedlein, "Web Project Management", Morgan Kaufmann Publishers, 2001. 3. H.M.Deitel, P.J.Deitel, A.B.Goldberg, "Internet and World Wide Web– How to Program", Third Edition, Pearson Education 2004. **Reference Books:** **4.** Van Duyne, Landay, and Hong"The Design of Sites: Patterns for creating winning websites", 2nd Edition, Prentice Hall, 2006. **5.** Lynch, Horton and Rosenfeld, "Web Style Guide: Basic Design Principles for Creating Web Sites", 2nd Edition, Yale University Press, 2002. **6.** Photoshop7 Bible Professional Edition, Wiley John & Son INC, New York, DekeMc Cleland, 2000. **7.** Flash Web Design, The Art of Motion Graph, Curtis Hillman, New Riders Publishing, Indianapolis, IN.U.S.A, 2000
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME42E1 - AUTOMOBILE ENGINEERING

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	BMP, FM	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn 1. The anatomy of the automobile. 2. The location and importance of each part. 3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels. 4. Concepts of modern automobile controls 5. The functioning of all major components of the modern automobile.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Demonstrate the vehicle construction, chassis, lubrication system and cooling system in automobile, 3-way catalytic converter
	CO2	Describe the principle and working of Carburettors, CRDI, MPFI, electronic fuel injection system and Ignition system.
	CO3	Differentiate between clutch, gear box, rear axle drives, fluid flywheel, and torque converter
	CO4	Identify the wheels, tyres, steering gear box, suspension system-telescopic, and leaf spring
	CO5	Appraise the recent trends in alternate fuels and automobile safety system.
	CO6	Develop a strong base for understanding future developments in the automobile industry
Course content	**UNIT – I** **AUTOMOBILES:** Classification, components – Chassis and Body, Power transmission system. Cylinder liners – Dry and Wet type. Functions and characteristics of Pistons, Types of heads. **UNIT – II** **FUEL SYSTEM COMPONENTS:** Fuel tank, fuel filter, fuel pump, air cleaner/filter, carburetors – Simple, SU, Direct Injection of Petrol Engines, Compression ignition engines – fuel injection system – air & solid injection system. Pressure charging – Super charging and Turbo charging. **UNIT – III** **IGNITION SYSTEMS**: Components, battery ignition system, Magneto-ignition system, Electronic ignition system, Laser ignition system. **LUBRICATING SYSTEMS:** Functions and properties of lubricants, methods of lubrication – splash type, pressure type, wet and dry sump and mist lubrication. **UNIT – IV** **COOLING SYSTEMS:** Characteristics of an effective cooling system, air cooling and water cooling, oil cooling, radiator, thermostat. **TRANSMISSION:** Gear boxes - sliding type, constant and synchromesh, Automatic Transmission and Differential, Propeller shaft, Functions of clutches.	

	UNIT – V **SUSPENSION SYSTEMS:** Types of spring shock absorbers, Front axle – rigid and independent suspension systems, Rear axle – Semi, three-fourth and full floating systems. **STEERING SYSTEM:** Functions of steering, steering linkage, wheel alignment – caster, camber, tow-in and toe-out, Power steering. **UNIT – VI** **BRAKES:** Mechanical, hydraulic, vacuum & air brake systems, arrangement of brake shoes. **ELECTRIC VEHICLES:** Limitations of IC Engine as prime mover, EV system, basic structure of EV, EV drive train advantages and disadvantages. **HYBRID VEHICLES**: Configurations of hybrid vehicles, advantages and limitations.
Text Books and reference Books:	**TEXT BOOKS:** 1. Automotive Mechanics, Srinivasan. S, 2nd Edition, Tata McGraw-Hill, 2003 2. Automobile Engineering, Kirpal Singh, Vol. 1 and Vol. 2, Standard Publishers, New Delhi, 2003. 3. Automobile Engineering, R.K. Rajput, Standard Publishers Distributors, 2004 **REFERENCES:** 1. Automotive Mechanism, Crouse and Anglin, 9th Edition. Tata McGraw-Hill, 2003. 2. A Systems Approach to Automotive Technology, Jack Erjavec, Cengage Learning Pub., 2009 3. Internal Combustion Engine Fundamentals, J.B. Heywood, McGraw Hill Co.1988
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME42E2 - PRODUCT DESIGN

