JNTUCEA

R19

2019-20

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-20
COURSE STRUCTURE

I Year Semester - 0

Semester - 0 (Theory - 8, Lab -7) Common for All Branches of Engineering				
S.No	**Course No**	**Course Name**	**Category**	**L-T-P-C**
1		Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-12-0
2		Career Counseling	MC	4-0-4-0
3		Orientation to all branches -- career options, tools, etc.	MC	6-0-0-0
4		Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	4-0-6-0
5		Proficiency Modules & Productivity Tools	ES	4-2-4-0
6		Assessment on basic aptitude and mathematical skills	MC	4-0-6-0
7		Remedial Training in Foundation Courses	MC	4-2-4-0
8		Human Values & Professional Ethics	MC	6-0-0-0
9		Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	4-2-4-0
10		Concepts of Programming	ES	4-0-4-0
Total				**40-6-44-0**

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COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-20
COURSE STRUCTURE

I YEAR I Semester

SEMESTER - 1					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19A15101	Linear Algebra And Calculus	BS	3-1-0	4
2	19A15301	Engineering Chemistry	BS	2-1-0	3
3	19A10501	Problem Solving & Programming	ES	3-1-0	4
4	19A10302	Engineering Workshop	LC(ES)	0-0-2	1
5	19A10301	Engineering Graphics	ES	1-0-4	3
6	19A15302	Engineering Chemistry Lab	BS	0-0-3	1.5
7	19A10506	Problem Solving & Programming Lab	ES	0-0-3	1.5
Total					**18**

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-20
COURSE STRUCTURE

I YEAR II Semester

SEMESTER - 2					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19A12402	Basic Electrical & Electronics Engineering	ES	3-0-0	3
2	19A15501	Communicative English 1	HS	2-0-0	2
3	19A15102	Differential Equations and Vector Calculus	BS	3-0-0	3
4	19A15203	Engineering Physics	BS	2-1-0	3
5	19A10305	Material science and Metallurgy	ES	3-1-0	4
6	19A10306	Material science and Metallurgy Lab	LC(ES)	0-0-3	1.5
7	19A10307	Mechanical Engineering Workshop	LC(PCC)	0-0-2	1
8	19A12403	Basic Electrical Engineering lab (Part-A - ½ lab)	LC(ES)	0-0-3/2	0.75
		Basic Electronics Engineering lab(Part-B - ½ lab)	LC(ES)	0-0-3/2	0.75
9	19A15502	Communicative English Lab-1	HS	0-0-2	1
10	19A15204	Engineering Physics Lab	BS	0-0-3	1.5
Total					**21.5**

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B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

II YEAR I Semester

Semester – 3 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A20601	Complex Variables, Transforms and PDE	BSC	2-1-0	3
2.	19A20301	Thermodynamics	PCC	2-1-0	3
3.	19A20302	Manufacturing Process	PCC	2-1-0	3
4.	19A21301	Engineering Mechanics	PCC(ES)	2-1-0	3
5.	19A20303	Design thinking and product innovation	BSC/ESC(PSC)	2-0-0	2
6.	19A20304	Machine Drawing	PCC	1-0-4	3
7.	19A20305	Computer Aided Drafting Lab	PCC	0-0-3	1.5
8	19A20306	Manufacturing Process lab	PCC	0-0-3	1.5
9	19A20307	Design thinking and product innovation Lab	PCC	0-0-3	1.5
10.	19A10804	Environmental Science	MC	2-1-0	0
Total					**21.5**

II YEAR IISemester

Semester – 4 (Theory - 6, Lab –2)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A20308	Thermal Engineering	PCC	2-1-0	3
2.	19A20309	Kinematics of Machinery	PCC	2-1-0	3
3.	19A21302	Mechanics of Materials	PCC(ES)	2-1-0	3
4.	19A21303	Fluid Mechanics& Hydraulic Machinery	PCC(ES)	2-1-0	3
5.	19A20603	Numerical Methods, Probability & Statistics	BSC/ESC(BSC)	2-1-0	3
6.	19A20310	Machine Tools	PCC	2-1-0	3
7.	19A20901	Universal Human Values	HSMC	2-0-0	2
8.	19A21304	Mechanics of Materials Lab	PCC(ES)	0-0-3	1.5
9.	19A21305	Fluid Mechanics& Hydraulic Machinery Lab	PCC(ES)	0-0-3	1.5
10.	19A28801	Biology for Engineers	MC	2-1-0	0
Total					**23**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

III.B.Tech I Semester (R19)

Semester – 5 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A50301	Heat Transfer	PCC	2-1-0	3
2.	19A50302	Dynamics of Machinery	PCC	2-1-0	3
3.	19A50303	Operation Research	PCC	2-1-0	3
4.	19A50304	**(Professional Elective-I)** **1.** Power Plant Engineering	PEC-I	2-1-0	3
	19A50305	**2.** Alternative Fuels for IC Engines			
	19A50306	3. Material handling Equipments			
5.	19A50307	**(Open Elective-I)** **1.** Optimization Techniques	OEC-I	2-1-0	3
	19A50308	**2.** Energy Management		2-1-0	
	19A50309	3. Rapid Prototyping		2-1-0	
	19A50514	4. Python Programming		2-0-2	
6.	19A50310	Design of Machine Members-I	PCC	2-0-0	2
7.	19A50311	Thermal Engg. Lab	PCC	0-0-3	1.5
8.	19A55101	Exploratory Data Analysis Lab	HSMC	0-0-3	1.5
9.	19A50312	Machine Tools Lab	PCC	0-0-2	1
10.	19A50313	Socially Relevant Project	PR	0-0-1	0.5
11.	19A55401	Research Methodology	MC	3-0-0	0
				Total	**21.5**

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COURSE STRUCTURE

III.B.Tech II Semester (R19)

Semester – 6 (Theory - 6, Lab –2)					
S.No	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A60301	Modern Manufacturing Methods	PCC	2-1-0	3
2.	19A60302	Design of Machine Members-II	PCC	2-1-0	3
3.	19A65501	English Language Skills	HSMC	3-0-0	3
4.	19A60303	**(Professional Elective-II)** 1. Automobile Engineering	PEC-II	2-1-0	3
	19A60304	2. Turbo Machinery			
	19A60305	3. Productions and Operations Management			
5.	19A60306	**(Open Elective-II)** 1. Solar Energy Systems	OEC-II	2-1-0	3
	19A60307	2. Introduction to Electric and Hybrid Vehicles			
	19A60308	3. Industrial Engineering			
6.	19A65401	**Humanities Elective-I** 1. Managerial Economics and Financial Analysis	HEC-I	2-1-0	3
	19A65402	2. Entrepreneurship and Incubation			
	19A65403	3. Business Ethics and corporate governance			
7.	19A60309	Heat Transfer Lab	PCC	0-0-3	1.5
8.	19A65502	English Language Skills lab	HSMC	0-0-3	1.5
9.	19A60310	Socially Relevant Project	PR	0-0-1	0.5
10.	19A65406	Constitution of India	MC	3-0-0	0
Total					**21.5**

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B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

IV.B.Tech I sem (R19)

Semester –7 (Theory - 5, Labs -2 &Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A70301	Introduction to CAD/CAM	PCC	2-1-0	3
2.	19A70302	Metrology & Measurements	PCC	2-1-0	3
3.	19A70303	**(Professional Elective-III)** 1. Refrigeration & Air-Conditioning	PEC-III	2-1-0	3
	19A70304	2. Mechanics of Composite Materials			
	19A70305	3. Automotive Transmission Systems			
4.	19A70306	**(Open Elective-III)** 1. Wind Energy Systems	OEC-III	2-1-0	3
	19A70307	2. Special Types of Vehicles			
	19A70308	3. Industrial Automation and Control Systems			
5.	19A75401	**Humanities Elective-II** 1. Organizational Behavior	HEC-II	2-1-0	3
	19A75402	2. Management Science			
	19A75403	3. Business Environment			
6.	19A70309	CAD/CAM Lab	PCC	0-0-3	1.5
7.	19A70310	Metrology &Measurements Lab	PCC	0-0-3	1.5
8.	19A70311	Seminar	PCC	0-0-1	0.5
9.	19A70312	Project*	PR	------	1.5
10.	19A70313	Industrial Training/Skill Development/Research Project*	PR	------	2
				Total	**22**

*** Marks shall be awarded in 7th semester, but started at end of 6th semester and complete before beginning of 7th semester.**

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COURSE STRUCTURE

IV. B.Tech II Semester (R19)

Semester –8 (Theory - 2, Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A80301	**(Professional Elective-IV)** 1. Total Quality Management	**PEC-IV**	**2-1-0**	**3**
	19A80302	2. Mechanical Vibrations			
	19A80303	3. Robotics and Applications in Manufacturing			
2.	19A80304	**(Open Elective-IV)** 1. Finite Element Methods	**OEC-IV**	**2-1-0**	**3**
	19A80305	2. Energy Conservation and Management			
	19A80306	3. Introduction to Mechatronics			
3.	19A80307	Project	PR	0-0-7	7
				Total	**13**

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COURSE STRUCTURE

I YEAR I Semester

SEMESTER - 1					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19A15101	Linear Algebra And Calculus	BS	3-1-0	4
2	19A15301	Engineering Chemistry	BS	2-1-0	3
3	19A10501	Problem Solving & Programming	ES	3-1-0	4
4	19A10302	Engineering Workshop	LC	0-0-2	1
5	19A10301	Engineering Graphics	ES	1-0-4	3
6	19A15302	Engineering Chemistry Lab	BS	0-0-3	1.5
7	19A10506	Problem Solving & Programming Lab	ES	0-0-3	1.5
				Total	**18**

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Linear Algebra & Calculus

Course Objectives:	
1	This course will illuminate the students in the concepts of calculus and linear algebra.
2	To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications

Bridge Course: Limits, continuity, Types of matrices

Unit 1: Matrices

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors, diagonal form and different factorizations of a matrix;
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.

Unit 2: Mean Value Theorems

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof)

Learning Outcomes:

At the end of this unit, the student will be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders
- Analyze the behaviour of functions by using mean value theorems

Unit 3: Multivariable calculus

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies.
- Acquire the Knowledge maxima and minima of functions of several variable
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of Variables.

Unit 4: Multiple Integrals

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates.

Learning Outcomes:

- At the end of this unit, the student will be able to
- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates
- Apply double integration techniques in evaluating areas bounded by region
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries

Unit 5: Special Functions

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- understand beta and gamma functions and its relations
- Conclude the use of special function in evaluating definite integrals

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
2	1	0	3

Engineering Chemistry

Subject Code	Title of the Subject	L	T	P	C
19A53101	Engineering Chemistry	2	1	-	3

COURSE OBJECTIVES	
1	To familiarize engineering chemistry and its applications
2	To impart the concept of soft and hard waters, softening methods of hard water
3	To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement

SYLLABUS

Unit 1: Water Technology **(8 hrs)**

Introduction –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles **-** scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

Unit 2: Electrochemistry and Applications: (10 hrs)

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zn-MnO_2 (Leclanche cell), Li Battery

Secondary cells – lead acid and lithium ion batteries- working of the batteries including cell reactions.

Fuel cells- Basic Principles and Working Principles of hydrogen-oxygen, methanol fuel cells

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Unit 3: Polymers and Fuel Chemistry:(12 hrs)

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization,
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of PVC and Bakelite
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol
Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

UNIT-4 Advanced Engineering Materials (8 hrs)

(i) Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications
(ii) Refractories- Classification, Properties, Factors affecting the refractory materials and Applications
(iii) Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils and Applications
(iv) Building materials- Portland Cement, constituents, phases and reactivity of clinker, Setting and Hardening of cement.

Unit 5: Surface Chemistry and Applications: (10 hrs)

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, solid-gas interface, solid-liquid interface, adsorption isotherm, applications of colloids and nanomaterials – catalysis, medicine, sensors.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	**List** the differences between temporary and permanent hardness of water, **explain**the principles of reverse osmosis and electrodialysis. **compare**quality ofdrinking water with BIS and WHO standards. **illustrate**problems associated with hard water - scale and sludge**. explain** the working principles of different Industrial water treatment processes
CO2	**Apply** Nernst equation for calculating electrode and cell potentials, **apply** Pilling Bedworth rule for corrosion and corrosion prevention, **demonstrate** the corrosion prevention methods and factors affecting corrosion, **compare** different batteries

	and their applications
CO3	**Explain** different types of polymers and their applications, **Solve the numerical problems based on Calorific value, select** suitable fuels for IC engines, **explain** calorific values, octane number, refining of petroleum and cracking of oils
CO4	Explain the constituents of Composites and its classification Identify the factors affecting the refractory material, Illustrate the functions and properties of lubricants, demonstrate the phases and reactivity of concrete formation, identify the constituents of Portland cement, enumerate the reactions at setting and hardening of the cement
CO5	**Summarize** the applications of SEM, TEM and X-ray diffraction in surface characterization, **explain** the synthesis of colloids with examples, **outline** the preparation of nanomaterials and metal oxides **identify** the application of colloids and nanomaterials in medicine, sensors and catalysis

Text Books:

1. Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, Foruth Edition, New Delhi
2. A Text Book of Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

References:

1.A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi

2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
3. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi
4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Problem Solving & Programming

COURSE OBJECTIVES	
1	Introduce the internal parts of a computer, and peripherals.
2	Introduce the Concept of Algorithm and use it to solve computational problems
3	Identify the computational and non-computational problems
4	Teach the syntax and semantics of a C Programming language
5	Demonstrate the use of Control structures of C Programming language
6	Illustrate the methodology for solving Computational problems

Unit 1:

Computer Fundamentals: What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU.

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

Introduction to computer problem solving: Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, the analysis of algorithms.

Unit Outcomes:

Student should be able to

1. Identify the different peripherals, ports and connecting cables in a PC (L2)
2. Illustrate the working of a Computer (L3)
3. Select the components of a Computer in the market and assemble a computer (L4)
4. Solve complex problems using language independent notations (L3)

Unit 2:

Types, Operators, and Expressions: Variable names, data types and sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment

and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.
Input and output: standard input and output, formatted output-Printf, formatted input-Scanf.
Control Flow: Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Do-while, break and continue, Goto and labels.

Learning Outcomes: Student should be able to

1. Solve Computational problems (L3)
2. Apply Algorithmic approach to solving problems (L3)
3. Analyze the algorithms (L4)

Unit 3:
Fundamental algorithms: Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.

Functions and Program Structure: Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.

Learning Outcomes: Student should be able to
1. Recognize the programming elements of C Programming language (L1)
2. Select the control structure for solving the problem (L4)
3. Apply modular approach for solving the problem (L3)

Unit 4:
Factoring methods: Finding the square root of a number, the smallest divisor of a number, the greatest common divisor of two integers, generating prime numbers.
Pointers and arrays: Pointers and addresses, pointers and function arguments, pointers and arrays, address arithmetic, character pointers and functions, pointer array; pointers to pointers, Multi-dimensional arrays, initialization of arrays, pointer vs. multi-dimensional arrays, command line arguments, pointers to functions, complicated declarations.
Array Techniques: Array order reversal, finding the maximum number in a set, removal of duplicates from an order array, finding the k^{th} smallest element

Learning Outcomes: Student should be able to
1. Solve mathematical problems using C Programming language (L3)
2. Structure the individual data elements to simplify the solutions (L6)
3. Facilitate efficient memory utilization (L6)

Unit 5:

Sorting and Searching: Sorting by selection, sorting by exchange, sorting by insertion, sorting by partitioning, binary search.

Structures: Basics of structures, structures and functions, arrays of structures, pointers to structures, self-referential structures, table lookup, typedef, unions, bit-fields.

Some other Features: Variable-length argument lists, formatted input-Scanf, file access, Error handling-stderr and exit, Line Input and Output, Miscellaneous Functions.

Learning Outcomes: Student should be able to

1. Select sorting algorithm based on the type of the data (L4)
2. Organize heterogeneous data (L6)
3. Design a sorting algorithm (L6)

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Construct his own computer using parts (L6).
CO2	Recognize the importance of programming language independent constructs (L2)
CO3	Solve computational problems (L3)
CO4	Select the features of C language appropriate for solving a problem (L4)
CO5	Design computer programs for real world problems (L6)
CO6	Organize the data which is more appropriated for solving a problem (L6)

Text Books:

1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.

Reference Books:

1. P.Chenna Reddy, " Computer Fundamentals and C Programming" 2018, BS Publications
2. RS Bichkar " Programming with C", 2012, Universities Press.
3. Pelin Aksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage Learning.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem **L T P C**
0 0 2 1

Engineering Workshop
(COMMON TO CIVIL, MECHANICAL, CHEMICAL)

Course Objective:	
1	To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills.

Wood Working:
Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint *
b) Mortise and Tenon joint *
c) Corner Dovetail joint or Bridle joint

Sheet Metal Working:
Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray *
b) Conical funnel *
c) Elbow pipe *
d) Brazing

Fitting:
Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit *
b) Dovetail fit *
c) Semi-circular fit
d) Wheel Balancing, tubeless tyre puncture and change of two wheeler tyre.

Electrical Wiring:
Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series *
b) Two way switch *
c) Godown lighting
d) Tube light *
e) Three phase motor
f) Soldering of wires

Note:* Students exercise. Remaining all for demonstration.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Apply wood working skills in real world applications. (L3)
CO2	Build different objects with metal sheets in real world applications. (L3)
CO3	Apply fitting operations in various applications. (L3)
CO4	Apply different types of basic electric circuit connections. (L3)
CO5	Understanding the soldering, brazing and principle of automobile wheel balancing, alignment and operation of power tools. (L2)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem **L T P C**

1 0 4 3

ENGINEERING GRAPHICS
(COMMON TO CIVIL, MECHANICAL, CHEMICAL)

Course Objectives	
1	Bring awareness that Engineering Drawing is the Language of Engineers.
2	To know how to represent letters and numbers in drawing sheets..
3	To know about the different types of the projections, projection of points, straight lines, planes and regular solids
4	To know sectional views and development of different types of surfaces.
5	To know about the projection of orthographic views, isometric views and isometric projections.

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance Curves used in practice:

a) Conic sections – Ellipse, Parabola, Hyperbola & Rectangular Hyperbola (general method)
b) Cycloid, Epicycloid and Hypocycloid – Normal and Tangent
c) Involutes – Normal and Tangent

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the Printing of Letters and dimensioning.(L1)
2. Draw the geometric constructions; drawing parallel and perpendicular lines, and to construct circles, arcs, tangencies, and irregular curves (L6)
3. Construct the Conic sections and cycloidal curves.(L6)

UNIT –II

Principles of orthographic projections – First and Third angle projections Projection of points., Projections of lines inclined to one plane and inclined to both planes – True length, true angles of projected lines – Projection of regular planes inclined to one plane and both planes by rotational method.

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the Orthographic Projection in four quadrants (L2)
2. Project the points, lines and planes (L6)

UNIT –III

Projection of solids inclined to one plane and inclined to both planes by rotational/auxiliary method – Prism, Cylinder, Pyramid, Cone.

Learning Outcomes:

At the end of this unit the student will be able to

1. Project the solids inclined to one or both planes. (L6)
2. draw the solids by auxiliary method. (L6)

UNIT –IV

Sections of solids: Sections and Sectional views of regular solids – Prism, Cylinder, Pyramid, Cone – True shapes

Development of solids- Prism, Cylinder, Pyramid, Cone

Interpenetration of Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs cone, square prism Vs square prism.

Learning Outcomes:

At the end of this unit the student will be able to

1. Project the sectional view of regular solids.(L6)
2. Draw the true shapes of the sections.(L2)
3. Draw the development of surfaces of the solids.(L6)
4. Develop the sectional parts of the solids.(L2)

UNIT –V

Orthographic projections: Conversion of Pictorial views to orthographic views – Conventions.

Isometric projection: Isometric views of lines, plane figures, simple and truncated solids – orthographic views into isometric views.

Learning Outcomes:

At the end of this unit the student will be able to

1. Draw the orthographic views with dimensions.
2. Draw the Isometric views and isometric projections.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Draw various curves applied in engineering. (L2)
CO2	Plot the projection of points, Lines and planes.(L2)
CO3	Draw the projections of solids inclined to one or both planes. (L2)
CO4	Draw the sectional views and development of surfaces.(L2)
CO5	Draw the orthographic views, Isometric views and isometric projections. (L3)

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers
2. Engineering Drawing, K.L. Narayana & P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

1. Engineering Drawing, Johle, Tata McGraw-Hill Publishers.
2. Engineering Drawing, Shah and Rana,2/e, Pearson Education
3. Engineering Drawing and Graphics, Venugopal/New age Publishers
4. Engineering Graphics, John & John.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem **L T P C**

0 0 3 1.5

Engineering Chemistry Lab

Subject Code	Title of the Lab	L	T	P	C
19A53103	Engineering Chemistry lab	-	-	4	2

COURSE OBJECTIVES	
1	Verify the fundamental concepts with experiments

LIST OF EXPERIMENTS

1. Determination of Hardness of a groundwater sample.
2. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and emfs
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Determination of percentage of Iron in Cement sample by colorimetry
8. Estimation of Calcium in port land Cement
9. Adsorption of acetic acid by charcoal
10. Determination of percentage Moisture content in a coal sample
11. Determination of Viscosity of lubricating oil by Red Viscometer 1
12. Determination of Flash and Fire points of fuels
13. Determination of Calorific value of gases by Junker's gas Calorimeter

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	**Determine** the cell constant and conductance of solutions (L3)
CO2	**Prepare** advanced polymer materials (L2)
CO3	**Determine** the physical properties like surface tension, adsorption and viscosity (L3)
CO4	**Estimate** the Iron and Calcium in cement (L3)
CO5	**Calculate** the hardness of water (L4)

TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson
Education.
2. Chemistry Practical – Lab Manual by Chandra Sekhar, GV Subba Reddy and Jayaveera

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Problem Solving & Programming Lab

Laboratory Experiments#

1. Basic DOS Commands/Unix Commands
2. Familiarize with windows/Linux Environment.
3. Familiarize with development environment of C Language
4. Design a C program which reverses the number
5. Design a C program which finds the second maximum number among the given list of numbers.
6. Construct a program which finds the kth smallest number among the given list of numbers.
7. Design an algorithm and implement using C language the following exchanges
   a ← b ← c ← d
5. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them.
7. Implement the C program which computes the sum of the first n terms of the series Sum = 1 – 3 + 5 -7 + 9
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565.
9. Design an algorithm and implement using a C program which finds the sum of the infinite series $1 - x^2/2! + x^4/4! - x^6/6! + ...$
10. Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1.
11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa.
12. Develop an algorithm which computes the all the factors between 1 to 100 for a given number and implement it using C.
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n.
14. Design a C program which reverses the elements of the array.
15. Given a list of n numbers, Design an algorithm which prints the number of stars

equivalent to the value of the number. The starts for each number should be printed horizontally.

16. Implement the sorting algorithms a. Insertion sort b. Exchange sort c. Selection sort d. Partitioning sort.
17. Illustrate the use of auto, static, register and external variables.
18. Design algorithm and implement the operations creation, insertion, deletion, traversing on a singly linked list.
19. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers.
20. Design a C program which sorts the strings using array of pointers.

The above list is not exhaustive. Instructors may add some experiments to the above list. Moreover, 50% of the experiments are to be changed every academic year. Instructors can choose the experiments, provided those experiments are not repetitions.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Construct a Computer given its parts (L6)
CO2	Select the right control structure for solving the problem (L6)
CO3	Analyze different sorting algorithms (L4)
CO4	Design solutions for computational problems (L6)
CO5	Develop C programs which utilize the memory efficiently using programming constructs like pointers.

References:

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", Tata McGraw-Hill, 2nd edition, 2002.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. P.Chenna Reddy, "Computer Fundamentals and C Programming" 2018, BS Publications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-20
COURSE STRUCTURE

I YEAR II Semester

SEMESTER - 2					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1		Basic Electrical & Electronics Engineering	ES	3-0-0	3
2		Communicative English 1	HS	2-0-0	2
3		Differential Equations and Vector Calculus	BS	3-0-0	3
4		Engineering Physics	BS	2-1-0	3
5		Material science and Metallurgy	ES	3-1-0	4
6		Material science and Metallurgy Lab	LC	0-0-3	1.5
7		Mechanical Engineering Workshop	LC	0-0-2	1
8		Basic Electrical Engineering lab (Part-A - ½ lab)	LC	0-0-1.5	0.75
		Basic Electronics Engineering lab(Part-B - ½ lab)	LC	0-0-1.5	0.75
9		Communicative English Lab-1	HS	0-0-2	1
10		Engineering Physics Lab	BS	0-0-3	1.5
				Total	**21.5**

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JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Electrical Engineering

PART- A

Course Objectives:

To make the students learn about:

1	The basics of AC & DC Circuits, DC generators & motors.
2	The construction and operation of Transformers, Induction motors and their performance aspects will be studied.

Syllabus:

UNIT – I

Introduction to DC & AC Circuits

Ohm‟s Law, Basic Circuit Components, Kirchhoff‟s Laws, Resistive Networks, Series Parallel Circuits, Star-Delta and Delta-Star Transformation. Principle of AC Voltages, Waveforms and Basic Definitions, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, The „j‟ Operator and Phasor Algebra, Basic concepts of AC series circuits.

Outcomes : After the completion of the unit the students will be able to

1. Perceive and analyse the basic laws of electrical circuits
2. Apply to basic laws to solve real life problems

UNIT-II

DC Machines

Constructional details of DC Machines

DC Generators: Principle of Operation, EMF equation, Types, O.C.C. of a DC Shunt Generator

DC Motors: Principle of Operation, Types, Torque Equation, Losses and Efficiency Calculation, Swinburne‟s Test, concepts of speed control.

