UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

DEPARTMENT OF MECHANICAL ENGINEERING

UCEV (Autonomous)

W.e.f:AY:2020-21

B.Tech – MECHANICAL ENGINEERING

R20

COURSE STRUCTURE, SYLLABUS, HONORS and MINORS

(for 2020 Admitted Batch)

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

B.Tech (ME) - COURSE STRUCTURE (2020 Admitted Batch)

I B.Tech I Semester

S. No	Course Code	Course Title	L	T	P	C
1	R2011BS01	Calculus and Differential Equations	3	0	0	3
2	R2011BS05	Engineering Chemistry	3	0	0	3
3	R2011ES15	Problem Solving and Programming Using C	3	0	0	3
4	R2011ES07	Engineering Graphics	1	0	4	3
5	R2011ES01	Basic Electrical and Electronics Engineering	3	0	0	3
6	R2011ES01A	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
7	R2011BS05A	Engineering Chemistry lab	0	0	3	1.5
8	R2011ES15A	Problem Solving and Programming Using C Lab	0	0	3	1.5

Total = 19.5

Category	Credits
Basic Science Course	7.5
Engineering Science Courses	12
Total Credits	19.5

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B.Tech (ME) - COURSE STRUCTURE (2020 Admitted Batch)

I B.Tech II Semester

S. No	Course Code	Course Title	L	T	P	C
1	R2012BS02	Linear Algebra and Numerical Methods	3	0	0	3
2	R2012BS03	Engineering Physics	3	0	0	3
3	R2012HS01	Communicative English	3	0	0	3
4	R2012ES09	Engineering Mechanics	3	0	0	3
5	R2012ES10	Material Science and Metallurgy	3	0	0	3
6	R2012BS03A	Engineering Physics Lab	0	0	3	1.5
7	R2012HS01A	English Communication Skills Lab	0	0	3	1.5
8	R2012ES11A	Engineering Workshop Practice	0	0	3	1.5
9	R2012MC01	Environmental Science	2	0	0	0

Total= 19.5

Category	Credits
Basic Science Course	7.5
Engineering Science Courses	7.5
Humanities & Social Science	4.5
Total Credits	19.5

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B.Tech (ME) - COURSE STRUCTURE (2020 Admitted Batch)

II B.Tech I Semester

S.No	Course Code	Course Title	L	T	P	C
1	R2021BS01	Vector Calculus, Transforms and PDE	3	0	0	3
2	R202103PC01	Mechanics of Solids	3	0	0	3
3	R202103PC02	Production Technology	3	0	0	3
4	R202103ES01	Thermodynamics	3	0	0	3
5	R2021HS01	Industrial Management	3	0	0	3
6	R202103ES01A	Material Testing Lab	0	0	3	1.5
7	R202103PC01A	Production Technology Lab	0	0	3	1.5
8	R202103PC02A	Machine Drawing	0	0	3	1.5
9	R202103SC01	Computer aided drafting and modeling Lab	0	0	3	2
10	R2021MC01	Constitution of India	2	0	0	0

Total=21.5

Category	Credits
Basic Science Course	3
Engineering Science Courses	4.5
Humanities & Social Science	3
Professional Core Course	9
Skill oriented course	2
Total Credits	21.5

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B.Tech (ME) - COURSE STRUCTURE (2020 Admitted Batch)

II B.Tech II Semester

S.No	Course Code	Course Title	L	T	P	C
1	R2022BS01	Complex Variables and Statistical Methods	3	0	0	3
2	R202203PC01	Fluid Mechanics & Hydraulic Machines	3	0	0	3
3	R202203PC02	Kinematics of Machinery	3	0	0	3
4	R202203PC03	Thermal Engineering-I	3	0	0	3
5	R202203PC04	Metal Cutting & Machine Tools	3	0	0	3
6	R202203PC01A	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	R202203PC02A	Theory of Machines Lab	0	0	3	1.5
8	R202203PC03A	Machine Tools Lab	0	0	3	1.5
9	R202203SC01	Advanced Communication Skills lab	0	0	3	2
					Total	**21.5**
Internship 2 Months (Mandatory) during summer vacation						
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4

Category	Credits
Basic Science Course	3
Professional Core courses	16.5
Soft skill course	02
Total Credits	21.5

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B.Tech (ME) - COURSE STRUCTURE (2020 Admitted Batch)

III B.Tech I Semester

S.No	Course Code	Course Title	L	T	P	C
1	R203103PC01	Engineering Metrology	3	0	0	3
2	R203103PC02	Design of Machine Members-I	3	0	0	3
3	R203103PC03	Thermal Engineering-II	3	0	0	3
4	R203103OE01	1. Operations Research 2. Energy Conservation Management 3. Design of Experiments 4. Total Quality Management	3	0	0	3
5	R203103PE01	1. Non Destructive Evaluation 2.UnConventional Machining Processes 3.Composite Materials 4.Mechanical Vibrations 5. MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
6	R203103PC01A	Thermal Engineering Lab	0	0	3	1.5
7	R203103PC02A	Engineering Metrology Lab	0	0	3	1.5
8	R203103SC01	Simulation Lab-I	0	0	3	2
9	R2031MC01	Professional Ethics and Human Values	2	0	0	0
	Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester		0	0	0	1.5
					Total	**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4