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 - 0
Prerequisite:	Industrial engineering, machine design	**Sessional Evaluation:** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Identify and analyse the product design and development processes in organization
	CO2	Define the components and their functions of product design and development processes and their relationships from concept to customer over whole product lifecycle.
	CO3	Analyse, evaluate and apply the methodologies for product design, development and management.
	CO4	Undertake a methodical approach to the management of product development to satisfy customer needs.
	CO5	Ability to map multiple, interdisciplinary tasks in order to develop product
	CO6	Carry out cost and benefit analysis through various cost models.
Course content		**UNIT – I** **INTRODUCTION:** Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development. **DEVELOPMENT PROCESSES AND ORGANIZATIONS:** A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization. **UNIT – II** **PRODUCT PLANNING:** The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process. **IDENTIFYING CUSTOMER NEEDS:** Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process. **UNIT – III** **PRODUCT SPECIFICATIONS:** What are specifications, when are specifications established, establishing target specifications, setting the final specifications. **CONCEPT GENERATION:** The activity of concept generation, clarify the problem, search externally, search internally, explore systematically, reflect on the results and the process. **CONCEPT SELECTION:** Overview of methodology, concept screening, and concept scoring. **CONCEPT TESTING:** Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process. **UNIT – IV** **PRODUCT ARCHITECTURE**: What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues. **INDUSTRIAL DESIGN:** Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design. **UNIT – V** **DESIGN FOR MANUFACTURING:** Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

	PROTOTYPING: Prototyping basics, principles of prototyping, technologies planning for prototypes. **UNIT – VI** **PRODUCT DEVELOPMENT ECONOMICS:** Elements of economic analysis, base case financial mode. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis. **MANAGING PROJECTS:** Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.
Text Books and reference Books:	**TEXT BOOKS:** 1. Product Design and Development : Karl.T.Ulrich, Steven D Eppinger, Irwin McGrawHill, 2000. 2. Product Design and Manufacturing : A C Chitale and R C Gupta, PHI, 2011 **REFERENCES:** 1. New Product Development : Timjones. Butterworth Heinmann, Oxford. UCI. 1997 2. Product Design for Manufacture and Assembly : Geoffery Boothroyd, Peter Dewhurst and Winston Knight, 2001.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME42E3 - SUPPLY CHAIN MANAGEMENT

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 - 0
Prerequisite:	Industrial ingineering	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	The objectives of this course are to provide the student with: 1. An understanding of the primary differences between logistics and supply chain management 2.An understanding of the individual processes of supply chain management and their interrelationships within individual companies and across the supply chain 3. An understanding of the management components of supply chain management 4. An understanding of the tools and techniques useful in implementing supply chain management 5. Knowledge about the professional opportunities in supply chain management.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand fundamental supply chain management concepts
	CO2	Demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.
	CO3	Analyze the creation of new value in the supply chain for customers, society and the environment
	CO4	Understand the foundational role of logistics as it relates to transportation and warehousing
	CO5	Apply knowledge to evaluate and manage an effective supply chain
	CO6	Analyze and improve supply chain processes
Course content	**UNIT – I** **STRATEGIC FRAMEWORK:** Introduction to supply chain management, decision phases in a supply chain, process views of a supply chain: push/pull and cycle views, achieving strategic fit, expanding strategic scope. **UNIT – II** **SUPPLY CHAIN DRIVERS AND METRICS:** Drivers of supply chain performance, framework for structuring drivers, obstacles to achieving strategic fit. **UNIT – III** **DESIGNING SUPPLY CHAIN NETWORK:** Factors influencing distribution network design, design options for a distribution network, E-business and distribution network, framework for network design decisions, models for facility location and capacity allocation.	