Outcomes: After the completion of the unit the students will be able to

1. Apprehend and interpret basic principles of DC machines
2. Evaluate the performance of DC machines

UNIT-III

AC Machines

Transformers: Principles of Operation, Constructional Details, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests.

Three Phase Induction Motors: Principle of Operation, Slip and Rotor Frequency, Torque (Simple Problems).

Alternators: Principle of Operation, Constructional Details, EMF Equation, Voltage Regulation by Synchronous Impedance Method.

Outcomes : After the completion of the unit the students will be able to

1. Identify different types of AC machines
2. Analyse the performance of various AC machines

Course Outcomes:

After completing the course, the student should be able to :

CO1	Understand the basics of AC & DC circuits and AC & DC machines
CO2	Analyse the circuit elements, various AC and DC machines

TEXT BOOKS:

1. Basic Electrical Engineering - By M.S.Naidu and S. Kamakshiah – TMH.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.

REFERENCES:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
3. Fundamentals of Electrical Electronics Engineering by T.Thyagarajan, SCITECH Publications 5th Edition-2007

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												

JNTUA COLLEGE OF ENGINEERING (Autonomous):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I –Year B.Tech.II -Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

ELECTRONICS ENGINEERING
PART- B

COURSE OBJECTIVES	
The students will be able to	
1	Understand principle and terminology of electronics.
2	Analyse the characteristics of electronic devices and understand the working of basic circuits such as rectifiers, amplifiers, filters, oscillators.
3	Understand the concept of Digital Logic
4	Understand the Concept & Principles of Digital Logic

UNIT I

Diodes and Transistors: Semiconductor Diode, Zener Diode, Rectifier Circuits, Wave Shaping Circuits, Bipolar Junction Transistors(operating modes, Configurations and Characteristics), Introduction to Transistor Biasing and Transistor as an amplifier, Introduction to Field-Effect Transistors (Configurations and characteristics).

UNIT II

Operational Amplifiers: Op-amp Equivalent Circuit, Ideal and practical Op-amp characteristics, Op-Amp Applications (Inverting amplifier, Non -inverting amplifier, Summing, scaling & averaging amplifiers, integrator, differentiator, Active filters, oscillators and comparators).

UNIT III

Digital Electronics: Number Systems and Codes, Logic Gates, Boolean Theorems, DeMogan‟s Theorems, Algebraic Simplification, Karnaugh Map Method. Binary Addition, 2‟s Complement System, Full Adder, BCD Adder. NAND and NOR gate Latches, S-R Flip-Flop, JK Flip-Flop, D Flip-Flop, Introduction to Shift registers and Counters

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Able to apply the knowledge of diodes, Zener diodes, BJT‟s and FET‟s for applications of different circuits.
CO2	Analyse the applications of operational amplifiers.
CO3	Solve problems of various digital logic gates and circuits.
CO4	Correlate the fundamental concepts to various Real life applications of today.

Text Books:

1. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education
2. Ramakant A.Gayakwad, Op-Amps and Linear Integrated Circuits, Eastern Economy Edition
3.M.Morris Mano and Michael D.Ciletti, Digital Design, Pearson Education,4th Edition

References:

1. R. Muthusubramanian, S. Salivahanan, “Basic Electrical and Electronics Engineering”, Tata McGraw-Hill Education.
2. Bell, D. A., Electronic Devices and Circuits, Oxford University Press
3. 3.R.J. Tocci: Digital Systems; PHI, 6e, 2001.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
2	0	0	2

Communicative English 1

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners‟ ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

COURSE OBJECTIVES	
The students will be able to	
1	Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
2	Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
3	Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4	Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5	Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Unit 1
Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing :**Beginnings and endings of paragraphs -

introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 2

Lesson: The Brook: Alfred Tennyson

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better reading comprehension
- write well structured paragraphs on specific topics
- identify basic errors of grammar/ usage and make necessary corrections in short texts

Unit 3

Lesson: The Death Trap: Saki

Listening: Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks and summarize the content with clarity and precision

- participate in informal discussions and report what is discussed
- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

Unit4

Lesson: Innovation: Muhammad Yunus

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Learning Outcomes

At the end of the module, the learners will be able to

- infer and predict about content of spoken discourse
- understand verbal and non-verbal features of communication and hold formal/informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

Unit 5

Lesson: Politics and the English Language: George Orwell

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences. **Grammar and Vocabulary:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Learning Outcomes

At the end of the module, the learners will be able to

- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts orally and in writing
- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors

Prescribed Text:

Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
CO2	Apply grammatical structures to formulate sentences and correct word forms
CO3	Analyze discourse markers to speak clearly on a specific topic in informal discussions
CO4	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
CO5	Create a coherent paragraph interpreting a figure/graph/chart/table

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- Oxford Learners Dictionary, 12th Edition, 2011

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

Differential Equations and Vector Calculus

COURSE OBJECTIVES	
1	To enlighten the learners in the concept of differential equations and multivariable calculus
2	To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications

UNIT 1: Linear differential equations of higher order
Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

Learning Outcomes:
At the end of this unit, the student will be able to

- Identify the essential characteristics of linear differential equations with constant Coefficients
- Solve the linear differential equations with constant coefficients by appropriate method

UNIT 2: Equations reducible to Linear Differential Equations
Cauchy‟s and Legendre‟s linear equations, simultaneous linear equations with constant coefficients, Applications to L-C-R Circuit problems and Mass spring system.

Learning Outcomes:
At the end of this unit, the student will be able to

- Classify and interpret the solutions of linear differential equations
- Formulate and solve the higher order differential equation by analyzing physical situations

UNIT 3: Partial Differential Equations First order partial differential equations, solutions of first order linear and non-linear PDEs.
Solutions to homogenous and non-homogenous higher order linear partial differential equations.
Learning Outcomes:
At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs

- outline the basic properties of standard PDEs

UNIT4: Vector differentiation

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply del to Scalar and vector point functions
- illustrate the physical interpretation of Gradient, Divergence and Curl

UNIT 5: Vector integration

Line integral-circulation-work done, surface integral-flux, Green‟s theorem in the plane (without proof), Stoke‟s theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes:

At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field
- evaluate the rates of fluid flow along and across curves
- apply Green‟s, Stokes and Divergence theorem in evaluation of double and triple integrals.

COURSE OUTCOMES	
At the end of this course the student will be able to	
.CO1	Solve the differential equations related to various engineering fields
CO2	Identify solution methods for partial differential equations that model physical processes
CO3	Interpret the physical meaning of different operators such as gradient, curl and divergence
CO4	Estimate the work done against a field, circulation and flux using vector calculus

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson

Publishers, 2013.
4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
6. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
7. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
8. Peter O"neil, Advanced Engineering Mathematics, Cengage Learning.
9. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
10. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
11. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
12. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
2	1	0	3

Engineering Physics

Subject Code	Title of the Subject	L	T	P	C
	ENGINEERING PHYSICS	2	1		3

COURSE OBJECTIVES	
1	To make a bridge between the physics in school and engineering courses.
2	To understand the concepts of mechanics and employ the applications of oscillations to engineering fields.
3	To familiarize the basic ideas of acoustics and ultrasonic‟s with their Engineering applications.
4	The mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
5	To evoke interest on applications of superposition effects like interference, diffraction and polarization in engineering.
6.	To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications. Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nano materials, their properties and applications in modern emerging technologies are elicited.

Unit-1: Introduction to Mechanics and Oscillations

Introduction to Mechanics and Oscillations-Basic laws of vectors and scalars-Rotational frames-Conservative forces – F = - grad V, torque and angular momentum – Simple harmonic oscillators-Damped harmonic oscillator-Heavy, critical and under damping- Energy decay in damped harmonic oscillator- Forced oscillations – Resonance.

Unit-II: Acoustics and Ultrasonics

Acoustics: Introduction to acoustics – Reverberation – Reverberation time– Sabine‟s formula- Derivation using growth and decay method – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics: Introduction, Properties and Production by magnetostriction & piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications

Unit-III: Lasers and Fiber optics

Lasers: Introduction – Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein‟s coefficients – Population inversion – Pumping mechanisms – Nd:YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance Angle-Numerical Aperture-Classification of fibers based on refractive index profile –Propagation of electromagnetic wave through optical fibers – Modes -Importance of V-number-Fiber optic sensors (Pressure/temperature/chemical change)

Unit-IV: Wave Optics

Interference-Principle of superposition –Interference of light – Conditions for sustained interference-interference in thin films- Colors in thin films-Newton‟s Rings-Determination of wavelength and refractive index.

Diffraction-Introduction-Fresnel and Fraunhofer diffraction-Fraunhofer diffraction due to single slit and double slit – Diffraction grating- Grating spectra.

Polarization-Polarization by double refraction-Nicol‟s Prism--Half wave and Quarter wave plates- Engineering applications of Polarization.

UNIT V: Engineering Materials

Dielectric Materials: Introduction-Dielectric polarization- Dielectric constant- Types of polarizations: Electronic and Ionic, Orientation Polarizations (Qualitative) - Lorentz (Internal) field- Clausius- Mossotti equation-Applications of Dielectrics: Ferroelectricity and Piezoelectricity.

Magnetic Materials: Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials- Hysteresis - Soft and hard magnetic materials-Applications.

Nanomaterials: Introduction – Surface area and quantum confinement –Physical properties: electrical and magnetic properties- Synthesis of nanomaterials: Top-down: Ball Milling, Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

COURSE OUTCOMES	
After studying this course, the student will be able to:	
CO1	Understand the basics of mechanics and types of oscillations.
CO2	Explain sound propagation in buildings, acoustic properties of typically used materials in buildings and the use of ultrasonics.
CO3	Apply the different realms of physics in both scientific and technological systems through the study of lasers and fiber optics.
CO4	Analyze different physical phenomena of optics like interference, diffraction and polarization.
CO5	Compare the properties of dielectric, magnetic and nano materials along with their engineering applications.

Prescribed Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company

2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.

Reference Books:

1. Introduction to modern optics – Grant R Fowles
2. A text book on Optics – Brijlal & Subramanyam
3. Laser Fundamentals – William T. Silfvast, Cambridge University Press
4. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley
6. Hand Book of Non-destructive evaluation, C.J.Hellier, McGraw-Hill
7. Engineering Physics – K.Thyagarajan, MacGraw Hill Publishers
8. Engineering Physics – M.R.Srinivasan, New Age Publications
9. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
10. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
11. Engineering Physics – M. Arumugam, Anuradha Publications

Method of Evaluation:

Please mention if it is apart from the regular practice

Data Books Required: Nil

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

MATERIAL SCIENCE AND METALLURGY

COURSE OBJECTIVES	
1	To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams
2	Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints
3	Explain the methods to change the properties of materials through heat treatment processes
4	Familiarize the principles of powder metallurgy and methods of making composite materials

UNIT – I

Structure of Metals: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the importance of material science in engineering.(L2)
- Recall the definitions and terminology of crystallography. (L1)
- Know the concept of metallography in studying the microstructures of metals and alloys. (L2)
- Understand the metals and alloys and types of solid solutions.(L2)

UNIT -II

Equilibrium of Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe_3C.

Learning Outcomes:

At the end of this unit the student will be able to

- Make use of the principles of construction of binary phase diagrams. (L3)

- Identify various invariant reactions in binary phase diagrams. (L3)

UNIT –III

Cast Irons and Steels : Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys :

Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

Learning Outcomes:

At the end of this unit the student will be able to

- Classify various types of steels, their properties and applications. (L2)
- Identify various types of cast irons, their properties and applications. (L3)
- Compare steels and cast irons and their limitations in applications. (L3)
- Understand the importance of non-ferrous metals and alloys in engineering applications. (L2)

UNIT –IV

Heat treatment of Alloys:

Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering , Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Learning Outcomes:

At the end of this unit the student will be able to

- Know the influence of heat treatment in modification of properties of steels. (L2)
- Develop a heat treatment cycle based on properties required. (L3)
- Comprehend the principles of surface hardening methods. (L2)

UNIT – V

Powder Metallurgy: Introduction to powder metallurgy, production of metal powders processing methods compaction of metal powders, sintering, finishing operations.

Composite Materials: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

Learning Outcomes:

At the end of this unit the student will be able to

- Describe the production of metal powders, processing methods and finishing of powder metallurgical products.
- Understand the properties of ceramics and their applications. (L2)
- Summarize the properties and methods of composites and their use. (L2)

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand the crystal structures of metals & alloys and types of solid solutions. (L2)
CO2	Make use of the principles of construction of binary phase diagrams. (L2)
CO3	Select steels, cast irons and nonferrous metals & alloys in engineering for a given application. (L3)
CO4	Apply heat treatment process to different applications. (L3)
CO5	Explain powder metallurgical methods, properties of composite materials and manufacturing methods of composite materials. (L2)

TEXT BOOKS:

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Essential of Materials science and engineering/ Donald R.Askeland/Thomson.

REFERENCES:

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal
3. Materials Science and engineering / William and collister.
4. Elements of Material science / V. Rahghavan
5. An introduction to materialscience / W.g.vinas & HL Mancini
6. Material science & material / C.D.Yesudian & harris Samuel
7. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
8. Engineering materials and metallurgy/R. K. Rajput/ S.Chand.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	3	1.5

MATERIAL SCIENCE AND METALLURGY LAB

COURSE OBJECTIVES	
1	To impart knowledge on metallographic techniques for studying the microstructures of alloys.

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Differentiate various microstructures of ferrous and non-ferrous metals and alloys. (L4)
CO2	Visualize grains and grain boundaries. (L3)
CO3	Importance of hardening of steels. (L2)
CO4	Evaluate hardness of treated and untreated steels. (L4)
CO5	Differentiate hardness of super alloys, ceramics and polymeric materials.(L4)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	2	1.5

MECHANICAL ENGINEERING WORKSHOP

COURSE OBJECTIVES	
1	Familiarize moulding and casting skills.
2	Train on different types welding joints
3	Develop assemble or disassembly skills.
4	Make plastic components
5	Familiarize with use power tools
6	Demonstrate assembly of computer and installation of software

Foundry Practice:

a) Pattern making *
b) Determination of average grain size for sand sample using sieve shaker *
c) Preparation of a green sand mould using single piece pattern *
d) Preparation of a green sand mould using split piece pattern with core * and demonstration of casting.

Welding Practice:

a) Lap joint, butt joint and T joint using arc welding *
b) Lap joint using resistance spot welding *
c) Lap and butt joints using gas welding

Assembling/Disassembling Practice:

a) Bicycle
b) Clutch and carburetor
c) Two wheeler engine parts
d) Desktop Computer and installation of Operating system Software

Manufacture of a Plastic Component

a) Use of injection moulding machine *
b) Use of blow moulding machine *

Manufacturing any two domestic utility products with any material by above methods (2 Sessions) Use of Power Tools

Drilling, Cutting, Plaining, Finishing, Etc, on wood or metals

Black Smithy

a) Preparation of L. Nail *
b) Preparation of S- Hook *
c) Preparation of Poker

Note: * Students exercise. Remaining all for demonstration.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Make moulds for sand casting
CO2	Develop different weld joints
CO3	Assemble or disassemble of machine components
CO4	Make plastic components
CO5	Use power tools for different applications

Text Books:

1. K. Venkata Reddy Workshop Mannual 6th Ed., B.S. Publishers, 2013.
2. B.L. Juneja Workshop practice 1st Ed., Cengage, 2015.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	1.5	0.75

BASIC ELECTRICAL ENGINEERING LAB

(PART-A - ½ LAB)

Course Objectives: To make the student learn about:

1	The DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
2	Various test conditions of single phase transformers.

Syllabus:

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne‟s Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
2. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors and Determination of Equivalent Circuit).
3. Brake Test on 3-Phase Induction Motor (Determination of Performance Characteristics)
4. Regulation of Alternator by Synchronous Impedance Methods.
5. Speed Control of D.C.Shunt Motor by
   a) Armature Voltage Control B) Field Flux Control Method
6. Brake Test on D.C Shunt Motor

Course Outcomes	
At the end of this course the student will be able to	
CO1	Learn about DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
CO2	Various test conditions of single phase transformers.

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	1.5	0.75

BASIC ELECTRONICS ENGINEERING LAB

(PART-B - ½ LAB)

(Common to ME & CHEM)

COURSE OBJECTIVES	
The students will be able to	
1	Understand the characteristics of PN junction diode and zener diode.
2	Understand the characteristics of BJT in CE and CB configurations
3	Learn the frequency response of CE Amplifier
4	Exposed to linear and digital integrated circuits

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator
3. Full Wave Rectifier with & without filter
4. Wave Shaping Circuits (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting Amplifiers using Op Amps
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs
9. Verification of Truth Tables of RS, JK, T & D flip flops using respective ICs

LAB REQUIREMENTS:

Cathode Ray Oscilloscopes (30MHz)

Signal Generator /Function Generators (3 MHz)

Dual Regulated Power Supplies (0 – 30V)

IC Trainer Kit

Bread Boards

Electronic Components

COURSE OUTCOMES	
At the end of this course the student will be able to,	
CO1	Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.
CO2	Analyze the application of diode as rectifiers, clippers and clampers.
CO3	Learn the fundamental principles of amplifier circuits and need of Bias in Amplifier circuits.
CO4	Learn the basics of linear integrated circuits and understand characteristics of operational amplifier.
CO5	Learn about available digital ICs and verify truth tables of logic gates and flip flops.

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

COMMUNICATIVE ENGLISH LABORATORY-1

COURSE OBJECTIVES	
1	Students will be exposed to a variety of self instructional, learner friendly modes of language learning
2	Students will cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL, and GMAT etc.
3	Students will learn better pronunciation through stress, intonation and rhythm
4	Students will be trained to use language effectively to face interviews, group discussions, public speaking
5	Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Unit 1

1. Phonetics for listening comprehension of various accents
2. Reading comprehension
3. Describing objects/places/persons

Learning Outcomes

At the end of the module, the learners will be able to

- understand different accents spoken by native speakers of English
- employ suitable strategies for skimming and scanning on monitor to get the general idea of a text and locate specific information
- learn different professional registers and specific vocabulary to describe different persons, places and objects

Unit 2

1. JAM
2. Small talks on general topics
3. Debates

Learning Outcomes

At the end of the module, the learners will be able to

- produce a structured talk extemporarily
- comprehend and produce short talks on general topics
- participate in debates and speak clearly on a specific topic using suitable discourse markers

Unit 3

1. Situational dialogues – Greeting and Introduction
2. Summarizing and Note making
3. Vocabulary Building

Learning Outcomes

At the end of the module, the learners will be able to

- Learn different ways of greeting and introducing oneself/others
- summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions
- replenish vocabulary with one word substitutes, homonyms, homophones, homographs to reduce errors in speech and writing

Unit4

1. Asking for Information and Giving Directions
2. Information Transfer
3. Non-verbal Communication – Dumb Charade

Learning Outcomes

At the end of the module, the learners will be able to

- Learn different ways of asking information and giving directions
- Able to transfer information effectively
- understand non-verbal features of communication

Unit 5

1. Oral Presentations
2. Précis Writing and Paraphrasing
3. Reading Comprehension and spotting errors

Learning Outcomes

At the end of the module, the learners will be able to

- make formal oral presentations using effective strategies
- learn different techniques of précis writing and paraphrasing strategies
- comprehend while reading different texts and edit short texts by correcting common errors

Suggested Software

- Young India Films
- Walden Infotech
- Orell

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
CO2	Apply communication skills through various language learning activities
CO3	Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension
CO4	Evaluate and exhibit acceptable etiquette essential in social and professional settings
CO5	Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUCEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	3	1.5

ENGINEERING PHYSICS LAB

Subject Code	Title of the Lab	L	T	P	C
	ENGINEERING PHYSICS LABORATORY	0	0	3	1.5

COURSE OBJECTIVES	
1	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
2	To develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.
3	To train engineering students on basis of measurements and the instruments
4	To equip the students with practical knowledge in electronic and optics experiments

LIST OF EXPERIMENTS

Any TEN of the following experiments has to be performed during the SEMESTER

1. Laser: Determination of wavelength using diffraction grating.
2. Laser: Determination of Particle size.
3. Determination of spring constant of springs using Coupled Oscillator
4. Determination of ultrasonic velocity in liquid (Acoustic grating)
5. Determination of dielectric constant and Curie temperature of a ferroelectric material.
6. B-H curve
7. Stewart-Gee‟s Method
8. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
9. Determination of numerical aperture of an optical fiber.
10. Determination of thickness of thin object by wedge method.
11. Determination of radius of curvature of lens by Newton‟s rings.
12. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method.
13. Determination of dispersive power of the prism

14. Sonometer: Verification of the three laws of stretched strings
15. Meldes experiment: Determination of the frequency of tuning fork

Note: Out of 10 experiments, two experiments will be performed using virtual laboratory.

Data Books Required: Nil

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution.
CO2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO3	Understand measurement technology, usage of new instruments and real time applications in engineering studies.
CO4	The student will be able to analyze the physical principle involved in the various instruments, also relate the principle to new application.
CO5	The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUACEA **R19**

2019-2020

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020

Course Structure for 2nd Year B.Tech

Semester – 3 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Complex Variables, Transforms and PDE	BSC	2-1-0	3
2.		**Thermodynamics**	**PCC**	**2-1-0**	**3**
3.		**Manufacturing Process**	**PCC**	**2-1-0**	**3**
4.		Engineering Mechanics	PCC	2-1-0	3
5.		**Design thinking and product innovation**	**BSC/ESC**	**2-0-0**	**2**
6.		**Machine Drawing**	**PCC**	**1-0-4**	**3**
7.		**Computer Aided Drafting Lab**	**PCC**	**0-0-3**	**1.5**
8		**Manufacturing Process lab**	**PCC**	**0-0-3**	**1.5**
9		**Design thinking and product innovation Lab**	**PCC**	**0-0-3**	**1.5**
10.		Environmental Science	MC	2-1-0	0
				Total	**21.5**

JNTUACEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

COMPLEX VARIABLES, TRANSFORMS & PARTIAL DIFFERENTIALEQUATIONS
(Common to MECHANICAL, CHEMICAL & CIVIL)

L	T	P	C
2	1	0	3

Course Objective:

- This course aims at providing the student to acquire the knowledge on the calculus of functionsof complex variables.
- The aim is to analyze the solutions of partial differential equations.

COURST OUTCOMES : After completion of the course a successful student is able to

CO 1: Acquire knowledge in

a. Fourier series.
b. Laplace transforms and their applications.
c. Find the derivatives of complex functions.
d. Solving Partial Differential equations
e. Heat transfer and wave motion.

CO 2: To Develop skills in analyzing the

a. Properties of Fourier series for a given function.
b. Understand the analyticity of complex functions and conformal mapping.
c. Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
d. Engineering systems & processes involving wave forms and heat transfer.
e. Partial differential equations through different evaluation methods.

CO 3: To develop skills in designing mathematical models for

a. Understand the usage of Laplace transforms.
b. Apply Cauchy's integral theorem.
c. Understand singularities of complex functions.
d. Problems involving heat transfer and wave forms.

CO 4: To develop analytical tools in solving the problems involving

a. Fourier series
b. Laplace transforms
c. Heat transfer and wave motion.
d. Evaluate the Fourier series expansion of periodic functions.

CO 5: Use relevant mathematical technique for evaluating

a. Evaluate improper integrals of complex functions using Residue theorem.
b. Laplace transforms
c. Solve applications of partial differential equations.

Course Outcome	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	1	-	-	-	1	-	-	2	1	-	-					
CO2	1	3	-	-	-	1	-	-	2	2	-	-					
CO3	1	3	2	-	-	1	-	-	2	2	-	-					
CO4	1	1	1	3	-	1	-	-	2	1	-	-					
CO5	1	1	1	1	-	1	-	-	2	1	-	-					

Correlation Levels: High - 3 Medium – 2 Low - 1

Unit-I: Complex Variable – Differentiation:
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation,Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations (sin z, e_z, cos z, z_2) Mobius transformations (bilinear) and their properties.

Unit Outcomes:
Students will be able to

- Understand functions of Complex variable and its properties.
- Find derivatives of complex functions.
- Understand the analyticity of complex functions.
- Understand the conformal mappings of complex functions.

Unit-II: Complex Variable – Integration:

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula,Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof); power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with f(z) not having poles on real axis).

Unit Outcomes:

Students will be able to

- Understand the integration of complex functions.
- Apply Cauchy's integral theorem and Cauchy's integral formula.
- Understand singularities of complex functions.
- Evaluate improper integrals of complex functions using Residue theorem.

Unit-III: Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inversetransform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function– Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transformof Periodic function. Differentiation and integration of transform – solving Initial value problemsto ordinary differential equations with constant coefficients using Laplace transforms.

Unit Outcomes:

Students will be able to

- Understand the concept of Laplace transforms and find the Laplace transforms of elementary functions.
- Find the Laplace transforms of general functions using its properties.
- Understand Laplace transforms of special functions(Unit step function, Unit Impulse & Periodic).
- Apply Laplace transforms to solve Differential Equations.

Unit-IV: Fourier series

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourierseries – functions having discontinuity-Fourier series of Even and odd functions – Fourier seriesin an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.

Unit Outcomes:

Students will be able to

- Understand finding Fourier series expression of the given function.
- Determine Fourier coefficients (Euler's) and identify existence of fourier series of the given function.
- Expand the given function in Fourier series given in Half range interval.
- Apply Fourier series to establish Identities among Euler coefficients.
- Find Fourier series of wave forms.

Unit-V: Partial Differential Equations & Applications

Formation of partial differential equations by elimination of arbitrary constants and arbitraryfunctions – Solution of first order PDEs by Lagrange's method- Solution of non linear PDEs(Standard forms)-Solution of second order PDEs by Method of separation of variables –

Solutions of one dimensional wave equation, one dimensional heat equation under initial andboundary conditions.