Category	Credits
Professional Core Course	12
Professional Elective courses	3
Open Elective Course/Job oriented elective	3
Skill oriented course	2
Summer Internship	1.5
Total Credits	21.5

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B.Tech (ME) - COURSE STRUCTURE (2020 Admitted Batch)

III B.Tech II Semester

S.No	Course Code	Course Title	L	T	P	C
1	R203203PC01	Heat Transfer	3	0	0	3
2	R203203PC02	Design of Machine Members-II	3	0	0	3
3	R203203PC03	Dynamics of Machinery	3	0	0	3
4	R203203OE01	1. Industrial robotics 2. Supply Chain Management 3. Condition Monitoring 4. Entrepreneurship	3	0	0	3
5	R203203PE01	1. CAD/CAM 2. Finite Element Methods 3. Industrial Hydraulics and Pneumatics 4. Noise & Vibration Control 5. MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
6	R203203PC01A	Computer Aided Manufacturing Lab	0	0	3	1.5
7	R203203PC02A	Instrumentation & Control Systems Lab	0	0	3	1.5
8	R203203PC03A	Heat Transfer Lab	0	0	3	1.5
9	R203203SC01	Computational Fluid Dynamics Lab	0	0	3	2
10	R2032MC01	Essence of Indian Traditional Knowledge	2	0	0	0
					Total	**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4
Industrial/Research Internship (Mandatory) 2 Months during summer vacation						

Category	Credits
Professional Core Course	13.5
Professional Elective courses	3
Open Elective Course/Job oriented elective	3
Skill oriented course	2
Total Credits	21.5

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B.Tech (ME) - COURSE STRUCTURE (2020 Admitted Batch)

IV B.Tech I Semester

S.No	Course Code	Course Title	L	T	P	C
1	R204103PE01	1.Production Planning & Control 2.Gas Dynamics and Jet Propulsion 3. Joining Processes 4. Statistical Quality Control 5.MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
2	R204103PE02	1.Instrumentation & Control Systems 2. Tribology 3. Advanced Materials 4. Computational Fluid Dynamics 5.MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
3	R204103PE03	1. Automation in Manufacturing 2. Nano Materials 3. Automobile Engineering 4. Heat Transfer Equipment & Design 5.MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
4	R204103OE01	1. Refrigeration & Air Conditioning 2. Nano Technology 3. Operations Management 4. Product Design & Development	3	0	0	3
5	R204103OE02	1. Power Plant Engineering 2. Renewable Energy Sources 3. Optimization Techniques 4. Advanced Mechanics of Solids	3	0	0	3
6	R204103HS01	Universal Human Values And Understanding Harmony	3	0	0	3
9	R204103SC01	Simulation Lab-II	0	0	3	2
	Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester		0	0	0	3
					Total	**23**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4

Category	Credits
Professional Elective courses	9
Open Elective Course/Job oriented elective	6
Skill oriented course	2
Humanities and Social Science Elective	3
Industrial/Research Internship	3
Total Credits	23

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IV B.Tech II Semester

S.No	Category	Code	Course	Hours per week			C
				L	T	P	
1	Major Project	R204203PR01	Project (Project work, seminar and internship in industry)	0	0	16	12
	INTERNSHIP (6 MONTHS)						
						Total	**12**

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B.Tech (ME) - SYLLABUS

		L	T	P	C
I Year-I Semester		**3**	**0**	**0**	**3**
CALCULUS AND DIFFERENTIAL EQUATIONS (R2011BS01)					

Course Objectives:

(i) This course will illuminate the students in the concepts of calculus.

(ii) To enlighten the learners in the concept of differential equations and multivariable calculus.

(iii) 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.

UNIT I: Sequences, Series and Mean value theorems: (10 hrs)

Sequences and Series: Convergence and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

UNIT II: Differential equations: (15 hrs)

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form

Non-homogeneous equations of higher order with constant coefficients with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, $e^{ax}V(x)$ and $x^nV(x)$ – Method of Variation of parameters- Euler-Cauchy equation and Legender's equation

Applications: Orthogonal trajectories – Electrical circuits (RL, RC, RLC) – Simple Harmonic motion.

UNIT III: Partial differentiation: (10 hrs)

Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mac Laurin's series expansion of functions of two variables.

Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT IV: Multiple integrals: (8 hrs)

Double integrals – Change of order of integration - Double integrals in polar coordinates- Areas enclosed by plane curves- Triple integrals – Volume of solids – Change of variables to polar, spherical and cylindrical co-ordinates.

Applications: Finding Areas and Volumes.