	UNIT – IV **FORECASTING IN SUPPLY CHAIN:** Role of forecasting in a supply chain, components of a forecast and forecasting methods, risk management in forecasting. **UNIT – V** **AGGREGATE PLANNING AND INVENTORIES IN SUPPLY CHAIN:** Aggregate planning problem in supply chain, aggregate planning strategies, planning supply and demand in a supply chain, managing uncertainty in a supply chain: safety inventory. **UNIT – VI** **COORDINATION IN SUPPLY CHAIN:** Modes of transportation and their performance characteristics, supply chain IT framework, coordination in a supply chain and bullwhip effect.
Text Books and reference Books:	**TEXT BOOKS:** 1. Sunil Chopra and Peter Meindl, Supply Chain Management - Strategy, Planning and Operation, 6th Edition, Pearson Education Asia, 2016. 2. David Simchi-Levi, PhilpKamintry & Edith Simchy Levy, Designing and Managing the Supply Chain-Concepts Strategies and Case Studies, 2nd Edition, Tata-McGraw Hill, 2000. **REFERENCES:** 1. David Burt, Donald Dobler, Stephen Starling, World Class Supply Management: The Key to Supply Chain Management**,** McGraw Hill Education; 7th edition, 2017. 2. James stevens, Supply Chain Management: Strategy, Operation & Planning for Logistics Management, Create space Independent Publishers, 2016.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME42E4 - TOTAL QUALITY MANAGEMENT

Course category:	Program elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	industrial engineering and management, metrology.	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To provide students' knowledge about basic concepts of Quality and to describe it in its broader perspective 2. To provide a forum for discussion on quality, and to provide an exposure and discussion on quality issues. 3. To analyze some existing methods and techniques of quality management within discussion on quality issues.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems
	CO2	Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality
	CO3	Critically appraise the organizational, communication and teamwork requirements for effective quality management
	CO4	Critically analyze the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans
	CO5	Understand the structure and functions of quality council in order to drive TQM implementation
	CO6	Efficiently designing the effective performance measurement system
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 of precedence, system failure analysis approach, flow chart, fault tree analysis, failure mode assessment and assignment matrix, organizing failure mode analysis and pedigree analysis.	

	UNIT –IV **QUALITY CIRCLES:** Organization, Focus Team approach – Ishikawa diagram, Quality Function Deployment (QFD), Elements of QFD, Bench Marking – Types, Advantages & limitations of Benchmarking. **UNIT – V** **TAGUCHI METHOD**: Taguchi Analysis, Loss Function, Taguchi Design of Experiments, Deming Cycle. **UNIT – VI** **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. **REFERENCES:** 1. Quality Management Systems - A Practical Guide : Howard S Gitlow, CRC Press, 2000. 2. Managing for Quality & Performance Excellence : James R. Evans. 9th ed., 2013. 3. Quality management : Kanishka Bedi, Oxford Univ. Press, India, 2006. 4. Total Quality Management : B.Senthil Arasu and J. Praveen Paul, 2nd ed., Scitech, 2007.
E-Resources	**1.https://nptel.ac.in/courses** **2.https://freevideolectures.com/university/iitm**

17ME42IN – INTERNSHIP

Course category:	Program elective	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practical:**	0- 0 - 0
Prerequisite:		**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	- 100 100

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Experience of applying existing engineering knowledge in similar or new situations
	CO2	Ability to identify when new engineering knowledge is required, and apply it
	CO3	Ability to integrate existing and new technical knowledge for industrial application
	CO4	Ability to demonstrate the impact of the internship on their learning and professional development through mapping to relevant Stage
	CO5	Understanding of lifelong learning processes through critical reflection of internship experiences.
Course content		
Text Books and reference Books:		
E-Resources		

17ME42PR – PROJECT

Course category:	Program elective	**Credits:**	11
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 - 0
Prerequisite:	Engineering and sciences knowledge	**Sessional Evaluation :** **Univ.Exam Evaluation:** **Total Marks:**	80 60 120

Course Objectives		
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Demonstrate a sound technical knowledge of their selected project topic
	CO2	Undertake problem identification, formulation and solution
	CO3	Design engineering solutions to complex problems utilising a systems approach
	CO4	Conduct an engineering project
	CO5	Communicate with engineers and the community at large in written an oral forms.
	CO6	Demonstrate the knowledge, skills and attitudes of a professional engineer.
Course content		
Text Books and reference Books:		
E-Resources		