Unit Outcomes:

At the end of this unit, the students will be able to

- Form Partial Differential Equations.
- Solve Partial Differential Equations of first order.
- Understand the method of separation of variables.
- Solve applications of Partial Differential Equations.

Text Books:

1. B.S.Grewal , “Higher Engineering Mathematics”, Khanna publishers.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India

Reference Books:

1. B.V.Ramana, “Higher Engineering Mathematics”, Mc Graw Hill publishers.
2. Alan Jeffrey, “Advanced Engineering Mathematics”, Elsevier.

JNTUACEA **R19**

2019-20

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

THERMODYNAMICS

L	T	P	C
2	1	0	3

Course Objectives	
1	Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
2	Explain relationships between properties of matter and basic laws of thermodynamics.
3	Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process
4	Introduce the concept of available energy for maximum work conversion
5	Familiarize steam properties to understand working of steam power plants.
6	Provide fundamental concepts of thermodynamics cycles used in steam power plants, IC engines and gas turbines

UNIT I

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

First law of Thermodynamics: Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process-limitations of first law of thermodynamics**.**

Unit outcomes

At the end of this Unit, the student will be able to

- Understand thermodynamic systems, properties and their importance in solving engineering problems.
- Make energy balance for closed systems and open systems.
- Explain the First Law of thermodynamics applied to flow and non-flow process.

UNIT II

Second Law of Thermodynamics: Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

Unit outcomes

At the end of this Unit, the student will be able to

- Understand second law of thermodynamics and apply for heat engine, refrigerator and heat pump.
- Explain the efficiency of thermodynamic systems.
- Enumerate the causes of irreversibility in thermodynamic systems.

UNIT III

Entropy: Clausius inequality - Concept of Entropy- entropy equation for different processes and systems

Availability and Irreversibility: Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

Unit outcomes

At the end of this Unit, the student will be able to

- Apply the concept of entropy to estimate the performance of systems.
- Evaluate expressions for availability and irreversibility of flow and non-flow processes.

UNIT IV

Properties of Steam and use of Steam Tables: Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry.

Unit outcomes

At the end of this Unit, the student will be able to

- Apply properties of steam to design steam systems.
- Examine steam systems using conservation equations.
- Evaluate the dryness fraction and performance of steam systems.

UNIT V

Thermodynamic Relations: Maxwell relations, TdS equations, difference in heat capacities, ratio of heat capacities, Energy equation, Joule Thompson coefficient, Clausius - Clapeyron equation.

Air Standard Cycles: Otto, Diesel and Dual cycles, P-V and T – S diagrams - description and efficiencies, mean effective pressures. Comparison of Otto, Diesel and dual cycles

Unit outcomes

At the end of this Unit, the student will be able to

- Understand the Tds equations, specific heats, Joule-Thomson coefficient in standard form, change in internal energy, enthalpy and entropy.
- Explain the working principle and construction of various air standards cycles.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Explain the importance of thermodynamic properties related to conversion of heat energy into work
CO2	Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles
CO3	Understand the concepts of entropy, availability, irreversibility, steady flow and non-flow process
CO4	Utilize steam properties to design steam based components
CO5	Understand the thermodynamic relations and Compare the air standard cycles

Text Book(s)

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7th edition, Tata McGraw Hill, 2011.

References

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2th edition, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6th edition, Laxmi publications, 2010.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 3

MANUFACTURING PROCESS

L	T	P	C
2	1	0	3

Course Objectives	
1	To know the working principle of different metal casting processes and gating system.
2	To understand the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes and principles of forging processes.
3	To study the classifications of welding processes, working of different types of welding processes and welding defects.
4	To study the classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.
5	To learn the Characteristics of Unconventional Machining Processes.

UNIT I

Introduction: Importance and selection of manufacturing processes.

Casting Processes: Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

Unit Outcomes:

At the end of this unit, the student will be able to

- Understand the steps involved in metal casting, pattern making.
- Apply the knowledge of designing gating systems, risers.
- Compare the working of various metal casting processes.
- Identify the various casting defects.

UNIT II

Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.

Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

Unit Outcomes:

At the end of this unit, the student will be able to

- Compare cold working and hot working processes.
- Explain the working of rolling mills and analyze the forces involved.
- Understand the working of various extrusion and forging processes.
- Understand the various operations of Sheet metal forming.

UNIT III

Metal Joining Processes: Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. Applications, advantages and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies.

Unit Outcomes:

At the end of this unit, the student will be able to

- Classify the working of various welding processes.
- Compare V-I characteristics of different welding processes.
- Know the applications, advantages of various welding processes.
- Identify the defects in welding.

UNIT IV: Plastic Processing, Ceramics and Powder Metallurgy:

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding

Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Powder Metallurgy: Principle, manufacture of powders, steps involved.

Unit Outcomes:

At the end of this unit, the student will be able to

- Learn the methods of manufacturing plastics parts.
- Explain the steps in making ceramics parts.
- Explain the steps in manufacturing of powder metallurgy parts.
- Demonstrate the application of plastic, ceramics and power metallurgy.

UNIT V

Unconventional Machining Processes: Introduction-classification- Principles of Electrical discharge machining (EDM), Electro-chemical machining (ECM), Laser beam machining

(LBM), Plasma arc machining (PAM) and Electron beam machining, Abrasive jet machining (AJM), Water jet machining, Ultrasonic machining.

Unit Outcomes:

At the end of this unit, the student will be able to

- Classify the unconventional machining processes.
- Understand the principles of EDM, ECM, LBM, PAM ,AJM, Water jet and Ultrasonic machining process

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Demonstrate different metal casting processes and gating systems
CO2	Understand the hot and cold metal forming methods for rolling, extrusion and forging.
CO3	Know the application of various welding processes for different applications.
CO4	Outline the manufacturing methods of plastics, ceramics and powder metallurgy
CO5	Identify different unconventional processes and their applications

Text Books:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

L	T	P	C
2	1	0	3

ENGINEERING MECHANICS
(Common to CIVIL & MECHANICAL)

OBJECTIVE: *This course will serve as a basic course by introducing the concepts of basic mechanics which will help as a foundation to various courses.*

UNIT – I

INTRODUCTION OF ENGINEERING MECHANICS – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT – II

FRICTION : Types of friction– laws of Friction – Limiting friction- Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge, Screw jack and differential Screw jack.

UNIT – III

CENTROID AND CENTER OF GRAVITY: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

MASS MOMENT OF INERTIA: Moment of Inertia of Simple solids – Moment of Inertia of composite masses.(Simple problems only)

UNIT – IV

KINEMATICS: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

KINETICS : Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies – Work Energy Method – Equation for Translation – Work Energy application to Particle Motion, Connection System – Fixed axis Rotation and Plane Motion.

UNIT – V

ANALYSIS OF PERFECT FRAMES: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

MECHANICAL VIBRATIONS: Definitions, Concepts-Simple Harmonic motion-Free vibrations-Simple Compound and Torsional pendulum- Numerical problems

TEXT BOOKS:

(1) Engineering Mechanics by Dr.R.K.Bansal, Lakshmi Publications.
(2) Engineering Mechanics by Shames & Rao – Pearson Education.
(3) Engineering Mechanics by Bhavakatti, New age pubilishers

REFERENCES:

(1) Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
(2) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.
(3) Engineering Mechanics by FedrinandL.Singer – Harper Collings Publishers.
(4) Engineering Mechanics (Statics and Dynamics) by Hibller and Gupta; Pearson Education
(5) Engineering Mechanics by S.Timoshenko, D.H.Young and J.V.Rao, Tata McGraw-Hill Company
(6) Engineering Mechanics by Chandramouli, PHI publications.
(7) Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage Learning

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 3

L	T	P	C
2	0	0	2

DESIGN THINKING AND PRODUCT INNOVATION

Design is a realization of a concept or idea into a configuration, drawing or a product. Design thinking is cognitive and practical processes by which design concepts are developed by designers. Innovation is a new idea or a new concept. Product development is the creation of a new or different product that offers new benefits to the end user. This course introduces the design thinking in product innovation.

Course Objectives	
1	To bring awareness on innovative design and new product development.
2	To explain the basics of design thinking.
3	To familiarize the role of reverse engineering in product development.
4	To train how to identify the needs of society and convert into demand.
5	To introduce product planning and product development process

UNIT I

Design Thinking Background: Design Thinking Definition – Fundamental Concept – Resources – Processes – In Practice – Application.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Understand fundamental concepts of design thinking
- Understand the Resources and processes
- Familiar in application and practice

UNIT II

PROCESS OF DESIGN

Introduction – Product Life Cycle - Design Ethics - Design Process - Four Step – Five Step - Twelve Step - Creativity and Innovation in Design Process – Basic Materials - Design limitation.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Understand Product life cycle, Design Ethics and Process.
- Understand the Creativity and Innovation in Design Process, Basic Materials Design limitation.

UNIT III

Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Apply systematic approach in design
- Explain the steps in the design process
- Develop strategies for new product development

UNIT IV

Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, safety considerations in design.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Understand reverse engineering methods in product development
- Use new materials to improve the product
- Apply electronic controls to improve the product acceptability
- Summarize the safety and environmental factors in new product design

UNIT V

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates and smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Identify the needs for new product development in agriculture

- Develop simple electrical gadgets
- Explain the principles in design electrical vehicles and drones

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand fundamental concepts of design thinking, Resources and Applications.
CO2	Understand the Creativity and Innovation in Design Process and limitations
CO3	Apply systematic approach to innovative designs.
CO4	Identify Reverse engineering and importance of ergonomics in product development.
CO5	Identify new materials and manufacturing methods in design of agriculture machines and electrical vehicles

Text Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4/e, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2/e, Laurence King Publishing Ltd., 2010
3. An AVA Book, "Design Thinking", AVA Publishing, 2010.

Reference Books:

1. Design Thinking understanding How designs think & work, Nigal Cross, Berg Oxford-Newyork.
2. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3rd edition, Springer, 2007
3. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 3

MACHINE DRAWING

L	T	P	C
1	0	4	3

To impart knowledge on

Course Objectives	
1	Representing any matter/object with the help of picture & dimensioning
2	Working drawings of Machine Elements
3	Orthographic drawing of different machine parts
4	Developing assembly drawings

UNIT- I

Machine Drawing Conventions: Need for drawing conventions- introduction to IS conventions

a) Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.
b) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
c) Title boxes, their size, location and details-common abbreviations & their liberal usage

UNIT-II

Drawing of Machine Elements and simple parts: Selection of Views, additional views for the following machine elements and parts with drawing proportions:

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws,
b) Keys, cottered joints and knuckle joint,
c) Riveted joints for plates, flanged& protected flanged joint.
d) Shaft coupling, spigot and socket pipe joint.
e) Journal and foot step bearings.

UNIT- III

Assembly Drawings: Drawings of assembled views for the part drawings of the following.

a) Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.
b) Other machine parts- Screw jack, Machine Vice, single tool post.
c) Valves: Steam stop valve, feed check valve. Non return valve.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand drafting fundamentals and standards.
CO2	Interpret drawings and extract required information
CO3	Create part drawings and sectional views of machine components.
CO4	Develop assembly drawings from part drawings for engine parts.
CO5	Develop assembly drawings from part drawings for machine parts and valves

TEXT BOOKS:

1. Machine Drawing- K.L. Narayana, P.Kannaiah&K.Venkata Reddy, New Age Publishers
2. Machine Drawing- Dhawan, S.Chand Publications

REFERENCES:

1. Machine Drawing- P.S. Gill.
2. Machine Drawing- Luzzader
3. Machine Drawing – Rajput
4. Textbook of Machine Drawing-K.C.John,2009, PHI learning

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

COMPUTER AIDED DRAFTING LAB

L	T	P	C
0	0	3	1.5

Course Objectives:	
1	To develop skill to use software to create 2D and 3D models.

List of Exercises:

Using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modelling – Coordinate systems (Absolute, Relative, Polar, etc.).
2. Creation of simple figures like polygon and general multi-line figures.
3. Drawing of a Title Block with necessary text and projection symbol.
4. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
5. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
6. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects.
11. Obtaining 2-D multi-view drawings from 3-D model.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Ability to use the software packages for drafting and modelling
CO2	Ability to create 2D and 3D models of simple objects.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

MANUFACTURING PROCESS LAB

L	T	P	C
0	0	3	1.5

Course Objectives	
1	Acquire practical knowledge on Metal Casting, Welding, Press Working and unconventional machining Processes.

1. METAL CASTING

a) Gating Design and pouring time and solidification time calculations.
b) Sand Properties Testing – Exercise for Strength and Permeability.
c) Molding, Melting and Casting for ferrous/ nonferrous materials.

2. WELDING

a) TIG Welding.
b) MIG Welding.
c) Friction stir welding
d) Any other Special Welding Processes.

3. MECHANICAL PRESS WORKING

a) Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
b) Closed die forging, Deep Drawing and Extrusion operations.

4. UN CONVENTIONAL MANUFACTUNRING PROCESSES

a) Electro Discharge Machining(EDM)/ Wire cut EDM
b) Plasma arc cutting / Abrasive jet machining (AJM)
c) Additive manufacturing with reverse engineering

COURSE OUTCOMES	
At the end of the lab, the student will be able to	
CO1	Fabricate different types of components using various manufacturing techniques
CO2	Adapt unconventional manufacturing methods.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 3

L	T	P	C
0	0	3	1.5

DESIGN THINKING AND PRODUCT INNOVATION LAB

Course Objectives	
1	To develop products/models by 3D printing
2	To design measuring devices for temperature, pressure, humidity, water level, smart lighting.
3	To design pneumatic and hydraulic circuits

List of Experiments

1. 3D Printing
   a. To develop a CAD model and simulate in CAE environment.
   b. To develop tooling and make a physical prototype (Two Exercises).
2. To design a device for measurement of Temperature/ pressure.
3. To design a device for measurement of Humidity.
4. To design a device for Water Level Indicator.
5. To design a Smart Lighting system.
6. To design Automatic Car Wiper/ safety issues in Auto mobiles.
7. Design of simple pneumatic and hydraulic circuits using basic components.
8. Design of pneumatic circuit for speed control of double acting cylinders.
9. Design a hydraulic circuit by using Flow Control Valves for simple application.
10. Design and Simulation of a Hydraulic Shaper.
11. Design and Simulation of a Hydro Electric Circuit for simple application.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	To develop 3D models using 3D printing
CO2	To design the system with measuring devices
CO3	To design hydraulic / pneumatic circuits

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUACEA **R19**

2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 3

L	T	P	C
2	1	0	0

ENVIRONMENTAL SCIENCE

(Common to All Branches)

OBJECTIVE: *To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.*

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : Introduction Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT : Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK : Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

TEXT BOOKS :

(1) Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Palaniswamy – Pearson education
(3) Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES :

(1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
(2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.

(3) Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
(4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
(5) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Pubilishing House
(6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

JNTUACEA **R19**

2019-2020

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

B.Tech (Mechanical Engineering) 2019-2020

Course Structure for 2nd Year B.Tech

Semester – 4 (Theory - 6, Lab –2)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		**Thermal Engineering**	**PCC**	**2-1-0**	**3**
2.		**Kinematics of Machinery**	**PCC**	**2-1-0**	**3**
3.		Mechanics of Materials	PCC	2-1-0	3
4.		Fluid Mechanics& Hydraulic Machinery	PCC	2-1-0	3
5.		Numerical Methods &Probability Theory	BSC/ESC	2-1-0	3
6.		**Machine Tools**	**PCC**	**2-1-0**	**3**
7.		Universal Human Values	HSMC	2-0-0	2
8.		Mechanics of Materials Lab	PCC	0-0-3	1.5
9.		Fluid Mechanics& Hydraulic Machinery Lab	PCC	0-0-3	1.5
10.		**Biology for Engineers**	**MC**	**2-1-0**	**0**
				Total	**23**

JNTUACEA **R19**

2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 4

THERMAL ENGINEERING

L	T	P	C
2	1	0	3

To impart knowledge on

Course Objectives	
1	Rankine cycle and efficiency enhancement methods
2	Steam Generators, Compressors, Nozzles, and Turbines
3	Various Gas Power cycles and Concept of Jet Propulsion

UNIT- I

Basic Concepts: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Illustrate the power generation through Rankine cycle.
- Understand efficiency enhancement methods of Reheating and regeneration.

UNIT -II

Boilers: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers.

Air Compressors - Reciprocating Compressor, Single Stage multistage compressor, problems related to Reciprocating Compressor, Axial, Centrifugal, Rotary & Screen Compressor.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Understand the working principles of different high pressure and low pressure boilers.
- Understand the working principles of different Air Compressors.

UNIT- III

Steam Nozzles: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio. Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at the Exit.

Condensers: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Distinguish the ideal flow and actual flow through nozzle.
- Know the importance of maximum discharge through nozzle.
- Entail the concept of Critical pressure ratio in calculations.
- Understand the effect of meta stable flow/ super saturation flow through nozzle.
- Understand the Concept of condensers

UNIT -IV

Impulse Turbine: Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine – Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow – Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

Reaction Turbine: Mechanical Details – Principle of Operation, Thermodynamic analysis of a Stage, Degree of Reaction –Velocity Diagram – Parson‟s Reaction Turbine – Condition for Maximum Efficiency.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Distinguish the working of impulse and reaction turbines.
- Construct the velocity triangle and combined velocity triangle.

UNIT -V

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle, Essential Components – Parameters of Performance – Actual Cycle – Regeneration, Inter Cooling and Reheating – Closed And Semi-Closed Cycles – Merits and Demerits, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants.

Jet Propulsion: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Familiar with the basic components of a gas turbine power plant.
- Illustrate the power generation using Joule Cycle.
- Know the methods to increase the specific power output and efficiency of the cycle.
- Know the working of various propulsive devices.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Able to Understand the Rankine cycle and efficiency enhancement methods.
CO2	Able to Understand the working of boilers and air compressors.
CO3	Able to Explain the flow through steam nozzles.
CO4	Able to Determine the efficiency of the impulse and reaction turbine using velocity triangles.
CO5	Able to Analyze gas turbines cycles and compare the operational aspects of jet engines.

Text Books:

1. Basic and Applied Thermodynamics, P.K. Nag, TMH , 2nd Edition,2012.
2. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013.

Reference Books:

1. Gas Turbines, V. Ganesan, TMH
2. Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.
3. Gas Turbines and Propulsive Systems, P.Khajuria&S.P.Dubey, Dhanpatrai
4. Thermal Engineering, R.S Khurmi& JS Gupta, S.Chand, 2012.
5. Thermal Engineering-M.L.Mathur&F.S.Mehta, Jain bros, 2006.
6. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.
7. Steam Tables SI Units- Dr.B.UmamaheswarGowd and A. Nagraju, Siri Publ.

NOTE: Steam tables and Mollier charts to be supplied for exam.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUACEA **R19**

2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 4

KINEMATICS OF MACHINERY

L	T	P	C
2	1	0	3

Course Objectives:

The objectives of this course are to

Course Objectives	
1	Introduce various basic mechanisms and applications
2	Explain different exact and approximate straight line motion mechanisms.
3	Explain the concept of instantaneous center
4	Familiarize the concept of velocity and acceleration of different points on a link
5	Describe cams and followers and their motions.
6	Introduce the gears, gear trends and their applications

UNIT – I

MECHANISMS AND MACHINES: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines– classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain. Mobility of mechanisms.

Unit Outcomes:

At the end of this unit the student will be able to

- Contrast the difference between machine and structure
- Identify the different types of kinematic pairs and kinematic chains
- Identify the inversion of four bar mechanism

UNIT-II

Straight Line Motion Mechanisms- Exact and approximate, copied and generated types – Peaucellier, Hart and Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermann‟s steering gear. Hooke‟s Joint (Universal coupling) – Single and double Hooke‟s joint — applications – Simple problems.

Unit Outcomes:

At the end of this unit the student will be able to

- Identify the difference between exact and approximate mechanism

- Explain the working principles of different mechanisms
- Understand the functions of steering gear mechanisms
- Understand the difference between Davi‟s and Ackerman‟s steering gear mechanism

UNIT – III

KINEMATICS

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, and determination of Coriolis component of acceleration. Klein‟s construction: Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method

Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centers in-line theorem – Locating instantaneous centers for simple mechanisms and determination of angular velocity of points and links.

Unit Outcomes:

At the end of this unit the student will be able to

- Draw the velocity and accelerations for different configurations.
- Find the velocity and accelerations of different points on and away from different links
- Understand the concept of instantaneous centres
- Find the velocity of different points on the links and angular velocities of different links using instantaneous centres method.

UNIT – IV

GEARS: Higher pairs, toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact. Introduction to Helical, Bevel and Worm gearing.

GEAR TRAINS: Introduction –Types of gears – Simple, Compound, Reverted and Epicyclic gear trains, Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains. Differential gear of an automobile, Simple problems.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the phenomenon of interference
- Find the relative merits and demerits tooth profiles
- Understand principle of operation of different gear trains for different purpose
- Find velocity ratio and torques for different gear traind.

UNIT – V CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity, Simple harmonic motion,

Cycloidal and uniform acceleration–and retardation Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

ANALYSIS OF MOTION OF FOLLOWERS: Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the cam terminology
- Draw the cam profile for different types of follower motion
- Find the velocity and acceleration of the follower for different types of follower motion

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	An understanding of concepts of different of mechanism with lower pairs and higher pairs.
CO2	Gain the knowledge of different types of straight line motion mechanism and steering gear mechanism
CO3	Obtain an in depth knowledge of finding displacement velocity and acceleration of different points on different mechanisms using different methods (relative velocity, instantaneous methods).
CO4	Acquire the knowledge on different gear profiles and calculating the different parameters of gears
CO5	Gain the knowledge in designing of gear trains for the required purpose. Design and analyze different cam profile for different types of followers

TEXT BOOKS:

1. S.S. Rattan, “Theory of Machines”, Tata McGraw Hill Publishers.
2. J.E. Shiegley “Theory of Machines”, McGraw Hill .

REFERENCES :

1. R.S. Khurmi& J.K. Gupta “Theory of Machines”, S. Chand Pub.
2. R.K.Bansal and J S Brar, “Theory of Machines”, Laxmi Publications.
3. Thomas Bevan, “Theory of Machines”, CBS.
4. J.S. Rao and R.V. Dukkipati, Mechanism and Machine Theory, New Age
5. R.L Norton. “Kinematics and dynamics of machinery” ,Tata McGraw Hill Publishers

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUACEA **R19**

2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 4

L	T	P	C
2	1	0	3

MECHANICS OF MATERIALS

Course Objectives:

- The subject provide the knowledge of simple stress strains flexural stresses in members, shear stresses and deflection in beams so that the concepts can be applied to the Engineering problems.

UNIT – I

SIMPLE STRESSES AND STRAINS : – Deformable bodies **-** Elasticity and plasticity – Types of stresses and strains – Hooke‟s law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson‟s ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses.

Strain energy **–** Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT – II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

FLEXURAL STRESSES : Theory of simple bending – Assumptions – Derivation of bending equation: M/I =f/y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections.

UNIT – IV

TORSION OF CIRCULAR SHAFTS – Theory of pure torsion – Derivation of Torsion equations : – Assumptions made in the theory Theory of pure torsion – Torsional moment of resistance – Polar section modulus.

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay‟s methods.

Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L. uniformly varying load-Mohr‟s theorems – Moment area method – application to simple cases including overhanging beams-deflections of propped cantilevers for simple loading cases.

UNIT – V

THIN CYLINDERS & THICK CYLINDERS : Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – Changes in dia, and volume of thin cylinders – Thin spherical shells.

Introduction Lame‟s theory for thick cylinders – Derivation of lame‟s formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

Course Outcomes:

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

(1) Strength of Materials by B.S.Basavarajaiah, Universities Press, Hyderabad
(2) Strength of Materials by Dr.R.K.Bansal, Lakshmi Publications.
(3) Mechanics of Materials by Swaroop Adarash, New Age Publications

REFERENCES:

1. Mechanics of Materials – Dr.B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.
2. Strength of Materials by R.K Rajput, S.Chand & Company Ltd.
3. Strength of Materials by S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.
4. Strength of materials by Sadhu Singh, Khanna Pubilications, NewDelhi.
5. Strength of materials by Surendar Singh, CBS Pubilications.
6. Strength of Materials by L.S.Srinath et al., Macmillan India Ltd., Dew Delhi.

JNTUACEA **R19**

2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 4

L	T	P	C
2	1	0	3

FLUID MECHANICS AND HYDRAULIC MACHINERY

Course Objectives:

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied.
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT - I

FLUID STATICS : Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.

FLUID KINEMATICS: stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.

Fluid dynamics: surface and body forces – Euler‟s and Bernoulli‟s equations for flowing stream line, momentum equation and its application on force on pipe bend.

UNIT – II

CONDUIT FLOW: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine current meter.

UNIT – III

TURBO MACHINERY: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.

HYDROELECTRIC POWER STATIONS: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.

UNIT – IV

HYDRAULIC TURBINES: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies hydraulic design-draft tube- theory- functions and efficiency.

PERFORMANCE OF HYDRAULIC TURBINES: Unit and specific quantities, characteristic c governing of turbines, selection of type of turbine, cavitation, surge tank, hammer.

UNIT – V

CENTRIFUGAL PUMPS: Classification, working, work done – manomertic head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves, NPSH.

Course Outcomes:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH. Standard book house
2. Fluid Mechanics by Dr.R.K.Bansal, Lakshmi Publications Pvt.Ltd.
3. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria &Sons
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
3. Instrumentation for Engineering Measurements by James W.Dally, Wiley Riley, John Wiley & Sons Inc. 2004

JNTUCEA **R19**

2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

NUMERICAL METHODS, PROBABILITY AND STATISTICS
(Common to CIVIL, MECHANIACAL& CHEMICAL)

Course Objective:

This course aims at providing the student with the knowledge on

- Various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
- The theory of Probability and random variables.

COURSE OUTCOMES: After completion of the course a successful student is able to

CO 1 : Acquire knowledge in basic concepts such as

a. Numbertheory.
b. Congruences and itsproperties.
c. Divisibilitytests.
d. Finitefields.
e. Cryptology.

CO 2 Develop skills in analyzing the

a. Representation of integers and its application in computerscience.
b. Linearcongruences.
c. Pseudoprimes
d. Factorization and factorbases.
e. Key management incryptography.

CO 3 Develop skills in designing mathematical models for

a. Problems on primenumbers.
b. Linearcongruences
c. The sum and number of divisors of a giveninteger.
d. Finding factorization of the giveninteger.
e. Different encryptionmechanisms.

CO 4 Develop analytical skills in solving the problems involving

a. CGD, factorization of integer, linear Diophantineequations.
b. System of linearcongruences
c. Storage and hashfunctions.

d. Quadratic residues.
e. Various public keycryptography algorithms.

CO 5 Use relevant mathematical technique for evaluating

a. Factorization ofintegers.
b. Solution for the given system of linearcongruences.
c. Cipher text using different named algorithms such as RSA, Public –key cryptography, discrete logarithm, knapsack ciphersetc.

Course Outcome	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	1	-	-	-	1	-	-	2	1	-	-					
CO2	1	3	-	-	-	1	-	-	2	2	-	-					
CO3	1	3	2	-	-	1	-	-	2	2	-	-					
CO4	1	1	1	3	-	1	-	-	2	1	-	-					
CO5	1	1	1	1	-	1	-	-	2	1	-	-					

Correlation Levels: High - 3 Medium – 2 Low - 1

Unit-I: Solution of Algebraic & Transcendental Equations:
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson methodSystem of Algebraic equations: Gauss Jordan method-Gauss Siedal method.
Unit Outcomes:
Students will be able to

- Calculate the roots of equation using Bisection method and Iterative method.
- Calculate the roots of equation using Regula falsi method and Newton Raphson method.
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Siedal method.

Unit-II: Interpolation
Finite differences-Newton‟s forward and backward interpolation formulae – Lagrange‟sformulae. Gauss forward and backward formula, Stirling‟s formula, Bessel‟s formula.
Unit Outcomes:
Students will be able to

- Understand the concept of interpolation.
- Derive interpolating polynomial using Newton‟s forward and backward formulae.
- Derive interpolating polynomial using Lagrange‟s formulae.
- Derive interpolating polynomial using Gauss forward and backward formulae.

Unit-III: Numerical Integration & Solution of Initial value problems to Ordinary differential equations

Numerical Integration: Trapezoidal rule – Simpson‟s 1/3 Rule – Simpson‟s 3/8 RuleNumerical solution of Ordinary Differential equations: Solution by Taylor‟s series-Picard‟sMethod of successive Approximations-Modified Euler‟s Method-Runge-Kutta Methods.

Unit Outcomes:

Students will be able to

- Solve integral equations using Simson‟s 1/3 and Simson‟s 3/8 rule.
- Solve integral equations using Trapezoidal rule.
- Solve initial value problems to ordinary differential equations using Taylor‟s method.
- Solve initial value problems to ordinary differential equations using Euler‟s method and Runge Kutta methods.

Unit-IV: Probability theory:

Probability, probability axioms, addition law and multiplicative law of probability, conditionalprobability, Baye‟s theorem, random variables (discrete and continuous), probability densityfunctions, properties, mathematical expectation.

Unit Outcomes:

Students will be able to

- Understand the concept of Probability.
- Solve problems on probability using addition law and multiplication law.
- Understand Random variables and probability mass and density functions.
- Understand statistical constants of random variables.

Unit-V: Random variables & Distributions:

Probability distribution - Binomial, Poisson approximation to the binomial distribution andnormal distribution-their properties-Uniform distribution-exponential distribution

Unit Outcomes:

Students will be able to

- Understand Probability distribution function.
- Solve problems on Binomial distribution.
- Solve problems on Poisson distribution.
- Solve problems on Normal distribution.

Text Books:

1. B.S.Grewal, “Higher Engineering Mathematics”, Khanna publishers.
2. Ronald E. Walpole “Probability and Statistics for Engineers and Scientists”, ,PNIE.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India

Reference Books:

1. B.V.Ramana, “Higher Engineering Mathematics”, Mc Graw Hill publishers.
2. Alan Jeffrey, “Advanced Engineering Mathematics”, Elsevier.

JNTUACEA **R19**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

L	T	P	C
2	1	0	3

MACHINE TOOLS

Course Objectives:

Course Objectives	
1	To understand the tool materials, tool geometry and theory of metal cutting
2	To make student familiar with various operations on lathe and automatic lathe machines
3	To make the students familiar with the drilling, boring, shaping, slotting and planning operations
4	To make the students familiar with different types milling and grinding operations.
5	To know the use of jigs and fixtures for different machine operations

UNIT I

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant"s Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability – economics of machining, cutting Tool materials and cutting fluids –types and characteristics .

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation.
- Understand how the physical and mechanical parameters dictate the cutting performance.

UNIT II

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.

Turret and capstan lathes – Collet chucks – other work holders – tool holding devices – box and tool layout.

Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the basic concepts and operations on lathe machines.
- Familiar with various accessories used in lathe machines.
- Understand the different constructions of lathes depending on the nature of operation

UNIT III

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring tools – machining time calculation.

Shaping, Slotting and planning machines –Principles of working – Principal parts – specification, classification, Operations performed. Machining time calculations.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the basic principles and operation of drilling, boring, Shaping, Slotting and planning machines.
- Familiar with machining time calculations, tool holding devices and parts of the drilling, boring, Shaping, Slotting and planning machines.

UNIT IV

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines.

Grinding machine –Theory of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines –Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing, machining time calculations.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the principle of milling, grinding, lapping , honing and broaching operations.
- Familiar with parts and types of milling and grinding machines.

UNIT V

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices, Typical examples of jigs and Fixtures Unit built machine tools – multispindle heads. Power units-principal of working types of UBMTS, characterization and applications.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the design of jigs and fixtures and uses
- Understand the classification of jigs and fixtures, principle of location and clamping
- Familiar with examples of jigs and fixtures.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand the cutting tool geometry, mechanism of chip formation and mechanics of orthogonal cutting
CO2	Identify basic parts and operations of lathe, turret and capstan lathes and Automatic lathes
CO3	Understand the principles of parts and operation on machine tools like drilling, boring, shaper, slotting planer
CO4	Know the different types of milling, grinding machines and finishing operation and its application
CO5	Design jigs and fixtures, locating and clamping devices to produce a component.

Text Books:

1. Workshop Technology – Vol II, B.S.Raghu Vamshi, Dhanpat Rai & Co, 10th edition, 2013
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition

Reference Books:

1. Manufacturing Technology-Kalpakzian- Pearson
2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st edition, 2001
4. Production Technology by K.L.Narayana, IK International Pub.
5. Unconventional Machining Process by V.K.Jain, Allied Pub.
6. Manufacturing Technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013
7. Machining and Machine Tools by AB. Chattopadyay, Wiley Edn,2013
8. Machine Technology Machine tools and operations by Halmi A Yousuf &Harson, CRC Press Taylor and Francies .

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUACEA **R19**

2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

UNIVERSAL HUMAN VALUES

(Common to all)

L	T	P	C
2	0	0	2

Introduction:

This course discusses the role of human values in one‟s family. It very briefly touches issues related to their role in society and nature, which need to be discussed at length in one more semester for which the foundation course name as"H-102 Universal Human Values 2 : "Understanding Harmony" is designed. This may be covered in their III or IV Semester of their B.Tech study.

In the Induction Programme, students would get an initial exposure to human valuesthroughUniversalHumanValues–I.Thisexposureistobeaugmentedby this compulsory full semester foundationcourse.

Course Objective:

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society andnature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence
- Strengthening ofself-reflection.
- Development of commitment and courage toact.

COURSE TOPICS:

The course has 28 lectures and 14 practice sessions in 5 modules:

Unit 1:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; „Natural Acceptance‟ and Experiential Validation- as the process for self-exploration

- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit 2:

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient „I" and the material „Body"
- Understanding the needs of Self („I") and „Body" - happiness and physical facility
- Understanding the Body as an instrument of „I" (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of „I" and harmony in „I"
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam andHealth.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one"s own life. Differentiate between prosperity and accumulation. Discuss programme for ensuring health Vs dealing with disease

Unit 3:

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students‟ lives.

Unit 4:

Understanding Harmony in Nature and Existence - Whole existence as Coexistence

- Understanding harmony in Nature
- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation innature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasivespace
- Holistic perception of harmony at all levels ofexistence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Unit 5:

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of humanvalues
- Definitiveness of Ethical HumanConduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic UniversalOrder
- Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems c. Ability to identify and develop appropriate technologies and management patterns for above productionsystems.
- Case studies of typical holistic technologies, management models and productionsystems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions andorganizations
- Sum up.

Text Book

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, “Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. A.N.Tripathi, “HumanValues”, NewAgeIntl.Publishers,NewDelhi,2004.
3. The Story of Stuff(Book).
4. MohandasKaramchandGandhi “TheStoryofMyExperimentswithTruth”
5. E. F. Schumacher. “Small is Beautiful”
6. SlowisBeautiful–CecileAndrews
7. J C Kumarappa “Economy of Permanence”
8. PanditSunderlal“Bharat Mein Angreji Raj”
9. Dharampal, “Rediscovering India”
10. Mohandas K.Gandhi, “Hind Swaraj or Indian Home Rule”
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

OUTCOME OF THECOURSE:

By the end of the course,

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life. At least a beginning would be made in thisdirection.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

II Year B.Tech. M.E. II-Sem

MECHANICS OF MATERIALS LAB

L	T	P	C
0	0	3	1.5

Course Objectives: The object of the course to make the student to understand the behaviour of materials under different types of loading for different types structures.

LIST OF EXERCISES:

1. Tension test.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test.
5. Hardness test.
6. Shear test

Course Outcomes:

- Ability to perform different destructive testing.
- Ability to characteristic materials.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

II Year B.Tech. M.E. II-Sem

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

- The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

LIST OF EXERCISES:

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli‟s equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

Course Outcomes:

- Ability to use the measurement equipments for flow measurement.
- Ability to do performance trust on different fluid machinery.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 4

BIOLOGY FOR ENGINEERS

L	T	P	C
2	1	0	0

Course Objectives:

Course Objectives	
1	To provide basic understanding about life and life Process. Animal and plant systems
2	To understand bio molecules, their structures, functions and Applications
3	Brief introduction about human physiology and bioengineering
4	To understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
5	Applications of biological Principles applied in our daily life using different technologies
6	Brief introduction to the production of transgenic microbes, Plants and animals.

Unit I: Introduction to Basic Biology

Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes.Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief
introduction to five kingdoms of classification.

Unit Outcomes:

After completing this unit, the student will be able to

- Summarize the basis of life.
- Understand the difference between lower organisms (prokaryotes) from higher organisms(eukaryotes).
- Understand how organisms are classified.

Unit II: Introduction to Biomolecules

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and theirtypes. Enzymes, Enzyme application in Industry. Large scale production of enzymes byFermentation.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what are bio molecules? Their role in living cells, their structure, function and how they are produced.
- Interpret the relationship between the structure and function of nucleic acids.
- Summarize the applications of enzymes in industry.
- Understand what is fermentation and its applications of fermentation in industry.

Unit III: Human Physiology

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic andanaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what nutrients are
- Understand the mechanism and process of important human functions

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription andTranslation. DNA technology. Introduction to gene cloning.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand and explain about gene structure and replication in prokaryotes andEukaryotes
- How genetic material is replicated and also understands how RNA and proteins aresynthesized.
- Understand about recombinant DNA technology and its application in differentfields.
- Explain what is cloning.

Unit V: Application of Biology

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins,Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basicsof Production of Transgenic plants and animals.

Unit Outcomes:

After completing this unit, the student will be able to Understand.

- How biology is applied for production of useful products for mankind.
- What are biosensors, biochips etc.
- Understand transgenic plants and animals and their production

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.
CO2	Explain about biomolecules, their structure and function and their role in the living organisms. How biomol ecules are useful in Industry.
CO3	Briefly about human physiology
CO4	Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms
CO5	Know about application of biological Principles in different technologies for the production of medicines and Pharmaceutical molecules through transgenic microbes, plants and animals

Text books:

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications -
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

Reference Books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A Global Approach”, Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011

3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology –- 2014.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUACEA **R19**

2019-2020

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

III.B.Tech I Semester (R19)

Semester – 5 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Heat Transfer	PCC	2-1-0	3
2.		Dynamics of Machinery	PCC	2-1-0	3
3.		Operation Research	PCC	2-1-0	3
4.		**(Professional Elective-I)** 1. Power Plant Engineering 2. Alternative Fuels for IC Engines 3. Material handling Equipments	PEC-I	2-1-0	3
5.		**(Open Elective-I)** **1.** Optimization Techniques	OEC-I	2-1-0	3
		2. Energy Management		2-1-0	
		3. Rapid Prototyping		2-1-0	
		4. Python Programming		2-0-2	
6.		Design of Machine Members-I	PCC	2-0-0	2
7.		Thermal Engg. Lab	PCC	0-0-3	1.5
8.		Exploratory Data Analysis Lab	HSMC	0-0-3	1.5
9.		Machine Tools Lab	PCC	0-0-2	1
10.		Socially Relevant Project	PR	0-0-1	0.5
11.		Research Methodology	MC	3-0-0	0
				Total	**21.5**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

HEAT TRANSFER

Course Objectives

- To impart the basic laws of conduction, convection and radiation heat transfer and their applications
- To familiarize the convective heat transfer concepts
- To explain basics of radiation heat transfer
- To make conversant with the heat transfer analysis related to thermal systems like heat exchangers, evaporator, and condenser.
- To understand the phenomenon of boiling and condensation to familiarize the mass transfer process

UNIT- I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation – General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates, Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy – Critical Radius/Thickness of Insulation – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation.

UNIT -II

Heat Transfer in Extended Surface (Fins) – efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.

One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance-Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

UNIT -III

Convective Heat Transfer: Dimensional Analysis – Buckingham Π Theorem and Its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers – Concepts of Continuity, Momentum And Energy Equations.

Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

UNIT -IV

Heat Transfer with Phase Change: Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Film wise and Drop wise Condensation – Nusselt's Theory of Condensation on a Vertical Plate – Film Condensation on Vertical snd Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers – Overall Heat Transfer Coefficient and Fouling Factor –Concepts of LMTD and NTU Methods – Problems using LMTD and NTU Methods.

UNIT -V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation –Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies – Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

Course Outcomes

At the end of the course, the student will be able to

- Apply the concepts of different modes of heat transfer.
- Apply knowledge of conduction heat transfer in the design of insulation of furnaces and pipes.
- Analyze free and forced convection phenomena in external and internal flows

- Design a heat exchanger for a given application.
- Design of thermal shields using the concepts of black body and non-black body radiation

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.

Reference Books:

1. Heat Transfer, P.K.Nag, 3/e, TMH, 2011.

2. Heat Transfer, Ghoshdastidar, Oxford Univ. Press, 1st edition, 2004.

3. Heat Transfer, Holman.J.P, 10/e, TMH, 2012.

4. Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001.

5. Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ.

6. Fundamentals of Heat and Mass Transfer, Incropera, 5/e, Wiley India.

7. Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International, 2007.

NOTE: Heat transfer Data books are permitted for Exam.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

DYNAMICS OF MACHINERY

Course Objectives:

- To introduce to the basic concepts of friction and to analyze its effects on different applications.
- To understand the principles of gyroscopic effects and to analyze its effect on different applications.
- To impart knowledge on the principles in mechanisms used for governing of machines
- To analyze the machines on unbalanced forces and to determine their effects on them.
- To impart the knowledge on modeling and analysis of vibration behavior of different systems.

UNIT I

Friction: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Brakes And Dynamometers: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT II

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

Turning Moment Diagrams And Fly Wheels: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

UNIT III

Governors:Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

UNIT IV

Balancing: Balancing of rotating masses - single and multiple – single and different planes. Balancing Of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder inline and radial engines for primary and secondary balancing.

UNIT V

Vibration: Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Torsional vibrations - two and three rotor systems.

Course Outcomes:

At the end of the course student will be able to

- Apply the principles of friction on applications such as brakes and clutches.
- To apply the gyroscopic effect to stabilize aeroplanes, ships, two and four wheeled vehicles etc.
- To analyze different forces acting on governors and estimate the equilibrium speed of the engine.
- To estimate the magnitude of the unbalanced force in the system and determine the suitable balancing force/mass.
- To find the critical parameters of vibration of the system.

TEXT BOOKS:

1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.

2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

REFERENCES:

1. Theory of machines, thomas bevan, pearson, 3rd edition,2012.

2. The theory of machines, j.e. shiegley, mcgraw hill .

3. Theory of machines and mechanisms of shigley et.al. Oxford international student edition.

4. Theory of machines by r.s khurm, s.chand publications

NOTE: *End Exam should be conducted in Drawing Hall*

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

OPERATIONS RESEARCH

Course Objectives:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.
- Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
- Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry.
- Skills in the use of Operations Research approaches and computer tools in solving real problems in industry.
- Mathematical models for analysis of real problems in Operations Research.

UNIT- I

Introduction to OR and Linear Programming-, OR definition– Classification of Models –Types of Operations Research models. Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two–Phase Simplex Method, Big-M Method, Special Cases of LP-Degeneracy, Infeasibility and Multiple Optimal Solutions;

UNIT -II

Linear programming-2: Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method.

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method. Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method; Special Cases -Unbalanced Transportation Problem, Degenerate Problem; Assignment Problem – Formulation; Optimal Solution -Travelling Salesman problem.

UNIT -III

Game Theory: Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies – 2 X 2 Games – Dominance Principle– Solution by Graphical Method of m X 2 & 2 X n games.

Queuing Theory: Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern (Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non finite queue length.

UNIT- IV

Sequencing -Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models.

PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float. CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration. PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time.

UNIT -V

Dynamic Programming : Introduction – Bellman's Principle of Optimality – Applications of Dynamic Programming- Capital Budgeting Problem – Shortest Path Problem – Solution of Linear Programming Problem by DP. Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Course Outcomes:

CO1 Be able to understand the application of OR and frame a LP Problem with solution – graphical and through solver add in excel (software).
CO2 Be able to build and solve Transportation and Assignment problems using appropriate method.
CO3 Be able to design and solve simple models of CPM and queuing to improve decision making and develop critical thinking and objective analysis of decision problems.
CO4 Be able to solve simple problems of replacement and implement practical cases of decision making under different business environments .
CO5 Enables to take best course of action out of several alternative courses for the purpose of achieving objectives by applying game theory and sequencing models.

Text Books:

1. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.

2. Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, Preetam Basu, Geralld J. Lieberman, TMH, 9th edition,2011.

References:

1. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.

2. Operations Research, Wagner, PHI Publications , 2nd edition.

3. Operation Research, J.K.Sharma, MacMilan, 5th edition, 2013.

4. Linear Programming, Susy Phillippose, PHI

5. Operations Research, A.M.Natarajan, P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.

6. Operations Research: Methods & Problems , Maurice Saseini, Arhur Yaspan& Lawrence

Friedman

7. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

Power Plant Engineering (Professional Elective-I)

Course Objectives:

1. Apply knowledge of mechanical engineering related to power generation systems.
2. Control and economics in different type of power plants for their operation and maintenance.
3. To introduce students to different aspects of power plant engineering.
4. To familiarize the students to the working of power plants based on different fuels.
5. To expose the students to the principles of safety and environmental issues.

UNIT -I

Introduction to the Sources of Energy – Resources and Development of Power in India.

Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection, Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor – Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment – Pollutants and Pollution Standards – Methods of Pollution Control. Inspection and Safety Regulations.

UNIT -II

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems. Steam Power Plant: Combustion Process : Properties of Coal – Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders.

UNIT -III

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage.

Gas Turbine Plant : Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT- IV

Hydro Electric Power Plant: Water Power – Hydrological Cycle / Flow Measurement – Drainage Area Characteristics – Hydrographs – Storage and Pondage – Classification of Dams and Spill Ways. Hydro Projects and Plant: Classification – Typical Layouts – Plant Auxiliaries – Plant Operation Pumped Storage Plants.

UNIT V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Principle of its Working, Wind Energy – Types of Turbines – HAWT & VAWT-Tidal Energy. MHD power generation. Nuclear Power Station: Nuclear Fuel – Nuclear Fission, Chain Reaction, Breeding and Fertile Materials – Nuclear Reactor –Reactor Operation. Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding – Radioactive Waste Disposal.

Course Outcomes:

1	Analyze the efficiency and output of modern Rankin cycle steam power plants with superheat, reheat, regeneration, and irreversibilities.
2	Calculate the performance of gas turbines with reheat and regeneration, and discuss the benefit of combined cycle power plants.
3	Explain the major types of steam, hydro, nuclear, tidal power plants and
4	Estimate power generation potential.
5	Scope of employability in various power plants

Text Books:

1. Power plant Engineering, P.K. Nag, TMH, 3rd edition, 2013.
2. A course in power plant Engineering, Arora and S. Domkundwar.

Reference Books:

1. Power plant Engineering, Ramalingam, Scietech Publishers
2. Power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.
3. A Text Book of Power Plant Engineering, Rajput , Laxmi Publications, 4th edition, 2012.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III B.Tech I- SEMESTER

L	T	P	C
2	1	0	3

ALTERNATIVE FUELS FOR I.C. ENGINES
(Professional Elective-I)

Course Objectives

1 To expose potential alternate fuels and their characteristics

2 To use appropriate synthetic fuels and fuel additives for better combustion characteristics

3 To utilise alcohol fuels effectively for lower emissions

4 To elaborate on the utilisation of Bio-Diesel and its types as a suitable fuel in CI engines

5 To utilise different gaseous fuels and predict their performance and combustion characteristics

UNIT-I

Introduction: solid fuels, gases fuels, liquid fuels, chemical structure of petroleum, petroleum refining process, important requisite qualities of engine fuels, SAE rating of fuels.

UNIT-II

FUELS: Availability and Suitability to Piston Engines, Concept of conventional fuels, potential alternative fuels - Ethanol, Methanol, DEE/DME - Hydrogen, LPG, Natural gas, Producer gas, Bio gas and Vegetable oils - Use in I.C.Engines-Merits and Demerits of various fuels.

UNIT-III

ALCOHOL FUELS: Properties as engine fuels - Performance in S.I.Engines - Alcohol & Gasoline blends - Flexible Fuel Vehicle -Reformed alcohols.

Alcohols in C.I. Engines - Emulsions - Dual fuel systems -Spark assisted diesel engines - Surface ignition engines - Ignition accelerators - Manufacture of alcohol fuels.

UNIT-IV

GASEOUS FUELS: Hydrogen - Properties - Use in C.I Engines - Use in S.I Engines - Storage methods - Safety precautions -Production methods.

Production of Producer gas and bio gas - Raw materials - Gasification - Properties - Cleaning up the gas -Use in S.I. and fuel engines, LPG & Natural gas - Properties - Use in S.I. and C.I. Engines.

UNIT-V

VEGETABLE OILS: Properties - Esterification - Performance in Engines.

FUEL QUALITY: Fuel quality standards for Automotive Engines - Lead free gasolines, low and ultra -low sulphur diesels, LPG, CNG, and Biodiesels.

Course Outcomes

CO1 Categorize, interpret and understand the essential properties of fuels for IC engines

CO2 Identify the need for alternate fuels and characterize prospective alternate fuels

CO3 evaluate the storage and dispensing facility requirements

CO4 Analyze the implement limitations with regard to performance, emission and materials compatibility

CO5 Develop strategies for control of emissions as per the legislation standards

TEXT BOOKS:

1. Internal combustion engines by V . Ganesan, Tata McGraw Hill book cop. 2007
2. Richard L.Bechtold, Automotive Fuels Guide Book, SAE Publications,1997.

REFERENCES:

1. Osamu Hirao and Richard K.Pefley, Present and Future Automotive Fuels, John Wiley and sons, 1988.
2. Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

MATERIAL HANDLING EQUIPMENTS (Professional Elective-I)

Course Objectives:

1. To understand how the knowledge of materials management can be an advantage to logistics and supply chain operations.

2. To sensitize the students on the materials management functions – Planning, Purchase,Controlling, Storing, Handling, Packaging, Shipping and Distributing, and Standardizing.

3. To realize the importance of materials both in product and service.

4. planning/ production and plant layouts, studying about strategies of material handling and equipments, and selection of site locations.

5. It also aims to explore the layout planning by computer applications following different algorithms.

UNIT-I

Overview of Material Handling: Principles of Material Handling, Principal groups of Material Handling equipment – General Characteristics and application of Material Handling Equipment, Modern trends in material handling.

UNIT-II

Lifting Equipments: Hoist- Components of Hoist – Load Handling attachments hooks, grabs and clamps – Grabbing attachments for bulk material – Wire ropes and chains.

UNIT-III

Lifting tackle pulleys for gain of force and speed: Tension in drop parts – Drums, Shears and sprockets – Arresting gear and brakes – Block brakes, Band brakes, thrust brakes – Safety and hand cranks. Principle operation of EOT, Gantry and jib cranes Hoisting Mechanisms, Travelling mechanisms, lifting mechanisms – Slewing Mechanisms – Elevators and lifts.

UNIT-IV

CONVEYORS: Types - description -applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors

UNIT-V

ELEVATORS: Bucket elevators: Loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Course Outcomes :

1. The students will be able to select appropriate location for establishing industrial plants by applying the concepts of location selection.
2. The students will be able to plan and design plant and production layouts through basic strategies and with computer applications.
3. The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to the optimize the layout/ material handling system
4. The students will be able to develop algorithms for new planning layouts for typical applications in the industries and Suggesting appropriate material handling strategies in the industries.
5. The students will be able to design of fork lift trucks.

REFERENCES

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.

2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.
3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.
5. P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

OPTIMIZATION TECHNIQUES (Open Elective-I)

L	T	P	C
2	1	0	3

Course Objectives:

- To introduce various optimization techniques i.e classical, linear programming,
- Transportation problem, simplex algorithm, dynamic programming Constrained and unconstrained optimization techniques for solving and optimizing.
- Electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project
- Learn the knowledge to formulate optimization problems

UNIT - I

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

UNIT - II

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - III

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems

UNIT – IV

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam and general optimization model of a machining process.

Course Outcomes:

After completion of this course, the student will be able to explain the need of optimization of engineering systems

- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm,
- transportation problem apply unconstrained optimization and constrained non-linear programming and
- dynamic programming Formulate optimization problems.

TEXT BOOKS:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

ENERGY MANAGEMENT (Open Elective-I)

Course Objectives:

To impart knowledge on

1. To understand importance of Energy Management.
2. To Carry out Energy Audit.
3. Methods to reduce consumption of energy and save cost.
4. Significance of project management and energy trade prices.
5. To improve energy efficiency of overall system.

UNIT - I

ENGINEERING ECONOMICS:

Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest- Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II

DEPRECIATION & COST ANALYSIS:

Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III

PROJECT MANAGEMENT:

Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.

Energy Management Programs: Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT – IV

ENERGY AUDITING: Definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

Course Outcomes:

Ability to

- Apply the principles energy management for conservation.
- Describe the energy rate structures.
- Examine the economic evaluation of energy conservation solutions.
- Carry out Energy Audit of the Residence / Institute/ Organization.
- Compare energy scenario of India and World.

Text Books:

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.
2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.
3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.

Reference Books:

1. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
2. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
3. The role of Energy Manager, E.E.O., U.K.
4. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
5. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

Rapid Prototyping (Open Elective-I)

Course Objectives:

Impart knowledge on

- Product development using rapid prototyping processes
- Rapid prototyping processes
- Rapid prototyping is a group of methods used to rapidly manufacture a scale model of a physical part or assembly using three-dimensional computer aided design.
- Construction of the part or assembly is usually done using 3D printing technology.
- Rapid prototyping techniques are often referred to solid free.

UNIT-I

Introduction: Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry and classification of RP systems.

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Application.

Selective Laser Sintering: Type of machine, Principle of operation, Process parameters, Data preparation for SLS, Applications.

UNIT-II

Fusion Deposition Modelling: Principle, Process parameter,Path generation, Application

Solid Ground Curing: Principle of operation, Machine details, Applications.

UNIT-III

Laminated Object Manufacturing: Principle Of Operation, LOM materials.
Process details, application.

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, Object Quadra systems.

UNIT-IV

LASER ENGINEERING NET SHAPING (LENS)

Rapid Tooling: Indirect Rapid tooling -Silicon rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

UNIT-V

Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation errors, Part building errors, Error in finishing, Influence of build orientation.

Allied Processes: Vacuum casting, surface digitizing, Surface generation from point cloud, Surface modification-data transfer to solid models.

Course Outcomes:
Ability to

- Select and employ appropriate rapid prototype methods for product development.
- Develop prototypes of products.
- Describe product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications.
- Identify The process photopolymers, photo polymerization, layering technology, laser and laser scanning.
- Applying of measurement and scaling technique for prototype manufacturing.

TEXT BOOKS:

1. Rapid Prototyping and Tooling by Hari Prasad & K.S. Badhrinarayan/ Page Turners
2. Paul F. Jacobs- "**Stereo lithography and other RP & M Technologies**", SME, NY 1996.
3. Flham D.T & Dinjoy S.S - "**Rapid Manufacturing**" Verlog London 2001.
4. Lament wood, "**Rapid automated",** Indus press New York

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	0	2	3

Python Programming (Open Elective-I)

Subject Code	Title of the Subject	L	T	P	C
19A30501	Introduction to Application Development with Python	2	0	2	3

COURSE OBJECTIVES	
1	Study the computer basics , software engineering and network basics , HTML
2	Learn Java features to create applications & perform event handling .
3	Learn the Database and interconnection with java.

COURSE OUTCOMES	
CO1	Ability to know basics of computer and software engineering
CO2	Ability to write Efficient programs of HTML
CO3	Create Tables with the databases and retrieving by using queries.
CO4	Able to design java application and dynamic behavior of classes.
CO5	Design and develop the object oriented programs using pure functions, operator overloading, and Inheritance, set, lists, tuples and dictionary concepts in python.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		2		1		2	1			3		
CO2	3	3		2							2			3	
CO3	2	3	1			1			3			1			1
CO4	3		2		3					3	3			3	
CO5	3									3				2	

UNIT-1

Introduction to Computer Basics: Computer, Hardware, CPU, Monitor, Keyboard/mouse, Memory, - RAM, Storage, Software, OS, Application, Saving a file, Files and Folders.

Basics of Network: Home and Office Networks,Networking Types and Structures, Wired vs Wireless Networks,Networking Topologies,Networking Topology- Physical vs Logical, Peer to Peer, Client Server, Network Size.

Networking Levels and Layers and Protocols: Network Addressing, Classes of IPv4, Public and Private IP Addresses, What is a Protocol? What is a Protocol Suite?

Protocol Stacks, Networking and Internet Service: IP protocol, DHCP (Dynamic Host configuration Protocol), DNS (domain Name Service), General Networking Physical Component.

Software Engineering Fundamentals : Software Requirement, Problem Recognition, Evaluation and Synthesis, Modeling, Specification, Review, Objectives of Software Design, Software Design Concepts, Different levels of Software Design, Software Design Process, Architectural Design, Structured Programming, Functional Programming, Programming style, Software Documentation, Software Implementation Challenges , Software Validation, Software Verification, Manual Vs Automated Testing, Testing Approaches, Testing Levels, Testing Documentation, Testing vs. Quality Control, Quality Assurance and Audit

Software Engineering Fundamentals & OOP: Overview of Software Maintenance Need for Maintenance, Categories of Software Maintenance.

Overview of Configuration management and version control : What is Software Configuration Management?, Why do we need Configuration management?, Tasks in SCM process, Configuration Identification, Baseline, Change Control, Configuration Status Accounting, Configuration Audits and Reviews, Participant of SCM process, Software Configuration Management Plan, Software Configuration Management Tools.

Agile Basics:

What is Agile?, What are Agile Methodologies?, What is the Agile Manifesto?, What is Agile project management?, Agile Scrum methodology.

OOP :

Object Oriented Concepts Problems in Functional Programming, What Is ObjectOriented Programming? , Objects and Classes Declaration of Class, Declaring Objects, State of an Object, Behaviour of an Object Principles in ObjectOriented technology Abstraction, Encapsulation

OOP & HTML, CSS and JavaScript:

Principles in Object-Oriented technology, Inheritance, Polymorphism

HTML, CSS and JavaScript

Introduction to Web Technology

World Wide Web, IoT, Web Programming, Web Framework, HTML, CSS and JavaScript

Introduction to HTML5: HTML5 Elements, Semantic Elements HTML Overview, HTML Versions, Semantic Web, Semantic Elements in HTML5, <header>, <nav>, <section>, <article>, <aside>, <footer>

Table, List, Working with Links, Image Handling

Define an HTML Table, <table>, <tr>, <td>, <th>, <caption>, Unordered List, Ordered List, Description List, <ul>, <ol>, <li>, <dl>, <dt>, <dd>, Hyperlinks, The target Attribute, Absolute URLs vs. Relative URLs, Use an Image as a Link, Link to an Email Address, <a>, href Attribute, <img>, The src Attribute, The alt Attribute, Image Size - Width and Height, Image as a Link

Form-Input Elements, HTML5 Form elements

The <form> Element, The <input> Element, Text Fields, The <label> Element, Radio Buttons, Checkboxes, The Submit Button

1. List the basic concepts of computer fundamentals(L1)
2. Identify and apply the basic concepts of OOP, HTML, CSS and JavaScript.(L3)

UNIT-II

HTML, CSS and JavaScript:

HTML5 Attributes, Video & Audio, iframes

Standard Attributes, align, background, bgcolor, class, height, hidden, id, style, tabindex, valign, width, Embedding Video, Embedding Audio, Handling Media Events, HTML <iframe> Tag

Introduction to CSS3, CSS Syntax, CSS Styling

What is CSS, Why use CSS, Inline Style, CSS Style Tags, Linking to CSS, Style Override Precedence

Text and Fonts properties, CSS Selectors, Different color schemes

Text Color and Background Color, CSS Text Alignment, Text Direction, Vertical Alignment, Generic Font Families, The CSS font-family Property, Font Style, Font Size

CSS Borders, CSS Margins, CSS Backgrounds

CSS Border Style, The border-style property, Border Width, Border Color, Border Sides, CSS Rounded Borders, margin-top, margin-right, margin-bottom, margin-left, CSS background-color, Opacity / Transparency, CSS background-image, CSS background-repeat

JavaScript basics

Introduction to Javascript, Execution of Javascript, Scripts in head and body of HTML, Internal and External Javascript, Javascript Variables, Comments

Functions in Javascript

JavaScript Function Syntax, Built in methods in Javascript, Function Invocation, Function Return, Why Functions?, The () Operator Invokes the Function, Functions Used as Variable Values, Local Variables

Javascript validation

Client-side form validation, Different types of client-side validation, Using built-in form validation, Validating forms using JavaScript, Validating forms without a built-in API

Events, Javascript event handling

Introduction to JavaScript events, Event flow, Event bubbling, Event capturing, Event object, addEventListener(), preventDefault(), stopPropagation()

JavaScript Strings

String Methods and Properties, String Length, Extracting String Parts, The substring() Method, Replacing String Content, Converting Upper and Lower Case, The concat() Method

JavaScript Dates

JavaScript Date Output, Creating Date Objects, new Date(),new Date(year, month, ...), new Date(dateString), Date Methods, Displaying Dates

Array in Javascript

What is an Array, Creating an Array, Accessing Array Elements, Array Properties and Methods, Looping Array Elements

Document Object Model (Window, Frame, Navigator Objects)

What is Document Object Model (DOM), Node Types, The nodeName and nodeValue properties, Node and Element, Node Relationships

Working with Document Object (Its Properties and methods, Cookie handling)

Selecting Elements, Traversing Elements, Manipulating Elements

RDBMS Concepts and SQL Using Oracle:

Introduction to RDBMS Concepts

What is a Relational Database, The relational model, Benefits of relational database management

system, ACID properties and RDBMS ,Introduction to SQL History of SQL, SQL Standards, How SQL Works Creating and Managing Tables , Guidelines for Managing Tables, Creating Tables, Altering Tables, Dropping Tables, Data Manipulation: INSERT, UPDATE, DELETE

1. Analyze and apply the different HTML features to design the web applications(L4)
2. Create the different forms and check for data accuracy using Javascript and RDBMS. (L5)

UNIT-III

RDBMS Concepts and SQL Using Oracle:
Basic SQL SELECT Statements
SELECT, FROM Clause, Comparison Operators, WHERE Clause, ORDER BY, AND, OR, DISTINCT, IN, IS NULL, IS NOT NULL, LIKE, REGEXP_LIKE, NOT, ALIASES
Scalar & Aggregate Functions
String Functions, Numeric Functions, Date Functions, Conversion Functions, NULL-related Functions, AVG, COUNT, MAX, MIN, LISTAGG, SUM
Joins & Subqueries
Oracle INNER JOIN, Oracle LEFT JOIN, Oracle RIGHT JOIN,
Introduction to the Oracle Subquery: Advantages of Oracle Subqueries, Oracle Subquery in the SELECT clause, Oracle Subquery in the FROM clause, Oracle Subquery with comparison operators, Oracle Subquery with IN and NOT IN operators, Oracle correlated Subquery, Oracle correlated Subquery in the WHERE clause, Oracle correlated Subquery in the SELECT clause,
Oracle correlated Subquery with the EXISTS operator
Views & Index
What is a VIEW in Oracle, Create VIEW, Update VIEW, DROP VIEW, What is an Index in Oracle, Create an Index, Create a Function-Based Index, Rename an Index, Drop an Index
RDBMS Concepts and SQL & Introduction to Java:
Sequence, Synonym
About Sequences, Creating Sequences, Altering Sequences, Using Sequences, Dropping Sequences
About Synonyms, Creating Synonyms, Using Synonyms in DML Statements, Dropping Synonyms
Data Control Language Statements , GRANT, REVOKE

1. Create the SQL statements that edit existing data. (L5)
2. Explain and Design the SQL statements that create database objects.(L6)

UNIT-IV:
Introduction to Python : Type Conversion, I/O and import, Operators, Namespace, Modules in Python, Python DateTime.

Classes and Objects: What Are Classes and Objects in Python? Advantages of Using Classes in Python, Defining a Class in Python, Creating an Object in Python, The self, The_init_() function in Python, Python Inheritance and its Types.

Strings: Creating a String in Python, Accessing Python String Characters, Deleting/Updating from a String, Escape Sequencing in Python, Formatting of Strings, Python Operators for Strings, Builtin Python String Methods

1. Solve the problems by applying modularity principle(L3)
2. Design programs for manipulating strings (L6)

UNIT-IV:

Lists: Python Lists, Accessing Values in Lists, Updating Lists, Delete List Elements, Basic List Operations, Indexing, Slicing, and Matrixes, Built-in List Functions & Methods

Sets: Set commands, Create a set in Python, Iteration Over Sets, Add member(s) in Python set, Remove item(s) from Python set, Intersection of sets, Union of sets, set difference in Python, Clear sets.

Tuples: What is Tuple? Accessing Values in Tuples, Updating Tuples, Delete Tuple Elements, Basic Tuples Operations, Indexing, Slicing, and Matrixes, Built-in Tuple Functions.

Dictionary: What is Dictionary? Accessing Values in Dictionary, Updating Dictionary, Properties of Dictionary Keys, Built-in Dictionary Functions & Methods.

1. Analyze and Apply modifications to PYTHON programs that solve real-world problems. (L4)
2. Use data structure dictionaries (L3)
3. Organize data in the form of sets, tuples and dictionary (L6)

Text books:

Reference Books:

1. Introduction to Application Development with Python, Learning Reference Guide
2. Think Python How to Think Like a Computer Scientist 2nd Edition, Version 2.4.0, Allen Downey Green Tea Press
3. LEARNING TO PROGRAM WITH PYTHON Richard L. Halterman.
4. https://www.tutorialspoint.com/basics_of_computers/bas ics_of_computers_introduction.htm
5. https://courses.lumenlearning.com/santaanainformationsystems/chapter/networking-introduction
6. https://www.javatpoint.com/network-addressing
7. https://whatis.techtarget.com/definition/Internet-Protocolsuite-IP-suite
8. https://docs.microsoft.com/en-us/windowsserver/networking/technologies/dhcp/dhcp-top
9. https://www.guru99.com/c-sharp-inheritance-polymorphism.html
10. https://www.tutorialspoint.com/html5/html5_attributes.htm
11. https://www.geeksforgeeks.org/introduction-to-javascript/
12. https://www.javascripttutorial.net/javascript-dom
13. https://www.techonthenet.com/oracle/synonyms.php
14. https://www.programiz.com/python-programming/input-outputimport

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L	T	P	C
2	0	0	2

DESIGN OF MACHINE MEMBERS-I

Course Objectives:

- To introduce the basic principles of mechanical design and their applications
- Enable students to attain the basic knowledge required to understand select machine elements
- To apply principles of machine component to satisfy functional and strength requirements.
- To analyze the cotter joints and shafts.
- To apply the design concepts to mechanical components

UNIT – I

Introduction: General considerations of design, design process. Selection of Engineering Materials - properties –Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

Stresses in Machine Members**:** Simple stresses – Combined stresses – Tensional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – factor of safety.

UNIT – II

Design For Fluctuating Loads**:** Stress concentration –notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line design of components for finite and infinite life.

UNIT – III

Design of Riveted Joints: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

Design Of Bolted Joints: Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

UNIT – IV

Design of Cotters and Knuckle Joints**:** Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

Design of Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Standard shaft sizes.

UNIT-V

Design of Keys and Couplings: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Course Outcomes:

Able to

- Analyse stresses acting on components and determine the size based on theories of failure.
- Decide specifications as per standards given in design data and select standard components to improve interchangeability.
- inculcate an ability to design cotter joints and shafts
- Design machine components for a given load condition using design data hand books.
- to design keys and couplings.

Text Books:

1. Design of Machine Elements, V.B.Bhandari , TMH Publishers,NewDelhi
2. Machine Design,Schaum's series,TMH Publishers, New Delhi
3. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

Reference Books:

1. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi
2. Machine Design, R.S. Kurmi and J.K. Gupta ,S.Chand Publishers, New Delhi
3. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, NewDelhi.
4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.
5. Machine Design, Pandya and Shah, Charotar Publishers, Anand.
6. Machine Design, R.L. Norton, Tata McGraw Hill Publishers
7. Machine Design by Groover – CBS Publications.

NOTE: Design data books are not permitted in the examinations.

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L	T	P	C
0	0	3	1.5

THERMAL ENGINEERING LAB

Course Objective

1. To impart practical exposure of various thermal engineering systems
2. To study the concepts, applications of the thermal engineering laboratory
3. To demonstrate and conduct experiments, interpret and analyze results of IC Engine testing.
4. To develop an idea of fuel properties and their variation with temperature.
5. To determine kinematic viscosity and calorific value of fuels.

1. Valve / Port Timing Diagrams of an I.C. Engines

2. Performance Test on a 4 -Stroke Diesel Engines

3. Performance Test on 2-Stroke Petrol engine

4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine

5. Retardation and motoring test on 4- stroke engine

6. Heat Balance of an I.C. Engine.

7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.

8. Performance Test on Variable Compression Ratio Engines, economical speed test.

9. Performance Test on Reciprocating Air – Compressor Unit

10. Study of Boilers

11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.

Course Outcomes

CO1 Evaluating the Air/Fuel Ratio and Volumetric efficiency of an I.C.Engines & Performance of Air - Compressors

CO2 Appreciate the Mechanism of ports /Valves functioning in 2-stroke petrol /Diesel engine and to understand IC Engine Assembly

CO3 Evaluating the performance characteristics of single cylinder petrol engine at different loads and single cylinder diesel engine at different loads and draw the heat balance sheet

CO4 Understand the method of finding the indicated power of individual cylinders of an engine by using morse test

C05 Understand the working and various components of Boilers

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L	T	P	C
0	0	3	1.5

EXPLORATORY DATA ANALYSIS LAB

Course Objectives:

- Focuses on analyzing and summarizing the main characteristics of data sets including visual methods.
- Explores techniques for formulating hypothesis about data for testing and for new data collection and experiments

List of lab assignments:

1. The basics of analytic graphics and the base plotting system in R.
2. Advanced graphing systems available in R: the Lattice system and the ggplot2 system
3. Clustering and dimension reduction techniques to make graphical displays of very high dimensional data
4. A complete EDA Analysis using R
5. Plotting and Coloring in R

Course Outcomes:

Upon completion of this course, learners will be able to:

• Use the R programming language with relative facility
• Command the use of the basic Plotting Systems used in R
• Analyze Data Sets using the Principles of Exploratory Data Analysis
• Explain the Visual Information contained in the R-generated Graphs
• Explain and present the Findings in the Data Sets, after the Analysis is complete

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L	T	P	C
0	0	2	1

MACHINE TOOLS LAB

Course Objectives::

1. Demonstration of construction & operations of general purpose machines
2. Know the working principles of different instruments.
3. Familiarize different machine tools used in production floor.
4. Impart hands on experience on lathe, drilling, shaping, milling, slotting, grinding and tool and cutter grinding machines.

List of Experiments:

1. Job on Step turning and
2. Taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planing
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.
10. Study of Injection Moulding Machine.

Course Outcomes:

- Perform step, taper turning, knurling and threading.
- Produce stepped surface using shaper and keyway using milling machine
- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations.
- Ability to manufacture tools using cutter grinder.

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L	T	P	C
0	0	1	0.5

SOCIALLY RELEVANT PROJECT

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L	T	P	C
3	0	0	0

RESEARCH METHODOLGY

Subject Code	Title of the Subject	L	T	P	C
	Research Methodology	3	0	0	0

COURSE OBJECTIVES : The objective of this course is	
1	To understand the basic concepts of research and research problem
2	To make the students learn about various types of data collection and sampling design
3	To enable them to know the method of statistical evaluation
4	To make the students understand various testing tools in research
5	To make the student learn how to write a research report
6	To create awareness on ethical issues n research

Syllabus

UNIT I Introduction to Research

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the concept of research and its process
- Explain various types of research
- Know the steps involved in research design
- Understand the different research approaches

UNIT IISampling Design

Steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of sampling and sampling design
- Explain various techniques in measurement and scaling
- Learn various methods of data collection
- Design survey questionnaires for different kinds of research

- Analyze the questionnaires

UNIT III Correlation and Regression Analysis

Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

LEARNING OUTCOMES:-After completion of this unit student will

- Know the association of two variables
- Understand the importance of correlation and regression
- Compare and contrast correlation and regression
- Learn various types of correlation
- Apply the knowledge of C&R Analysis to get the results

UNIT IV Statistical Inference

Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

LEARNING OUTCOMES:-After completion of this unit student will

- Know the statistical inference
- Understand the hypothesis testing procedure
- Compare and contrast Parametric and Non-parametric Tests
- Understand the use of chi-square test in investigating the distribution of categorical variables
- Analyze the significance of variance and covariance

UNIT VReport Writing and Professional Ethics

Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

LEARNING OUTCOMES:-After completion of this unit student will

- Learn about report writing
- Understand how to write research paper
- Explain various techniques of interpretation
- Understand the importance of professional ethics in research
- Design a scientific paper to present in the conferences/seminars
-

Text books:

1. Research Methodology:Methods and Techniques – C.R.Kothari, 2nd Edition, New Age International Publishers.
2. Research Methodology: A Step by Step Guide for Beginners- Ranjit Kumar, Sage Publications

REFERENCES:

1. Research Methodology and Statistical Tools – P.Narayana Reddy and G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.
2. Business Research Methods–Donald R. Cooper & Pamela S Schindler, 9/e,
3. S C Gupta, Fundamentals of Statistics,7th Edition Himalaya Publications

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the basic concepts and its methodologies
CO2	Understand the concept of sampling, research design etc.
CO3	Demonstrate the knowledge of research processes
CO4	Analyze the importance of research articles in their academic discipline
CO5	Select appropriatetesting toolsused in research
CO6	Design a research paper without any ethical issues

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

III.B.Tech II Semester (R19)

Semester – 6 (Theory - 6, Lab –2)					
S.No	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Modern Manufacturing Methods	PCC	2-1-0	3
2.		Design of Machine Members-II	PCC	2-1-0	3
3.		English Language Skills	HSMC	3-0-0	3
4.		**(Professional Elective-II)** 1. Automobile Engineering 2. Turbo Machinery 3. Productions and Operations Management	PEC-II	2-1-0	3
5.		**(Open Elective-II)** 1. Solar Energy Systems 2. Introduction to Electric and Hybrid Vehicles 3. Industrial Engineering	OEC-II	2-1-0	3
6.		**Humanities Elective-I** 1. Managerial Economics and Financial Analysis 2. Entrepreneurship and Incubation 3. Business Ethics and corporate governance	HEC-I	2-1-0	3
7.		Heat Transfer Lab	PCC	0-0-3	1.5
8.		English Language Skills lab	HSMC	0-0-3	1.5
9.		Socially Relevant Project	PR	0-0-1	0.5
10.		Constitution of India	MC	3-0-0	0
Total					**21.5**

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L	T	P	C
2	1	0	3

MODERN MANUFACTURING METHODS

Course Objectives:

- To learn the importance and basics of unconventional machining.
- To understand the rapid prototyping processes.
- To have the knowledge of different micro machining methods
- To understand the working principles of various Non-traditional machining methods.
- To learn about Non-traditional forming processes.

UNIT-I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications.

Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT-II

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters, applications and limitations, Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

UNIT-III

Electro –Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

Chemical Machining: Fundamentals of chemical machining- Principle of material removal-maskants – etchants- process variables, advantages and applications.

UNIT-IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations.

Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

UNIT-V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.

Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Course Outcomes:

At the end of this course the student should be able to understand

- Technical aspects of precision machining.
- Applications of rapid prototyping technologies.
- Tool selection for non traditional processes.
- Knowledge of economic aspects of Non traditional processes.
- Fabrication of microelectronic devices.

TEXT BOOKS:

1. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.
2. Advanced machining processes, VK Jain, Allied publishers.

REFERENCES:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984
2. Manufacturing Technology, Kalpakzian, Pearson
3. Modern Machining Process, Pandey P.C. and Shah H.S., TMH.

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L	T	P	C
2	1	0	3

DESIGN OF MACHINE MEMBERS– II

Course Objectives:

- To impart knowledge and skills in applying elementary design principles, basic design procedures and use of design data for the design of mechanical elements.
- To provide knowledge about the concepts, procedures and the data, to design and analyse machine elements in power transmission systems.
- To impart competency to specify, select and design the mechanical components for transmission systems.
- To Design mechanical machine components

UNIT -I

Design Of Curved Beams: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps.

Design Of Power Transmissions Systems: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT- II

Design Of Mechanical Springs: Stress and deflections of helical Springs-Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs-Design of leaf springs.

Design Of Power Screws: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

UNIT- III

Design Of Bearings: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

UNIT -IV

Design Of Spur & Helical Gears: Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur and Helical gears – Estimation of centre distance, module and face width. Check for dynamic and wear considerations.

UNIT- V

Design of IC Engine Parts: Pistons– Construction, Design of piston. Cylinder, Cylinder block, Connecting Rod, Crank shafts- Centre cranks.

Course Outcomes:
Student will be able to

- Identify the working principles of mechanical components employed in mechanical transmission systems.
- Apply suitable theories and basic engineering principles and procedures to design the transmission elements.
- Select appropriate engineering design data from standard data books for the design of mechanical transmission components.
- Design the transmission systems components for given conditions using Design data hand book.
- Design the engine parts

Text Books:

1. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, New Delhi, 9th edition, 2010.

2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

References:

1. Machine Design, Schaum‟s series, TMH Publishers, New Delhi, 1st edition, 2011

2. Design of Machine Elements, V.B.Bhandari , TMH Publishers, New Delhi, 2nd edition, 2013.

3. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi

4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.

5. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 2012.

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L	T	P	C
3	0	0	3

ENGLISH LANGUAGE SKILLS

Subject Code	Title of the Subject	L	T	P	C
	English Language Skills	3	0	0	3

Course Description:

English Language Skills aims to enable the engineering students to meet the demands of the modern job market through thorough training in LSRW skills, presentation skills, interview skills, academic writing etc. Students of our region have knowledge of their respective subjects, but the surveys make it clear that they are lagging behind in expressing themselves effectively in a professional setting. So this course will enable them to hone these skills and excel in their respective fields.

COURSE OBJECTIVES	
1	To develop awareness in students of the relevance and importance of technical communication and presentation skills.
2	To prepare the students for placements
3	To sensitize the students to the appropriate use of non-verbal communication
4	To train students to use language appropriately for presentations and interviews
5	To enhance the documentation skills of the students with emphasis on formal and informal writing

COURSE OUTCOMES	
CO1	To recall and memorize the basic concepts of effective communication
CO2	To understand the various components of effective communication.
CO3	To apply writing skills in order to meet the demands of work place environment.
CO4	To analyze verbal and non-verbal interpretations in multicultural context.
CO5	To evaluate different aspects of verbal and linguistic competence to become effective presenters.
CO6	To design and develop an effective written documents in technical domain.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓										
CO2				✓								
CO3		✓										
CO4							✓					
CO5		✓										
CO6												

SYLLABUS

UNIT 1: LSRW SKILLS

Introduction to LSRW Skills – Definition – Importance of LSRW Skills - Advantages and Disadvantages of Oral and Written Skills – Advantages and disadvantages of Written & Speaking skills - Barriers to effective communication

OUTCOMES
To recall and memorize the basic concepts of LSRW skills
To understand the various components of oral and written skills
To apply English language skills to avoid barriers to effective communication

UNIT II: VERBAL & NON-VERBAL SKILLS

Informal and Formal Conversation - Non-verbal Skills–Kinesics, Proxemics, Chronemics, Haptics, Oculesics ,Paralinguistic features – Body language for interviews

To understand the basic components of non-verbal communication.
To apply the knowledge of the difference between informal and formal conversation in order to meet the demands of work place environment.
To analyze non-verbal interpretations in multicultural context.

UNIT III: ACADEMIC WRITING SKILLS

Writing Skills–Art of condensation- summarizing and paraphrasing - Abstract Writing, Synopsis Writing – Formal Letter Writing - Report Writing

To understand the basic components of written communication.
To apply knowledge of different formats of written communication needed in

work place environment.
To analyze the structure of letters, reports etc.

UNIT IV: CREATIVE WRITING SKILLS

Film Review Writing – Creative Writing- Short Story Writing – Speeches for academic settings – Writing Skits – Script for Short Films/Web Series

To apply writing skills in creative writing to meet the demands of documentation in professional life
To analyze different figures of speech in creative writing
To evaluate different aspects creative and academic writing to become effective at written communication

UNIT V: PROFESSIONAL SPEAKING SKILLS

Job Interviews –Types of Job Interviews – Characteristics of a job interview - Interview Preparation Techniques –How to overcome Stage fright
Group Discussions(GD): Importance of Group Discussion- Characteristics of a GD - GD as a tool for selection – GD Strategies – Do's & Don't of GD - GD Vs Debates

To analyze the different aspects of interviews and group discussions
To evaluate the group dynamics to excel in group discussions
To design and develop strategies to answer effectively in interviews

Text Books:

1. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma,3rd Edition, O U Press 2015

References:

1. **Communication Skills by Pushpalatha& Sanjay Kumar, Oxford Univsesity Press**

2. Books on **TOEFL/GRE/GMAT/CAT/IELTS** by Barron's/DELTA/Cambridge University Press.2012.

3. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.

4. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.

5. Successful Presentations by John Hughes & Andrew Mallett, Oxford.

6. Winning at Interviews by Edgar Thorpe and Showick Thorpe, Pearson

7. Winning Resumes and Successful Interviews by Munish Bhargava, Mc Graw Hill

WEB LINKS

1. **https://blog.allaboutlearningpress.com/listening-comprehension/**
2. **https://www.englishclub.com/**
3. **https://www.helpguide.org/articles/relationships-communication/nonverbal-communication.htm**
4. **https://www.slideshare.net/poojavrs/lsrw-109040479**
5. https://www.slideshare.net/nandapalit/non-verbal-verbal-communication
6. https://www.slideshare.net/madeehasaeed96/writing-skills-71430610
7. https://www.slideshare.net/rhinautan/creative-writing-76208225
8. https://www.slideshare.net/vikkerkar/interview-skills-presentation
9. https://www.slideshare.net/ritikadhameja/group-discussion-46255658

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III Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

AUTOMOBILE ENGINEERING (Professional Elective-II)

Course Objectives

The student will be made to learn:

1. The anatomy of the automobile in general
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. Suspension, frame, springs and other connections
5. Emissions, ignition, controls, electrical systems and ventilation

UNIT -I

Introduction: Components of a Four Wheeler Automobile – Chassis and Body – Power Unit – Power Transmission – Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive – Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging – Oil Filters, Oil Pumps – Crank Case Ventilation.

UNIT- II

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel – Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter.

Propeller Shaft – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles

UNIT- III

Steering System: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages.

UNIT -IV

Suspension System: Objects of Suspension Systems – Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System.

Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

UNIT- V

Emissions from Automobiles – Pollution Standards National and International – Pollution Control–Modern Techniques in automobiles – Multipoint Fuel Injection for SI Engines-Common Rail Diesel Injection, Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.

Electrical System: Charging Circuit, Generator, Current – Voltage Regulator – Starting System, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Temperature Indicator.

Course Outcomes

CO1: Identify the different parts of the automobile

CO2: Explain the working of various parts like engine, transmission, clutch, Gear box & Propeller Shaft

CO3: Describe how the steering system operates.

CO4: Describe how the suspension and the Braking system operate.

CO5: Understand the environmental implications of automobile emissions & develop a strong base for understanding future developments in the automobile industry

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers

2. Automobile Engineering BY Joseph Hidner

Reference Books:

1. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.

2. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.

3. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.

4. Automotive engines , Newton, Steeds & Garret.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

TURBO MACHINERY (Professional Elective-II)

Course Objectives :

1. Learning the fundamentals of turbo machines and their applications in the thermodynamic analysis.
2. Study of functioning of steam nozzles and steam turbines and their thermodynamic analysis.
3. Understanding the concepts of gas dynamics with respect to thermodynamics and learning about the functioning of centrifugal compressors.
4. Study of functioning and performance analysis of axial flow compressors.
5. Learning the concepts of axial flow gas turbines and thermodynamic analysis of axial flow gas turbines.

Unit – I:

Fundamentals of Turbo machines: Classification, Applications Thermodynamic analysis; Isentropic flow, Energy transfer; Efficiencies; static and Stagnation conditions; continuity equation; Euler's flow through variable cross sectional area; unsteady flow in turbo machines.

Unit –II:

Steam Nozzles: Effect of back – pressure on the analysis; Design of nozzles.

Steam Turbines of C & C –D nozzles : Impulse Turbines: work done and velocity triangles; Efficiencies; Constant Reaction Blading; Design of blade passages, angles and height; Secondary flow; leakage losses; Thermodynamic analysis of steam turbines.

Unit – III:

Gas Dynamics: Fundamentals thermodynamic concepts; Isentropic conditions; Mach number and Area – Velocity relation; Dynamic pressure; normal shock relations for perfect gas; supersonic flow, oblique shock waves ; normal shock recovery ; detached shocks ; Aerofoil theory.

Centrifugal Compressor: Types; Velocity triangles and efficiencies; Blade passage design; Diffuser and pressure recovery; slip factor; stanitz and stodolas formulae; Effect of inlet mach number; Prewirl; performance.

Unit – IV:

Axial Flow Compressors: Flow analysis, work and velocity triangles ; Efficiencies; Thermodynamic analysis; stage pressure rise ; Degree of reaction ; stage loading ; general design, effect of velocity incidence ; performance.

Cascade Analysis: Geometry and Terminology; Blade forces, Efficiency; losses; free and forced vortex blades.

Unit – V:

Axial Flow Gas Turbines: Work done; velocity triangles and efficiencies; thermodynamic flow analysis; degree of reaction; Zweifels relation; Design cascade analysis – Soderberg – Hawthrone – ainley-correlations; secondary flow; Free-vortex blades; Blade angles for variable degree of reaction; Actuator disc theory; stresses in blades; Blade assembling; materials and cooling of blades; performance; Matching of compressor and turbine; off-design performance.

Course Outcomes :

1. Analysis of Euler's flow through variable cross sectional area and unsteady flow in turbo machines.
2. Designing of steam nozzles and steam turbines and obtaining the thermodynamic performance of steam turbines.
3. Obtaining the relations of gas dynamics in gas flow and analyzing the performance of centrifugal compressor thermodynamically.
4. Analyzing the performance of axial flow compressor thermodynamically and obtaining the cascade analysis.
5. Calculating the efficiencies of axial flow gas turbines and analyzing their performance thermodynamically.

REFERENCES:

1) Fundamentals of Turbo machines – Shephard
2) Practise on Turbomachines – G. Gopalakrishnan & D. Prithviraj, SciTech Publishers, Chennai.
3) Theory and practice of steam turbines – Kearton
4) Gas Turbines – Theory and practice – Zucrow
5) Elements of Gas Dynamics – Liepman and Roshkow
6) Elements of Gas Dynamics – Yahya
7) Turbines, Pumps, Compressors – Yahya
8) Axial Flow Compressors – Horlock.
9) Gas Turbines- Cohen, Roger & Sarvanamuttu

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DEPARTMENT OF MECHANICALENGINEERING

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2	1	0	3

PRODUCTION & OPERATIONS MANAGEMENT

(Professional Elective-II)

Course Objectives:

The objectives of the course are as follows:

1. Identify the three functions of production planning and control operations.
2. Able to understand forecasting methods.
3. Describe the factors effect the location and different types of layouts.
4. Summarize different Aggregate planning Strategies and functions of Inventories .
5. Able to understand the scheduling policies and elements of TQM.

UNIT – I

Functions of production planning & controls operations & productivity, productivity measurement, goods and services, Design of goods and services: selection, generating new products, product development, issues in product design.

UNIT – II

Forecasting – Importance of forecasting – Types of forecasting, their uses – General Principles of forecasting – Forecasting techniques – qualitative methods and quantitive methods – accuracy of forecasting methods.

UNIT – III

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities- layout: product layout, process layout, group technology layout, Assembly line balancing, computerised layout: ALDEP, CRAFT, CORELAP.

UNIT – IV

Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects. Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P– Systems and Q-Systems-(S, s) Policy.

UNIT – V

Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques.
MRP, –lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).
Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control.

Course Outcomes:

Upon completing this course, students should be able to:

1. Understand the functions of production planning and control operations.
2. Able to apply forecasting methods.
3. Understand the factors effect the location and different types of layouts.
4. Analyze different Aggregate planning Strategies and Inventory control methods .
5. Develop the scheduling policies and elements of TQM.

TEXT BOOKS:

1. Modern Production / Operations Management by Baffa & Rakesh Sarin, Wiley, 1987
2. Operation Management by B. Mahadevan, Pearson Edu.
3. Operation Management by Adam & Ebert- PHI Pub.,

REFERENCES:

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach / John E. Biegel.
4. Production Control / Moore.
5. Operations Management / Joseph Monks.
6. Operation Management by Jay Heizar & Read new Pearson
7. Elements of Production Planning and Control / Samuel Eilon.

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SOLAR ENERGY SYSTEMS (Open Elective-II)

Course objectives

1. Learning the fundamental principles of solar radiation and geographic distribution of solar radiation.
2. Study of various solar energy technologies with different types of concentrating collectors.
3. Comparative study of different solar cells with respect to properties and applications of solar cells in nano technology.
4. Understanding the basics of economics involves in the solar system.
5. Learning the concepts and designing aspects in thermal power. 6. Study of solar pond and solar stills and their applications.

UNIT – I

SOLAR RADIATION:

Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces.

Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of time-estimation of average radiation falling on tilled.

UNIT-II

SOLAR ENERGY TECHNOLOGIES:

Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III

SOLAR CELLS:

Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV

ECONOMICS:

Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V

THERMAL POWER:

The power concepts- design aspects, thermo-chemical reactor.

SOLAR POND AND SOLAR STILLS:

Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

Course Outcomes :

1. Illustrate the fundamental principles of solar radiation and geographic distribution of solar radiation.
2. Obtaining the performance analysis of liquid flat plate collector and cylindrical parabolic collector.
3. Developing solar cells in the field of nano technology.
4. Calculating the cash flow and costs involves in the solar energy systems.
5. Designing and developing of thermo chemical reactor with respect to thermal power.

Reference Books:

1. Solar Energy Thermal Process Diffice and Beckman
2. Solar Heating and Cooling by Kreith and Kreider
3. Solar Energy Utilization by G.D.Rai
4. Solar Energy Utilization by G.D.Rai , Khanna Publishers.
5. Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.,
6. Applied Solar Energy by Meinel and Meinel
7. Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
8. Energy Resources Utilization and Technologies By Anjaneyulu, BS Pub.,

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2	1	0	3

INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES
(Open Elective-II)

Course Objectives

1. To understand the need of electric vehicles and hybrid vehicles
2. To understand the energy sources of electric vehicles and its types
3. To understand about basics of motors and controller
4. To analyze and design the various components of electric with environment corner
5. To understand the type of hybrid vehicles and considerations

UNIT I NEED FOR ALTERNATIVE SYSTEM

Need of electric vehicles hybrid vehicles – comparative study of diesel, petrol, pure electric and hybrid vehicles. Limitations of electric vehicles. Specification of some electric and hybrid vehicles

UNIT II ENERGY SOURCES : BATTERIES AND FUEL CELLS

Battery Parameters-Power requirement of electric vehicles- Different types of batteries - Lead acid-Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick charging devices- Battery Modeling. Different type of energy storage – Solar, wind, compressed fluid.
Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III PROPULSION MOTORS AND CONTROLLERS

Characteristic of permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

UNIT IV VEHICLE DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES

Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice-Wing Mirror, Aerials and Luggage racks

UNIT V HYBRID VEHICLES

Types of Hybrid- Series, parallel, split – parallel, series - parallel - Advantages and Disadvantages.
Power split device – Energy Management System - Design consideration - Economy of hybrid vehicles

Course Outcomes

1. Explain the need of electric vehicles and hybrid vehicles instead of IC engines
2. discuss different energy storage technologies, used for hybrid and electric vehicles and their control
3. develop the electric propulsion unit and its control for application of electric vehicles
4. UNDERSTAND OF electric vehicle drive systems
5. understand of hybrid vehicle drive systems

TEXT BOOKS:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003
2. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
3. Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press,2005

REFERENCES:

1. Ron HodKinson, " light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005

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III Year B.Tech.M.E. II Semester

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2	1	0	3

INDUSTRIAL ENGINEERING (Open Elective-II)

Course Objectives:

1. Understand the Levels, Functions, importance of Management and Organizational Structures.

2. Design Plant Location and Plant Layout Selection Criteria of Material Handling Equipment.

3. To impart knowledge on work study, Method study, work Measurement techniques towards productivity improvement industrial engineering concepts towards manufacturing management quality engineering and reliability tools.

4. To impart knowledge on the material management, inventory Models Stores Management andStores Records

5. Understand the working principle of Human Resource Management& marketing management.

UNIT- I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg's Two factor Theory of Motivation, Maslow's Hierarchy of Human needs – Systems Approach to Management.

Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and their Merits, Demerits and Suitability.

UNIT -II

Plant Location: Definition, Factors affecting the Plant Location, Comparison of Rural and Urban sites, Methods for Selection of Plant – Matrix Approach Plant Layout: Definition, Objectives, Organization, Types of Production, Types of Plant Layout – Various Data Analyzing Forms – Travel Chart, Optimization of Layout-Load Distance Model & CRAFT-Materials Handling Function-Objectives - Types-Selection Criteria of Material Handling Equipment.

UNIT- III

Work Study – Definition, Objectives, Method Study – Definition, Objectives, Steps Involved – Various Types of Associated Charts – Differences between Micromotion and Memomotion Studies.

Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations, Differences with Time Study – Applications.

UNIT- IV

Material Management – Objectives, Inventory – functions, types, associated cost, inventory classification techniques- ABC Analysis; Inventory Models- Deterministic models- EOQ Model –Models with one Price Break and Multiple Price Breaks- shortages are not allowed – Stochastic Models – Demand may be Discrete Variable or Continuous Variable – Instantaneous Production. Instantaneous Demand and Continuous Demand and No Set-up Cost Stores Management and Stores Records- Purchase Management, Duties of Purchase Manager, Associated forms

UNIT -V

Human Resource Management-Functions of HRM, Job Evaluation, Merit Rating- Difference with Job Evaluation, Different Methods of Merit Ratings, Wage Incentives, Different Types of Incentive Schemes Inspection & Quality Control: Differences between Inspection & Quality Control. Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM- Quality circles-BIS & ISO Standards-Importance and Evaluation Procedure Marketing Management- Introduction, Marketing vs Selling, Market Segmentation.

Course Outcomes:

- Ability to apply various work study techniques towards productivity improvement apply industrial engineering concepts in real life environment
- Improve product design through quality engineering and reliability tools method
- Design organization structure and implement management principles in real time business environment.
- Design layouts for different types of industries, manufacturing, process and service sectors.
- Elaborate productivity and profitability by implementing work study techniques towards productivity improvement apply in IE&M concepts in real life environment for goal achievement

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004

2. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International Publishers, 1st edition, 2011.

References:

1. Industrial Engineering and production management, MartindTelsang S.Chand.

2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.

3. Work Study by ILO(International Labour Organization)

4. Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005

5. Production and Operations management, PanneerSelvam, PHI,2004.

6. Statistical Quality Control by EL Grantt, McGrawhil

7. Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

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2	1	0	3

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS
(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	3	0	0	3

COURSE OBJECTIVES: The objective of this course is	
1	To inculcate the basic knowledge of micro economics and financial accounting
2	To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
3	To know the various types of Market Structures & pricing methods and its strategies
4	To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
5	To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

SYLLABUS

UNIT-I:Managerial Economics

Introduction – Nature, meaning, significance, functions and advantages. Demand-Concept, Function, Law of Demand - DemandElasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

State the Nature of Managerial Economics and its importance
- Understand the concept of demand andits determinants
- Analyze the Elasticity and degree of elasticity
- EvaluateDemand forecasting methods
- Design the process of demand estimation for different types of demand

UNIT-II: Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Shortrun and longrun Production Function- Isoquants andIsocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost&Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) -

Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Define the production function, Input-Output relationship and different cost concepts
- Apply the least-cost combination of inputs
- Analyze the behavior of various cost concepts
- Evaluate BEA for real time business decisions
- Develop profit appropriation for different levels of business activity

UNIT-III: Business Organizations and Markets

Introduction – Nature, meaning, significance, functions and advantages.Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises.Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Explain the structure of markets, features of different markets and forms of business organizations
- Apply the price output relationship in different markets
- Analyze the optimum output levels to maximize profit in different markets
- Evaluate price-output relationship to optimize cost,revenue and profit

UNIT- IV:Capital Budgeting

Introduction – Nature, meaning, significance, functions and advantages. Typesof Working Capital,Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals,Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Explain the concept of capital budgeting and its importance in business
- Contrast and compare different investment appraisal methods
- Analyze the process of selection of investment alternatives using different appraisal methods
- Evaluate methods of capital budgeting for investment decision making and for maximizing returns
- Design different investment appraisals and make wise investments

UNIT-V: Financial Accounting and Analysis

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). ***Financial Analysis -***

Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Discuss the concept,convention and significance of accounting
- Apply the fundamental knowledge of accounting while posting the journal entries
- Analyze the process and preparation of final accounts and financial ratios
- Evaluate the financial performance of an enterprise by using financial statements

Text Books:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

References:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Data Books Required:

Present Value Factors table

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the concepts related to Managerial Economics, financial accounting and management.
CO2	Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
CO3	Apply the concepts of production, cost and revenues for effective business decisions
CO4	Analyze how to invest their capital and maximize returns
CO5	Evaluate the capital budgeting techniques
CO6	Develop theaccounting statements and evaluate the financial performance of business entity.

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2	1	0	3

ENTREPRENEURSHIP AND INCUBATION

(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
	ENTREPRENEURSHIP& INCUBATION	2	1	0	3

COURSE OBJECTIVES: The objective of this course is	
1	To make the student understand about Entrepreneurship
2	To enable the student in knowing various sources of generating new ideas in setting up ofnew enterprise
3	To facilitate the student in knowing various sources of finance in starting up of a business
4	To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
5	To encourage the student in creating and designing business plans

Syllabus

UNIT-I: Entrepreneurship

Introduction-Nature, meaning, significance, functions and advantages. concept, characteristics-knowledge and skills requirement - process - Factors supporting entrepreneurship - Differences between Entrepreneur and Intrapreneur - entrepreneurial mindset and personality - Recent trends.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India
- Analyzerecent trends in Entrepreneurship across the globe
- Develop a creative mind set and personality in starting a business.

UNIT-II: Women Entrepreneurship

Introduction – Nature, meaning, significance, functions and advantages. Growth of women entrepreneurship in India. - Issues & Challenges - Entrepreneurial motivations.Entrepreneurship

Development and Government. Role, of Central and State Government - incentives, subsidies and grants – Export-oriented Units - Fiscal and Tax concessions.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the role of government in promoting women entrepreneurship
- Analyze the role of export-oriented units
- Evaluate the tax concessions available for Women entrepreneurs

.

UNIT-III:Product Development

Introduction – Nature, meaning, significance, functions and advantages. Startup Initiatives - Generating business/ Service idea – Sources and methods –Identifying opportunities - Feasibility study - Market feasibility, technical/operational feasibility, Financial feasibility. Developing business plan, Preparing project report, Presenting business plan to investors.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze the sources of new methods in generating business idea
- Evaluate market feasibility, financial feasibility and technical feasibility
- Design and draw business plansin project preparation and prepare project reports

UNIT-IV:Startups

Introduction – Nature, meaning, significance, functions and advantages. Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence theType/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand the importance of business incubation
- Apply brilliant ideas in the process of business incubation
- Analyze the process of business incubation/incubators.
- Design their own business incubation/incubators as viable-business unit.

UNIT-V: Finance

Introduction – Nature, meaning, significance, functions and advantages. Sources - Long term and Short term - Institutional Finance – Commercial Banks, SFC's and NBFC's in India, Role in

small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions supporting entrepreneurship development.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the various sources of finance in Starting the new venture
- Analyze the role of banks and other financial institutions in promoting entrepreneurship in India
- Evaluatethe need and importance of MSMEs in the growth of country

TEXT BOOKS

1. D F Kuratko and T V Rao, **Entrepreneurship** - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit :login.cengage.com)
2 .Nandan H, Fundamentals of Entrepreneurship, PHI, 2013

REFERENCES

1. Vasant Desai,Small Scale Industries and Entrepreneurship, Himalaya Publishing 2012.
2. Rajeev Roy Entrepreneurship, 2nd Edition, Oxford, 2012.
3.B.JanakiramandM.Rizwana Entrepreneurship Development: Text & Cases, Excel Books, 2011.
4.Stuart Read, Effectual Entrepreneurship, Routledge, 2013.

E-RESOURCES

1. Entrepreneurship-Through-the-Lens-of-enture Capital

2.http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship

3.http://nptel.ac.in/courses/122106032/Pdf/7_4.pd

4.http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Concepts related to the Entrepreneurship and Incubators
CO2	Understand the concept of Entrepreneurship and challenges in the world of competition.
CO3	Apply the Knowledge in generating ideas for New Ventures.
CO4	Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
CO5	Evaluate the role of central government and state government in promoting Entrepreneurship.
CO6	Create and design business plan structure through incubations.

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2019-2020

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

BUSINESS ETHICS AND CORPORATE GOVERNANCE
(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
	BUSINESS ETHICS AND CORPORATE GOVERNANCE	2	1	0	3

COURSE OBJECTIVES : The objectives of this course are	
1	To make the student understand the principles of business ethics
2	To enable them in knowing the ethics in management
3	To facilitate the student's role in corporate culture
4	To impart knowledge about the fair-trade practices
5	To encourage the student in creating knowingabout the corporate governance

Syllabus

UNIT-I:ETHICS

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior - Value systems - Business Ethics,Types, Characteristics, Factors, Contradictions and Ethical Practices inManagement- Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze the corporate social responsibility of management

UNIT-II: ETHICS IN MANAGEMENT

Introduction Ethics in production, finance, ,Human Resource Managementand,Marketing,Management - Technology Ethics and Professional ethics - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts,

Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the meaning of Marketing Ethics
- Compare and contrasttechnical ethics and professional ethics
- Develop ethical values

UNIT-III: CORPORATE CULTURE

Introduction, Meaning,definition,Nature, Scope, Functions,andsignificance– Cross cultural issues in Ethics - - Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

LEARNING OUTCOMES: -After completion of this unit student will

- Define UniversalismUtilitarianism, Distributive
- Understand the corporate culture in business
- Analyze Ethical Value System Ethical Values in different Cultures

UNIT- IV:LEGAL FRAME WORK

Law and Ethics, Agencies enforcing Ethical Business Behavior, Legal Impact– Environmental Protection, Fair Trade Practices,legal Compliances, Safeguarding Health and wellbeing of Customers.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand Law and Ethics
- Analyze Different fair-trade practices
- Make use of Environmental Protection andFair-Trade Practices

UNIT -V : CORPORATE GOVERNANCE

Introduction, meaning – scope Nature - Issues, need, corporate governance code, transparency & disclosure, role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work, corporate scams, committees in India and abroad, corporate social responsibility. of BODs composition, Cadbury Committee - various committees - reports - Benefits and Limitations.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand corporate governance code

- Analyze role ofauditors, board of directors and shareholders in corporate governance
- Implementing corporate socialresponsibility in India.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH

2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH.

Reference books

1. Dr. K. Nirmala, KarunakaraReaddy : Business Ethics and Corporate Governance, HPH

2. H.R.Machiraju: Corporate Governance

3. K. Venkataramana, Corporate Governance, SHBP.

4. N.M.Khandelwal : Indian Ethos and Values for Managers

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Ethics and Types of Ethics.
CO2	Understand business ethics and ethical practices in management
CO3	Understand the role of ethics in management
CO4	Apply the knowledge in cross cultural ethics
CO5	Analyze law and ethics
CO6	Evaluate corporate governance

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0	0	3	1.5

HEAT TRANSFER LAB

Course Objectives:

Students undergoing this course would

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

***NOTE**: Heat transfer data books are permitted in the examinations*

Any 10 of the above 15 experiments are to be conducted.

Course Outcomes

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

- Differentiate different modes of heat transfer
- Identify parameters for measurement for calculating heat transfer.
- Determine effectiveness of heat exchanger.
- Design new equipment related to heat transfer.
- Apply principles of heat transfer in wide application in industries.

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0	0	3	1.5

ENGLISH LANGUAGE SKILLS LAB

Subject Code	Title of the Lab	L	T	P	C
	English Language Skills Lab	-	-	3	1.5

Course Description:

English Language Skills Lab aims to enable the engineering students to meet the demands of the modern job market through group activities, individual presentations, mock interviews and group discussions. Students of our region have knowledge of their respective subjects, but the surveys make it clear that they are lagging behind in expressing themselves effectively in a professional setting. So, this course will enable them to hone these skills and excel in their respective fields.

COURSE OBJECTIVES	
1	To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
2	Further, they would be required to communicate their ideas relevantly and coherently in writing.
3	To prepare all the students for their placements.
4	To initiate them into greater use of the computer in resume preparation, report writing, format making etc.
5	To train them to use language effectively to face interviews, group discussions, public speaking.

COURSE OUTCOMES	
CO1	To recall and memorize tips to communicate effectively
CO2	To understand various listening components that includes listening comprehension of gist and detailed information.
CO3	To apply extensive and intensive reading methods for specific reading and voracious reading of vast material.
CO4	To analyze differentdescriptive and technical writing material.
CO5	To evaluate and develop, academic research paper with appropriate citations,

	quotations, and references when needed.
CO6	To develop communicative competency and make the students job ready

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												✓
CO2												✓
CO3							✓					
CO4											✓	
CO5								✓				
CO6												

UNIT-I: COMMUNICATIVE COMPETENCY

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary for competitive purpose

OUTCOMES
To recall and memorize the basic concepts of reading and listening skills
To understand the various components to build up vocabulary
To apply English language skills to avoid barriers to effective reading and listening

UNIT-II: TECHNICAL WRITING

1. Email Writing
2. CV/Resume Writing
3. Mini Project Writing

To understand the basic components of writing Emails
To apply the knowledge of writing eye catching resumes
To analyze different ways of writing a mini project

UNIT-III: ORAL PRESENTATION SKILLS

1. Self-Introduction – Introducing Others – Welcome Speech – Vote of Thanks
2. Oral Presentation-Individual/Impromptu Speeches/ JAM
3. Stage Dynamics– Barriers to Effective Presentation

To understand the basic components of speeches
To apply knowledge of different forms of presentation.
To analyze stage dynamics for effective presentation

UNIT-IV: TECHNICAL**PRESENTATION SKILLS**

1. Information Transfer
2. PPT Presentation
3. Poster Presentation

To apply knowledge of different types of pictograms to transfer the information
To analyze the techniques of preparing PPTs
To evaluate different skills in poster presentation

UNIT-V: PROFESSIONAL SKILLS

1. Group discussions-II
2. Interview skills
3. Answering Strategies

To analyze the different aspects of interviews and group discussions
To evaluate the group dynamics to excel in group discussions
To design and develop strategies to answer effectively in interviews

MINIMUM REQUIREMENT FOR ELCS LAB:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder

- Headphones of High quality

SUGGESTED SOFTWARE:

1. Orell: Language Lab Software
2. Clarity Pronunciation Power – Part I (Sky Pronunciation)
3. Clarity Pronunciation Power – part II
4. LES(Learn English Select) by British council
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
6. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
7. Cambridge Advanced Learners' English Dictionary with CD.

The software consisting of the prescribed topics elaborated above should be procured and used.

REFERENCE BOOKS

1. **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
2. **TOEFL &GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
3. **Train2success.com**

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 2009.
3. Books on **TOEFL/GRE/GMAT/CAT/IELTS** by Barron's/DELTA/Cambridge University Press.2012.
4. **Handbook for Technical Writing** by David A McMurrey& Joanne Buckely CENGAGE Learning 2008.
5. **English for Technical Communication for Engineering Students, AyshaVishwamohan, Tata Mc Graw-Hill 2009.**
6. **Word Power Made Handy,** Shalini Verma, S Chand Publications, 2011.
7. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011.

WEB LINKS

1. https://www.slideshare.net/ruschellecossid/reading-comprehension-56872438

2. https://www.slideshare.net/FiveEEE/listening-comprehension-40031081

3. https://www.slideshare.net/shrutisalunkhe2/english-for-competitive-exams

4. https://www.slideshare.net/nidhipandey16/email-writing-52942112

5. https://www.slideshare.net/aamirmuhammadaamir77/resume-writing-ppt

6. https://www.powershow.com/view/1d8cf2-OWFhN/Mini_Project_Report_Writing_Workshop_powerpoint_ppt_presentation

7. https://www.slideshare.net/8788902/oral-presentations-28994496

8. https://www.slideshare.net/nandapalit/presentation-skills-33500438

9. https://www.slideshare.net/ritikadhameja/group-discussion-46255658

10. https://www.slideshare.net/vikkerkar/interview-skills-presentation

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0	0	1	0.5

SOCIALLY RELEVANT PROJECT

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L	T	P	C
3	0	0	0

CONSTITUTION OF INDIA

Subject Code	Title of the Subject	L	T	P	C
	CONSTITUTION OF INDIA	3	0	0	0

COURSE OBJECTIVES : The objective of this course is	
1	To Enable the student to understand the importance of constitution
2	To understand the structure of executive, legislature and judiciary
3	To understand philosophy of fundamental rights and duties
4	To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
5	To understand the central-state relation in financial and administrative control

Syllabus

UNIT-IIntroduction to Indian Constitution

Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History and features of Indian constitution
- Learn about Preamble, Fundamental Rights and Duties
-

UNIT-IIUnion Government and its Administration

Structure of the Indian Union- Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat–LokSabha-RajyaSabha - The Supreme Court and High Court - Powers and Functions

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-IIIState Government and its Administration

Structure of the State Govt. -Governor - Role and Position -CM and Council of Ministers - State Secretariat-Organization Structure and Functions

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of state government
- Analyze the role of Governor and Chief Minister
- Explain the role of State Secretariat
- Differentiate between structure and functions of state secretariat

UNIT-IV Local Administration

District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation PanchayatiRaj - Functions– PRI– ZillaParishath - Elected officials and their roles – CEO, ,ZillaParishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration's role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Learn about the role ofZillaParishath block level organization

UNIT-V Election Commission

Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

LEARNING OUTCOMES:-After completion of this unit student will

- Know the role of Election Commission
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze the role of state election commission
- Evaluate various commissions vizSC/ST/OBC and women

TEXT BOOKS

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi

2. SubashKashyap, Indian Constitution, National Book Trust

REFERENCES:

1. J.A. Siwach, Dynamics of Indian Government & Politics,

2. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

3. .J.C. Johari, Indian Government andPolitics, Hans India

4. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law,

Prentice – Hall of India Pvt. Ltd.. New Delhi

E-RESOURCES:

1.nptel.ac.in/courses/109104074/8
2.nptel.ac.in/courses/109104045/
3.nptel.ac.in/courses/101104065/
4.www.hss.iitb.ac.in/en/lecture-details
5.www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	State the historical background of the constitution making and its importance for building a democratic India.
CO2	Understand the functioning of three wings of the governmentie., executive, legislative and judiciary.
CO3	Demonstrate the value of the fundamental rights and duties for becoming good citizen of India.
CO4	Analyze the decentralization of power between central, state and local self-government
CO5	Appraise the knowledge in strengthening of the constitutional institutions like CAG,Election Commission and UPSC for sustaining democracy.
CO6	Develop themselves as responsible citizens and pave way to build a democratic country.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

IV.B.Tech I Sem (R19)

Semester –7 (Theory - 5, Labs -2 &Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Introduction to CAD/CAM	PCC	2-1-0	3
2.		Metrology & Measurements	PCC	2-1-0	3
3.		**(Professional Elective-III)** 1. Refrigeration & Air-Conditioning 2. Mechanics of Composite Materials 3. Automotive Transmission Systems	PEC-III	2-1-0	3
4.		**(Open Elective-III)** 1. Wind Energy Systems 2. Special Types of Vehicles 3. Industrial Automation and Control Systems	OEC-III	2-1-0	3
5.		**Humanities Elective-II** 1. Organizational Behavior 2. Management Science 3. Business Environment	HEC-II	2-1-0	3
6.		CAD/CAM Lab	PCC	0-0-3	1.5
7.		Metrology &Measurements Lab	PCC	0-0-3	1.5
8.		Seminar	PCC	0-0-1	0.5
9.		Project*	PR	------	1.5
10.		Industrial Training/Skill Development/Research Project*	PR	------	2
				Total	**22**

*** Marks shall be awarded in 7th semester, but started at end of 6th semester and complete before beginning of 7th semester.**

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INTRODUCTION TO CAD / CAM

	Course Objectives:
1.	To impart the students to CAD/CAM and CIM and the basics of computer graphics.
2.	To impart knowledge on geometric modeling.
3.	To impart fundamental knowledge on NC and concepts of part programming.
4	To introduce the philosophy of group technology, basics of Flexible Manufacturing Systems and computer aided quality control.
5	To impart the concepts of Computer Aided Process Planning, Computer Integrated Process Planning and introduce the trends in manufacturing.

UNIT –I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, clipping, hidden line / surface removal colour, shading.

UNIT -II

Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations.

Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.

UNIT- III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

UNIT -IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non optical, integration of CAQC with CAD and CIM.

UNIT- V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP- II, CIMS benefits. Trends in manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

	Course Outcomes: Ability to
CO1	To implement the concepts of CAD/CAM and CIM in industry.
CO2	Use CAD software for solid modeling.
CO3	To implement suitable NC part programming concepts.
CO4	Implement appropriate suitable production systems and computer aided quality control.
CO5	Utilize suitable computer aided process planning and computer integrated production planning for a customized manufacturing system.

Text Books:

1. CAD/CAM, A Zimmers & P.Groover, PE, PHI
2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010

References:

1. Automated Production Systems and CIM by P.Groover Pearson Education, Limited.
2. CAD/CAM/CIM (Revised second edition)- P. Radhakrishnan, S. Subramanyan, V. Raju- New Age International Edition
3. CAD/CAM- Theory and practice- Irahim Zeid- Tata Mcgraw Hill publications.

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Metrology & Measurements

Course Objectives:

- To introduce the science of measurement and measuring machines commonly used.
- To impart knowledge about limits, fits and tolerances, geometric dimensioning aspects.
- To introduce the methods of acceptance test for conventional machine tools.
- To familiarize students with the concepts of Laser metrology and surface roughness.
- Measurement techniques for measuring process parameters in industry and in research

UNIT- I

Limits, Fits and Tolerances: Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – inter-changeability and selective assembly. Indian standard system – International Standard organization system for plain work. Limit Gauges And Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor‟s principle. Design of Go and No Go gauges. Comparators: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic Comparators and their uses.

UNIT -II

Linear Measurement: Length standard, line and end & wavelength standards, slip gauges – Calibration of the slip gauges, Dial indicator, micrometers, Vernier height gauges.
Measurement of Angles and Tapers: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.
Flatness Measurement: Measurement of flatness of surfaces – straight edges– surface plates – optical flat and auto collimators, interferometer and their uses.

UNIT -III

Surface Roughness Measurement: Differences between surface roughness and Surface waviness-Numerical assessment of surface finish – CLA, R.M.S Values – Ra, Rz values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish. Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.
Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.
Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling and drilling machine tools. Preparation of acceptance charts.

UNIT- IV

Measurement Of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.
Measurement Of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer.
Stress & Strain Measurements: Various types - electrical strain gauge - gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.
Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments - Vibrometer and accelerometer.

UNIT-V

Measurement Of Temperature: Standards and calibration, thermal expansion methods, thermo electric sensors (thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods.
Measurement of Pressure and Sound: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement, sound measurement.
Measurement of Force, Torque, Power: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, shaft power Measurement (dynamometers), Vibrating wire force transducers.

Course Outcomes:

- Students will be able to work in metrology divisions in industries.
- Students will be able to understand the advanced metrology systems.
- Choose measuring instruments suitable for specific application.
- Design and fabricate a system for measuring simple parameters.
- Apply the knowledge in during the measurement process.

Text Books:

(1) Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE
(2) Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH,2012.
(3) Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013.

References:

(1) Engineering Metrology, Mahajan, Dhanpat Rai, 2nd edition, 2013.
(2) BIS standards on Limits & Fits
(3) Fundamentals of Dimensional Metrology, Connie Dotson ,4e, Thomson
(4) Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc GrawHill, 2013.
(5) Instrumentation, measurement &analysis ,B.C.Nakra & K K Choudhary, TMH, 6th edition, 2011.

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REFRIGERATION AND AIR CONDITIONING

(Professional Elective –III)

Course Objectives:

To impart knowledge on

- Working principle of refrigeration and air-conditioning cycle.
- Fundamentals of psychrometry.
- Applications of refrigeration and air-conditioning.
- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.

UNIT- I

Introduction to Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Refrigeration Needs of Air Crafts.

UNIT- II

Vapour Compression Refrigeration (VCR) System – Basic Cycle - Working Principle and Essential Components of the Plant – COP – Representation of Cycle on T-S and P-h Charts – Expander Vs. Throttling, Effect of Sub Cooling and Super Heating – Cycle Analysis – Actual Cycle

Refrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

UNIT- III

Vapour Absorption Refrigeration (VAR) System – Description and Working of NH3 – Water System and Li Br –Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System.

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required, Principle and Operation of: (I) Thermo-Electric Refrigerator (Ii) Vortex Tube OrHilsch Tube.

UNIT -IV

Introduction to Air Conditioning: Psychrometric Properties & Processes – Characterization of Sensible and Latent Heat Loads — Need For Ventilation, Consideration of Infiltrated Air – Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

UNIT -V

Air Conditioning Equipment - Humidifiers – Dehumidifiers – Air Filters, Fans and Blowers. Human Comfort: Requirements of Temperature, Humidity and Concept of Effective Temperature, Comfort Chart. Heat Pump – Heat Sources – Different Heat Pump Circuits.

Course Outcomes:
Ability to

- Understand various refrigeration systems.
- Demonstrate the working of refrigeration equipments.
- Understand various psychrometric processes.
- Design the space cooling load.
- Explain the air-conditioning equipment.

Text Books:

1. Refrigeration and Air Conditioning, CP Arora, TMH, 15th edition, 2013.

2. A Course in Refrigeration and Air conditioning, S.C Arora & Domkundwar, Dhanpatrai

References:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013

2. Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007.

3. Refrigeration and Air Conditioning-P.L .Ballaney, 2nd edition, 2012.

4. Basic Refrigeration and Air-Conditioning – P.N. Ananthanarayanan / TMH, 4th edition,

2013.

NOTE: Tables/Codes: Thermal Engineering Data Book containing Refrigerant and Psychrometric property Tables and charts are permitted in Exam

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

MECHANICS OF COMPOSITE MATERIALS
(Professional Elective –III)

Course Objectives:

1. Able to define of Basic Matrix materials ,understand the Mechanical properties of composites
2. Able to know the manufacturing of PMCs ,RTM,MMCs ,SMCs andCMCs.

3.Undestand Lamina constitutive Quations

4.Analysis of Lamina strength and Laminated flat plates.

5.Study Thermal Anaysis.

UNIT I INTRODUCTION TO COMPOSITE MATERIALS

Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute - Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites.

UNIT II MANUFACTURING OF COMPOSITES

Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state,vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation-interfaces

UNIT III INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke‟s Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Q_{ij}), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT IV LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill‟s Criterion for Anisotropic materials. Tsai-Hill‟s Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

UNIT V THERMAL ANALYSIS

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke‟s Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E‟s. C.T.E‟s for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

Course Outcomes

1. Able to Understand the Basic Matrix materials ,understand the Mechanical properties of composites
2. Able to Process the manufacturing of PMCs ,RTM,MMCs ,SMCs andCMCs.

3.Determine Strain Displacement relations and the Lamina Stresses

4. Able to Analyze of Lamina strength and Laminated flat plates.

5. Able to analyze Thermal Anaysis modifications of Hookes Law.

REFERENCES

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994,
Second Edition - CRC press in progress.
2. Hyer, M.W., “Stress Analysis of Fiber – Reinforced Composite Materials”, McGraw-Hill, 1998
3. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”,
Oxford University Press-2006, First Indian Edition - 2007
4. Mallick, P.K., Fiber –”Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.
5. Halpin, J.C., “Primer on Composite Materials, Analysis”, Techomic Publishing Co., 1984.
6. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
7. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.
8. Madhujit Mukhopadhyay, “Mechanics of Composite Materials and Structures”, University Press (India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008)
9. Chung, Deborah D.L., “Composite Materials: Science and Applications”, Ane Books Pvt. Ltd./Springer, New Delhi, 1st Indian Reprint, 2009

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DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. I Semester

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2	1	0	3

AUTOMOTIVE TRANSMISSION SYSTEMS
(Professional Elective –III)

Course bjectives:

- To know about the various Automation in Manufacturing
- Able to understand the Material handling and identification.
- Able to understand about the PLC
- Able to understand DDS,SCADA and DCS

UNIT I

Clutches Principle, Functions, General requirements, Torque capacity, Types of clutches, Cone clutch, Single-plate clutch, Diaphragm spring clutch, Multi-plate clutch, Centrifugal clutch, Electromagnetic clutch, Lining materials, Over-running clutch, Clutch control systems.

UNIT II

Drive Lines Propeller shaft-universal joints, hooks and constant velocity U.J., Drive line arrangements -Hotchkiss drive and torque tube drive, Rear wheel drive, front wheel drive and four-wheel drive layouts and its advantages and limitations.

UNIT III

Wheels and Tyres Basic requirements of wheels and tyres, Types of road wheels, Construction of wheel assembly, wheel balancing, Tyre construction, material, types, tubeless, cross ply radial type, tyre sizes and designation, Aspect ratio, tyre trade pattern, tyre valve, Tyre inflation pressure, safety precautions in tyres, Tyre rotation and matching, Types of Tyre wear and their causes, Selection of tyres under different applications, tyre retreating hot and cold, factors affecting tyre performance.

UNIT IV

Automatic Transmission Principle of semi-automatic and automatic transmission, Hydromantic transmission, Fully automatic transmission, Semi-automatic transmission, Hydraulic control system, Continuous variable transmission (CVT) – operating principle, basic layout and operation, Advantages and disadvantages.

UNIT V

Vehicle Chassis Introduction To chassis, chassis operating condition, chassis frame, vehicle components location. Manufacturing processes for chassis, causes of chassis failure.

Course outcomes:

- The students will understand the Level of automation
- The students will understand the FMS planning and implementation
- The students will be able to design block diagrams of PLC.
- The students will able to design of alarm and interlock systems

Text Books:

1. Dr. Kripal Singh, Automobile Engineering-Vol. 1, 13th Edition, Standard PublishersDistributors
2. N. K. Giri, Automotive Mechanics, Khanna Publishers, Delhi, Eighth Edition

Reference Book:

1. Newton, Steed andGarrot, Motor Vehicles, 13th Edition, Butterworth London
2. A. W. Judge, Modern Transmission, Chapman and Hall Std., 1989
3. Chek Chart, Automatic Transmission, A Harper and Raw Publications
4. J. G.Giles, Steering, Suspension and Tyres, – Lliffe Book Ltd., London
5. W. Steed, Mechanics of Road Vehicles, Lliffe Book Ltd
6. Heisler, Vehicle and Engine Technology, Second Edition, SAE International Publication

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DEPARTMENT OF MECHANICALENGINEERING

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2	1	0	3

WIND ENERGY SYSTEMS
(Open Elective –III)

Course objectives:

- To impart knowledge on the following Topics
- Recognize current and possible future role of renewable energy sources.
- Adequate inputs on a variety of issues in harnesing renewable Energy.
- Awarenes about renewable Energy Sources and technologies.

UNIT-I

Historical developments, latest developments, state of art of wind energy technology, turbine rating, cost of energy, wind power plant economics, installation and operation costs, decommissioning, Indian scenario and worldwide developments, present status and future trends

UNIT-II

Nature of atmospheric winds; wind resource characteristics and assessment; anemometry; wind statistics; speed frequency distribution, effect of height, wind rose, Weibull distribution, atmospheric turbulence, gust wind speed, effect of topography.

UNIT-III

Design of wind turbine blade; effect of stall and blade pitch on coefficient of power vs tip speed ratio and cut-out wind speeds, blade materials, design characteristics, multiple stream tube theory, vortex wake structure; tip losses; rotational sampling, wind turbine design programs, aerodynamic loads, tower shadow, wind shear, blade coning, gyroscopic, transient and extreme loads.

UNIT-IV

Pitch control, yaw control, Electrical and Mechanical aerodynamic braking, teeter mechanism. Wind turbine dynamics with DC and AC generators: induction and synchronous generators, variable speed operation, effect of wind turbulence. Power electronics Converter and Inverter interfaces for wind energy utilization system for isolated and grid connected system.

UNIT-V

Wind farm electrical design, Planning of wind farms, special application for developing countries, maintenance and operation, wind farm management, site selection. Environmental assessment; noise, visual impact etc. Instrumentation, data loggers, remote monitoring and control.

Course outcomes:

- The students will understand the Historical developments
- The students will understand the Nature of atmosphere is winds
- The students will be able to design wind warm electrical
- The students will be able to design wind turbine blade.

REFERENCES:

1. Paul Gipe, Wind Energy Comes of Age, John Wiley & Sons Inc.
2. Ahmed: Wind Energy Theory and Practice, PHI, Eastern Economy Edition, 2012
3. L.L. Freris, Wind Energy Conversion System, Printice Hall.
4. Tony Burton et al, Wind energy Hand Book, John Wiley & Sons Inc.
5. Directory, Indian Wind Power 2004, CECL, Bhopal.

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2	1	0	3

SPECIAL TYPES OF VEHICLES

(Open Elective –III)

Course Objectives:-

1.The course is designed to give knowledge of various special purpose vehicles.

2.To develop existing systems and their applications in the present context.

3. To understand the main components of tractor.

4. To identify man-lift chassis, scissor lift trucks.

UNIT –I

EARTH MOVING EQUIPMENTS Construction layout, capacity, specification and applications of dumpers, articulated haulers, front-end loaders, backhoe loaders, bulldozers, scrappers, motor graders, skid steer loaders ,excavator, hydraulic shovels, bucket conveyors , surface miners – high wall Miners. Selection criteria for prime mover.

UNIT- II

CONSTRUCTIONAL EQUIPMENTS Construction layout, capacity, specification and applications of cranes – types , Articulated Trucks ,concrete ready mixer ,trenchers , Asphalt Pavers , road reclaimers , General description, specification and functions of smooth wheeled rollers, pneumatic tired rollers, , sheep‟s foot rollers, vibrating compactors , draglines, drillers ,bore well machine

UNIT-III

FARM EQUIPMEMTS Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment –- Top lifting harvesters. General description, working, specification and functions of paddy harvesting machines, Sugarcane harvesting, feller bunchers, forest machines.

UNIT IV

INDUSTRIAL VEHICLE General description, specification, capacity and working of fork lifts - attachment, Utility vehicles, towing vehicles, man-lift chassis, scissor lift trucks, material handlers, fire fighting vehicle, reclaimers, Street sweepers.

UNIT V

MILITARY AND COMBAT VEHICLES Special features and constructional details of Main Battle tank, gun carriers, truck-mounted missile launchers, transport vehicles, armored vehicle-launched bridge, amphibious bridging vehicle, and communication vehicles.

Course Outcomes:-

Students will be able to

CO1:- Study the Special type of vehicles based on the need and purpose.

CO2:- Study about the Constructional Equipments of different Special type vehicles

CO3:- Understand and describe the working principles of Different vehicles used in Farm sector.

CO4:- Learn about the working principles of Industrial Purpose Vehicles.

CO5:- study the Special features and constructional details of Military and Combat Vehicles.

TEXT BOOKS:

1. Peurifoy R.L “Construction Planning, Equipment and Methods”, Tata McGraw-Hill, New Delhi, 2002.

REFERENCES:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. Jerry Scutts, “Advanced Military Vehicle Modelling” , Osprey Publishing, 1999
3. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
4. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
5. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.
6. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
7. Wong J “ Terramechanics and Off-Road Vehicle Engineering”, Butterworth-Heinemann, 2009

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INDUSTRIAL AUTOMATION AND CONTROL SYSTEMS
(Open Elective –III)

Course Objectives

1. To introduce the importance of automation techniques manufacturing and process industries.
2. To impart the role of PLC in industry automation.
3. To expose to various control techniques employed in process automation.
4. To develop automation system for manufacturing and process industries.

UNIT-I

Course Content Automation in Manufacturing Industries Introduction- Automation in production system, Principles and strategies of automation, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms, Analysis of transfer lines without storage, Automated flow lines with storage buffers.

UNIT-II

Material handling and identification technologies -Overview of material handling systems, Types of material handling equipment, Design of the system, Conveyor system, Automated guided vehicle system, Automated storage systems, Interfacing handling and storage with manufacturing, Overview of Automatic Identification Methods.

UNIT-III

Automated Manufacturing Systems-Components, Classification and overview of manufacturing systems, Cellular manufacturing, Flexible manufacturing system(FMS), FMS and its planning and implementation, Automated assembly system – design and types of automated assembly systems, Analysis of multi station and single station assembly machine.

UNIT-IV

Introduction to computer based industrial automation- Direct Digital Control (DDC), Distributed Control System (DCS) and supervisory control and data acquisition (SCADA) based architectures. SCADA for process industries includes understanding of RTUs, Pumping stations, Evacuation processes, Mass Flow Meters and other flow meters, Leak-flow studies of pipelines, Transport Automation

UNIT-V

Programmable Logic Controller (PLC)- Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of

PLCs, Integrating Process safety PLC and DCS, Application of international standards in process safety control.

Course outcomes:

- The students will understand the constructional, working principle of various types of manual and automotive transmission of an automobile.
- The students will understand the constructional

Text Books

1. M.P.Groover,"Automation, Production Systems and Computer Integrated Manufacturing", 5 th Edition, Pearson Education, 2009.
2. John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", 5th Edition, Prentice Hall Inc., New Jersey, 2003.
3. Krishna Kant, "Computer - Based Industrial Control", 2nd Edition, Prentice Hall, New Delhi, 2011.
4. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2016.

Reference Books

1. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson New International, 2013.
2. Lukas M.P, " Distributed Control Systems", Van Nostrand Reinhold Co., New York, 1986.
3. N. Viswanandham, Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", 1st Edition, 2009.
4. https://nptel.ac.in/syllabus/108108098/.

Course Outcomes On completion of this course, the students will be able to

1. familiar with various automation technologies in manufacturing and process industries.
2. understand various automation tools and methods in manufacturing industry.
3. implement various control and automation method in process industries.
4. familiar with various communication technologies in manufacturing and process industries.

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2	1	0	3

ORGANIZATIONAL BEHAVIOUR

(Humanities Elective –II)

Subject Code	Title of the Subject	L	T	P	C
	ORGANIZATIONAL BEHAVIOUR	2	1	0	3

COURSE OBJECTIVES:	
1	**Toenablestudent's comprehension of organizational behavior**
2	**To offer knowledge to students onself-motivation, leadership and management**
3	**To facilitate them to become powerful leaders**
4	**To Impart knowledge about group dynamics**
5	**To make them understand the importance of change and development**

Syllabus

Unit-I: Introduction

, Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behavior –Attitude -Perception - Learning – Personality.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of OrganizationalBehavior
- Contrast and compare Individual& Group Behavior andattitude
- Evaluate personality types

Unit-II: Motivation and Leading

Theories of Motivation- Maslow"sHierarchy of Needs - Hertzberg"s Two Factor Theory - Vroom"s theoryof expectancy - McClelland"s theory of needs–Mc Gregor"s theory X and theory Y– Adam"s equity theory – Locke"s goal setting theory– Alderfer"sERG theory - Leadership– research,theories, traits - LeadersVs Managers.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of Motivation
- Analyze theTheories of motivation
- Explain how employees are motivated according to Maslow"s Needs Hierarchy

Unit-III: Organizational Culture

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of goodLeader - Conflict Management -Evaluating Leader- Women and Corporate leadership.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of Leadership
- Contrast and compare Trait theoryand Managerial Grid
- Distinguish the difference between Transactional and Transformational Leadership
- Evaluate the qualities of good leaders

Unit-IV:Group Dynamics

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of groupbehavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

LEARNING OUTCOMES: -After completion of this unit student will

- Understand theconcept of Group Dynamics
- Contrast and compare Group behavior and group development
- Evaluate how to resolve conflicts in the organization

Unit-V:Organizational Change and Development

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization‟s change and development

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the importance of organizational change and development
- Apply change management in the organization
- Analyze work stress management
- Evaluate Managerial implications of organization

TEXT BOOKS:

1. Luthans, Fred, OrganisationalBehaviour, McGraw-Hill, 12 Th edition 2011 2. P Subba Rao,OrganisationalBehaviour,HimalyaPublishing House 2017

References

- McShane, Organizational Behaviour, TMH 2009
- Nelson,OrganisationalBehaviour, Thomson, 2009.
- Robbins, P.Stephen, Timothy A. Judge, OrganisationalBehaviour, Pearson 2009.
- Aswathappa,OrganisationalBehaviour,Himalaya, 2009

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Organizational Behavior, its nature and scope.
CO2	Understand the nature and concept of Organizational behavior
CO3	Apply theories of motivation to analyze the performance problems
CO4	Analyze the different theories of leadership
CO5	Evaluate group dynamics
CO6	Develop as powerful leader

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2	1	0	3

Management Science

(Humanities Elective–II)

Subject Code	Title of the Subject	L	T	P	C
	MANAGEMENT SCIENCE	2	1	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2	To make the students understand the role of management in Production
3	To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training &Development, job evaluation and Merit rating concepts
4	To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5	To make the students aware of the contemporary issues in management

Syllabus

UNIT-I:**INTRODUCTION TO MANAGEMENT**

Management-Concept and meaning-Nature-Functions-Management as a Science and Art and both. Schools of Management Thought-Taylor‟s Scientific Theory-Henry Fayol‟s principles-Elton Mayo‟s Human relations-Systems Theory- **Organizational Designs**-Line organization-Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of Organization-Social responsibilities of Management.

LEARNING OUTCOMES: At the end if the Unit, the learners will be able to

- Understand the concept of management and organization
- Analyze the organization chart & structure for an enterprise.
- Apply the concepts & principles of management in real life industry.
- Evaluate and interpret the theories and the modern organization theory.

UNIT-II:OPERATIONSMANAGEMENT

Principles and Types of Plant Layout-Methods of Production (Job, batch and Mass Production), Work Study- Statistical Quality Control- Deming „s contribution to Quality. **Materials Management -** Objectives- Inventory-Functions - Types, Inventory Techniques-EOQ-ABC Analysis-Purchase Procedure and Stores Management- **Marketing Management -**Concept- Meaning - Nature-Functions of Marketing - Marketing Mix- Channels of Distribution -Advertisement and Sales Promotion- Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Understand the core concepts of Management Science and Operations Management
- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Analyze Marketing Mix Strategies for an enterprise
- Evaluate Materials departments &Determine EOQ
- Create and design advertising and sales promotion

UNIT-III:HUMAN RESOURCES MANAGEMENT (HRM)

HRM- Evolution of HRM - Definition and Meaning – Nature-Managerial and Operative functions--Job Analysis -Human Resource Planning (HRP)–Process of Recruitment&Selection - Training and Development-Performance Appraisal-Methods of Performance Appraisal – Placement-Employee Induction-Wage and Salary Administration.

LEARNING OUTCOMES: At the end if the Unit, the learners will

- Understand the concepts of HRM in Recruitment, Selection, Training & Development
- Apply Managerial and operative Functions
- Analyze the need of training
- Evaluate performance appraisal
- Design the basic structure of salaries and wages

UNIT-IV:STRATEGIC& PROJECT MANAGEMENT

Strategy Definition& Meaning-Vision - Mission- Goals- Corporate Planning Process- Environmental Scanning-Steps in Strategy Formulation and Implementation-SWOT Analysis
Project Management- Network Analysis- Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost Analysis - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques
- Creative in completing the projects within given time

UNIT -V: Contemporary Issues In Management

The concept of Management Information System (MIS)- Materials Requirement Planning (MRP)- Customer Relations Management (CRM)- Total Quality Management (TQM)- Six Sigma Concept- Supply Chain Management (SCM)- Enterprise Resource Planning (ERP)- Performance Management- Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking -Balanced Score Card-Knowledge Management.

LEARNING OUTCOMES At the end if the Unit, the learners will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in modern
- Analyze CRM,MRP,TQM
- Evaluate Six Sigma concept and SCM

Text Books:

1. A.R Aryasri, Management Science, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.

References:

1. Koontz &Weihrich, Essentials of Management, 6/e, TMH, 2005.
2. Thomas N.Duening& John M.Ivancevich, ManagementPrinciples and Guidelines,Biztantra.
3. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
4. Samuel C.Certo, Modern Management, 9/e, PHI, 2005

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Management, and its Functions
CO2	Understand the concepts & principles of management and designs of organization in a practical world
CO3	Apply the knowledge of Work-study principles & Quality Control techniques in industry
CO4	Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
CO5	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
CO6	Create Modern technology in management science.

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2	1	0	3

BUSINESS ENVIRONMENT

(Humanities Elective –II)

Subject Code	Title of the Subject	L	T	P	C
	Business Environment	2	1	0	3

Course Objectives	
1	To make the student understand about the business environment
2	To enable them in knowing the importance of fiscal and monitory policy
3	To facilitate them in understanding the export policy of the country
4	To Impart knowledge about the functioning and role of WTO
5	To Encourage the student in knowing the structure of stock markets

Syllabus

Unit-I:Overview of Business Environment

Introduction – meaning Nature,Scope,significance, functions and advantages. Types- Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis-advantages & limitations of environmental analysis& Characteristics of business.

Learning Outcomes: -After completion of this unit student will

- Understand the concept of Business environment
- Classify various types of business environment
- Evaluate the environmental analysis in business
- Discuss the Characteristics of Business.

Unit-II:Fiscal Policy

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Public debt - Development activities financed by publicexpenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.

Learning Outcomes: -After completion of this unit student will

- Understand the concept of public revenue and public Expenditure
- Identify the functions of RBI and its role
- Analyze the Monitory policy in India
- Know the recent trends and the role of Finance Commission in the development of our country
- Differentiate between Fiscal and Monitory Policy

Unit-III:India's Trade Policy

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral TradeAgreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Learning Outcomes: -After completion of this unit student will

- Understand the role ofIndian international trade
- Understand and explain the need for Export and EXIM Policies
- Analyze causes for Disequilibrium and correction measure
- Differentiate between Bilateral and Multilateral Trade Agreements

UNIT-IV:World Trade Organization

Introduction – Nature, meaning, significance, functions and advantages. Organization and Structure - Role andfunctions of WTO in promoting world trade - Agreements in the Uruguay Round –TRIPS, TRIMS, and GATT - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

Learning Outcomes: -After completion of this unit student will

- Understand the role of WTO in trade
- AnalyzeAgreements on trade by WTO
- Understand the Dispute Settlement Mechanism
- Compare and contrast the Dumping and Anti-dumping Measures.

Unit-V:Money Markets And Capital Markets

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets

and capital markets - Reforms and recent development – SEBI - StockExchanges - Investor protection and role of SEBI.

Learning Outcomes: -After completion of this unit student will

- Understand the components of Indian financial system
- Know the structure of Money markets and Capital markets
- Analyze the Stock Markets
- Apply the knowledge in future investments
- Understand the role of SEBI in investor protection.

TEXT BOOKS:

1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.
2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH2016

REFERENCE BOOKS:

1.K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define Business Environment and its Importance.
CO2	Understand various types of business environment.
CO3	Apply the knowledge of Money markets in future investment
CO4	Analyze India‟s Trade Policy
CO5	Evaluate fiscal and monitory policy
CO6	Develop a personal synthesis and approach for identifying business opportunities

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. I Semester

CAD / CAM LAB

L	T	P	C
0	0	3	1.5

Course Objectives:
To impart the knowledge on the
1. Usage of computer in Design and Manufacturing.
2. Conceptualization of objects in three dimensions and producing orthographic views.
3. Visualization of assembly of various machine parts.
4. CNC part programming of simple profiles.
5. Ability to work with inter-disciplinary groups in professional, industry and research organizations.

List of Experiments:

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances. Study of script, DXE AND IGES FILES. Surface modelling.
2. **Part Modeling:**
   a) Generation of various 3D Models through protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.
   b) Generation of various 3-D models of simple machine parts by feature based /Boolean based modelling.
3. **Assembly Modeling:** Assembly modelling of Simple components.
4. **Computer Aided Analysis:**
   a) Structural Analysis (At least two exercises)
   b) Thermal Analysis (At least two exercises)
5. **CAM:**
   a) Study of various post processors used in NC Machines.
   b) Development of NC code for free form and sculptured surfaces using CAM packages.
   c) Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM packages.

Through Any Four Software Packages from the following:

Use of Auto CAD, Iron CAD, Edge CAM, Micro Station, CATIA, Pro-E, I-DEAS, Gibbs CAM, Master CAM, Ansys etc,.

Course Outcomes:
Ability to
1. Develop 3D models by representation techniques.
2. Modeling of parts and assemble them to create a functional assembly.
3. Utilize Computer Aided Analysis tools to solve real time engineering problems.
4. Use CAM software to generate NC code.
5. Implement CNC part Programme for manufacturing various profiles.

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L	T	P	C
0	0	3	1.5

METROLOGY & MEASUREMENTS LAB

Course Objectives:

To impart knowledge on

- Working principles of linear and angular measuring instruments
- Measurement of linear and angular dimensions of a typical work piece specimen using the measuring instruments
- Methods of form measurements.
- Hands on experience with various measuring instruments to utilize in industries.

Section A

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement
3. Study and calibration of LVDT transducer for displacement measurement
4. Calibration of strain guage for temperature measurement
5. Calibration of thermocouple for temperature measurement
6. Calibration of capacitive transducer for angular displacement
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed
8. Calibration of resistance temperature detector for temperature measurement

Section B

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by Two wire/ Three wire method.
10. Surface roughness measurement by Talysurf instrument.
11. Surface Wear Resistances Test using Electro Spark Coating Device.

Course outcomes:
Ability to

- Carry out- measurements with linear and angular measuring instruments.
- Measure linear and angular dimensions of a typical work piece specimen using the measuring instruments.
- Demonstrate and use different length measuring instruments like vernier calipers and micrometers.
- Explain different angle measuring instrument like universal bevel protractor, sine bar Formulate some unknown quantity or parameter of engineering interest.
- Evaluate the surface quality of a given specimen which is important in all kind of manufacturing.

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COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

IV.B.Tech II Semester (R19)

Semester –8 (Theory - 2, Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		**(Professional Elective-IV)** 1. Total Quality Management 2. Mechanical Vibrations 3. Robotics and Applications in Manufacturing	**PEC-IV**	**2-1-0**	**3**
2.		**(Open Elective-IV)** 1. Finite Element Methods 2. Energy Conservation and Management 3. Introduction to Mechatronics	**OEC-IV**	**2-1-0**	**3**
3.		Project	PR	0-0-7	7
				Total	**13**

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L	T	P	C
2	1	0	3

TOTAL QUALITY MANAGEMENT
(Professional Elective-IV)

Course Objectives:

1. To understanding of Basic concepts of Total Quality Management and Outline the Dimensions Barriers regarding with Quality.
2. Illustrate the TQM principles.
3. Demonstrate Tools utilization for Quality improvement.
4. Explain the various types of Techniques are used to measure Quality.
5. Study various Quality Systems and Auditing on implementation of TQM.

UNIT- I

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

UNIT- II

TQM PRINCIPLES

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

UNIT -III

TQM TOOLS AND TECHNIQUES I

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

UNIT -IV

TQM TOOLS AND TECHNIQUES II

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

UNIT- V

QUALITY SYSTEMS

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

Course Outcomes:

1. To define Quality and Dimensions of product ,service.
   Outline the Dimensions Barrietsregarding with Quality.
2. Able to apply the TQM principles.
3. The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.
4. Able to develop the Quality function and improve performance measures..
5. Develop different Quality Systems and Auditing on implementation of TQM.

TEXT BOOK:

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

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th
2. Edition, First Indian Edition, Cengage Learning, 2012.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,
4. 2006.
5. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall
6. (India) Pvt. Ltd., 2006.

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IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

MECHANICAL VIBRATIONS
(Professional Elective-IV)

Course Objectives: To impart knowledge on

1.	Understanding the behaviour of single degree freedom systems in damped and undamped condition.
2.	Formulating mathematical model for forced vibration problems
3.	Formulating mathematical model for two degree freedom vibration problems
4.	Formulating mathematical model for multi degree forced vibration problems
5.	Analysing the vibrations of continuous systems and critical speed problems

UNIT I

Introduction: Importance and scope ,definitions and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems.

UNIT II

Forced vibrations of Single Degree Freedom Systems : Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and vibrometer, methods of vibration control- excitation reduction at source, system modification.

UNIT III

Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum Beat Phenomena, forced vibration, dynamic vibration absorber.

UNIT IV

Multi Degree Freedom Systems: Lagrangian method for formulation of equation of motion Influence coefficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, Matrix iteration method, orthogonality of mode shapes, model analysis of free and forced vibrations.

UNIT V

Vibration of Continuous Systems: Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts.

Whirling of Shafts: Critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

Course outcomes: At the end of the course the student will be

CO1	Familiar with the basics of free vibration problems in single degree with and without damping
CO2	Able to understand the concepts of forced vibrations problems and their measurements
CO3	Able to formulate equations for 2 DOF and evaluate the modes of vibration
CO4	Able to frame and solve the equations of multi degree problems using various numerical analysis methods
CO1	Able to analyse the continuous systems and critical speeds shafts

Text Books:

1. Elements of Vibrations Analysis L. Meirovich Tata McGraw Hill.

2. Vibration of Mechanical System, C. Nataraj, Cenage Learning, 1st edition, 2012.

Reference Books:

1. Mechanical Vibrations, S. Graham Kelly, Tata McGraw Hill.

2. Vibration Theory and Applications, William Thomson, Pearson Education, New Delhi

3. Vibration problems in Engineering, Timeoshenko and Young, John Wiley and sons Publishers,

4. Mechanical Vibrations, Singresu S. Rao, Pearson Education, New Delhi.

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IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

ROBOTICS AND APPLICATIONS IN MANUFACTURING
(Professional Elective-IV)

Course objectives:

- To know about the various Manufacturing systems in industries
- Able to understand the assembly line balancing
- Able to understand functional line diagrams and degree of freedom
- Able to understand Manipulator kinematics

UNIT I

Introduction to Automation: Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT II

Automated flow lines: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.

Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT III

Introduction to Industrial Robotics: Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

UNIT IV

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

UNIT V

Robot Programming: Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Course outcomes:

- The students will understand the Basics elements of an automated system
- The students will understand Automated flow line and assembly of balancing
- The students will be able to understand about the robot configurations.
- The students will able to design the homogenous transformations

Text Books:

1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.

2. Industrial Robotics - M.P. Groover, TMH.

Reference Books:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.

2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd.

1983 London.

3. Robotic Engineering , Richard D. Klafter, Prentice Hall

4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006

5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

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IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

FINITE ELEMENT METHODS

(Open Elective-IV)

	Course Objectives:
1.	To introduce the concepts of Mathematical Modeling of Engineering Problems.
2.	To understand the FEM concepts of structural components
3	To apply FEM concepts for higher order complex elements
4	To analyze the problems of solid mechanics
5	To design the heat transfer equipments and fluid mechanics systems

UNIT I

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions. Approximate methods for solving the differential equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.

Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems. Solution methods for solving simultaneous equations.

UNIT II

Problems with One-dimensional geometry: Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.

Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations. Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.

UNIT III

Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local, coordinates for triangular (2D simplex) elements, quadrilateral element.

Higher Order And Isoparametric Elements: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

UNIT IV

Finite Element Application In Solid Mechanics: Problem modelling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Iso-parametric, sub-parametric and super-parametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.

Axi-symmetric triangular elements: formulation of stiffness and load vectors.
Introduction to 3D stress analysis.

UNIT V

Heat Transfer And Fluid Mechanics Problems:

Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems, Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces, Two dimensional potential flow problems: Potential function formulation and stream function

formulation.

	Course Outcomes : After the completion of the course, the student will be
CO1	Familiar with the concepts, principles and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems.
CO2	Able to evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations
CO3	Able to write polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and isoparametric elements.
CO4	Familiar with triangular and quadrilateral elements and solve problems on numerical integration Gaussian Quadrature and Axisymmetric elements.
CO5	Able to solve problems on steady state heat flow and fluid flow problems in ID & 2D

Text Books:

1. Introduction to Finite Element in Engineering, TirupatiChandrapatla and Bellagundu ,

Pearson Education, New Delhi.

2. Finite Element Methods, S. S. Rao , Pergamom Press, New York

Reference Books:

1. Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.

2. Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.

3. Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.

4. Introduction to the Finite Element Methods, Desai and Abel , CBS Publishers, New Delhi.

5. Finite and Boundary Methods in Engineering, O.P.Gupta, Oxford and IBH Publishers, New Delhi.

6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

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L	T	P	C
2	1	0	3

ENERGY CONSERVATION AND MANAGEMENT
(Open Elective-IV)

Course Objectives:

* To understanding of technical and commercial aspects of energy conservation and energy auditing.
* To inculcate knowledge and skills about assessing the energy efficiency of an entity
* To impart knowledge in the domain of energy conservation
* To bring out Energy Conservation Potential and Business opportunities across different user segments under innovative business models
* To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding energy conservation and energy auditing.

UNIT - I

THERMODYNAMICS

Availability, energy and Anergy-Exergy, energy, entropy relationship- Degradation of energy – exergy analysis- exergy conservation- combustion, thermal efficiency, thermal losses; thermal balance sheets.

HEAT EXCHANGER THEORY:

Types Of heat exchangers - overall heat transfer coefficient – fouling factor - Design of heat Exchangers, L.M.T.D. and N.T.U. methods.

UNIT - II

ENERGY CONSERVATION:

Rules for efficient energy conservation – technologies for energy conservation – outline of waste heat and material reclamation, load management.

ENERGY AUDITING:

A definition- Level of responsibility- Control of Energy- Uses of Energy - Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- General energy audit- Detailed energy audit.

UNIT - III

THERMAL INSULATION & REFRACTORIES:

Heat loss through un insulated and insulated surfaces; effect of insulation on current carrying wires – economic thickness of insulation – critical radius of insulation – properties of thermal insulators – classification of insulation materials – classification of refractories – properties of refractories – Criteria for good refractory material – application of insulating & refractory materials.

UNIT - IV

WASTE HEAT RECOVERY SYSTEMS:

Guideline to identify waste heat – feasibility study of waste heat – shell and tube heat exchangers – Thermal wheel – heat pipe heat exchanger – Heat pump – waste heat boilers – Incinerators.

UNIT - V

HEAT RECOVERY SYSTEMS:

Liquid to liquid heat exchangers – regenerators, recuperaters, rotating regenerators – selection of materials for heat exchangers, U- tube heat exchanger, fluidized bed heat exchanger – economizer.

Course Outcomes:

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

CO1. Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing

CO2. Ability to analyze the viability of energy conservation projects

CO3. Capability to integrate various options and assess the business and policy environment regarding energy conservation and energy auditing

CO4. Strategic and policy recommendations on energy conservation and energy auditing.

CO5. Ability to develop for waste heat recovery Systems.

References :

1. The role of Energy Manager, E.E.O., U.K.
2. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
3. Conduction Heat Transfer- -Schneder Addition Wieslthy
4. Conduction of Heat in Solids -Carslaw & Jaeger.
5. Fundamentals of heat and mass transfer -R.C. Sachdev New Age International Publishers
6. Heat Transfer By R.K. Rajput/ laxmi publication

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IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

INTRODUCTION TO MECHATRONICS
(Open Elective-IV)

Course objectives:

To introduce the basics of mechatronics systems.
To undersatand the microprocessors and microcontrollers technology and related applications.
To impart knowledge in Study of the architectural details and programming of 16 bit 8085 microprocessor.
To understand the system modeling and analysis in time domain.
To develop architecture and programming of 8051 processor.

UNIT-I

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

UNIT-II

8085 MICROPROCESSOR AND 8051 MICROCONTROLLER

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

UNIT-III

PROGRAMMABLE PERIPHERAL INTERFACE

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

UNIT- IV

PROGRAMMABLE LOGIC CONTROLLER

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

UNIT-V

ACTUATORS AND MECHATRONIC SYSTEM DESIGN

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

Course Outcomes : At the end of the course students will be able to
Students can able to understand the concepts,need and importance of mechatronics.
They can able to know the concepts of 8085 microprocessor, 8051 microcontroller
They can able to understand the Programmable peripheral Interface
Students can able to know the structure, programming and selection of PLC
They can able to know the working principle and design concepts of actuators, mechatronic system.

TEXT BOOKS:

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

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , “Mechatronics Integrated Technologies for Intelligent Machines”, Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.
5. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.
6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013