UNIT V: Beta and Gamma functions: (5 hrs)

Introduction to Improper Integrals-Beta and Gamma functions- Properties - Relation between Beta and Gamma functions- Evaluation of improper integrals.

Course Outcomes: At the end of the course, the student will be able to

(i) Utilize mean value theorems to real life problems (L3)

(ii) Solve the differential equations related to various engineering fields (L3).

(iii) Familiarize with functions of several variables which are useful in optimization (L3)

(iv) Apply double and triple integration techniques in evaluating areas and volumes bounded by region (L3)

(v) Conclude the use of Beta and Gamma functions in evaluating improper integrals (L4)

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. B. V. Ramana**,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. Erwin Kreyszig,Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. Joel Hass, Christopher Heil and Maurice D. Weir, Thomas calculus, 14th Edition, Pearson.
3. Lawrence Turyn,Advanced Engineering Mathematics, CRC Press, 2013.
4. Srimantha Pal, S C Bhunia**,** Engineering Mathematics, Oxford University Press.

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		L	T	P	C
I Year-I Semester		**3**	**0**	**0**	**3**
ENGINEERING CHEMISTRY (R2011BS05)					

Course Objectives: Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

(i) ***Importance*** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
(ii) ***Outline*** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
(iii) ***Express*** the increases in demand as wide variety of advanced materials are introduced; which have excellent engineering properties. Classify and discuss the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also summarized.
(iv) ***Relate*** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
(v) ***Explain*** the importance and usage of water as basic material in almost all the industries; ***interpret*** drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

UNIT I: POLYMER TECHNOLOGY **8 hrs**

Polymerisation:-Introduction, methods of polymerization (emulsion and suspension), mechanical properties.

Plastics: Compounding, fabrication (compression, injection, blown film and extrusion), preparation, properties and applications (PVC, polycarbonates and Bakelite), mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste (waste to wealth).

Elastomers:- Introduction, preparation, properties and applications (Buna S, thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics, conducting polymers, biodegradable polymers, biopolymers, biomedical polymers.

UNIT II: ELECTROCHEMICAL CELLS AND CORROSION **10 hrs**

Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, construction of glass electrode, batteries (Dry cell, Li ion battery and zinc air cells), fuel cells (H_2-O_2, CH_3OH-O_2, phosphoric acid and molten carbonate).

Corrosion:-Definition, theories of corrosion (chemical and electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, galvanic series, factors influencing rate of corrosion, corrosion control (proper designing and cathodic protection), Protective coatings (surface preparation, cathodic coatings, anodic coatings, electroplating and electroless plating [nickel]), Paints (constituents, functions and special paints).

UNIT III: CHEMISTRY OF MATERIALS 10 hrs

Part- A:

Nano materials:- Introduction, sol-gel method, characterization by (Brunauer Emmet Teller [BET]), (scanning electron microscopy [SEM]) and (transmission electron microscopy [TEM]) with example (TiO_2), applications of graphene and fullerenes, carbon nanotubes (types, preparation and applications)

Thermal analysis techniques: Instrumentation and applications of thermogravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

Part-B:

Refractories: **-** Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: **-** Definition, mechanism of lubricants, properties (definition and importance).

Cement: **-** Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

UNIT IV: FUELS 10 hrs

Introduction, calorific value, higher calorific value, lower calorific values, problems using Dulong's formula, proximate and ultimate analysis of coal sample and their significance, numerical problems, petroleum (refining-cracking), synthetic petrol (Fischer Tropsch and Bergius), petrol knocking, diesel knocking, octane and cetane ratings, anti-knocking agents, Introduction to alternative fuels (Bio-diesel, ethanol, methanol, natural gas, liquefied petroleum gas, compressed natural gas), Flue gas analysis by Orsat apparatus, rocket fuels.

UNIT V: WATER TECHNOLOGY 8 hrs

Hardness of water, determination of hardness by complexometric method, boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement), internal treatments, softening of hard water (zeolite process and related sums, ion exchange process), treatment of industrial waste water, potable water and its specifications, steps involved in purification of water, chlorination, break point chlorination-desalination (reverse osmosis and electro dialysis).

Course Outcomes: ***At the end of this unit, the students will be able to***

(i) ***Analyze*** the different types of composite plastic materials and interpretthe mechanism of conduction in conducting polymers.

(ii) ***Utilize*** the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorizethe reasons for corrosion and study methods to control corrosion

(iii)***Synthesize*** nanomaterials for modern advances of engineering technology. Summarize the techniques that detect and measure changes of state of reaction. Illustratethe commonly used industrial materials.

(iv)***Differentiate*** petroleum, petrol, synthetic petrol and have knowledge how they are produced. Studyalternate fuels and analyseflue gases.

(v) ***Analyze*** the suitable methods for purification and treatment of hard water and brackish water.

Text Books:

1. P.C. Jain and M. Jain "**Engineering Chemistry**", 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, "**Engineering Chemistry**", Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, "**A Textbook of Engineering Chemistry**", S.Chand & Co, (2010).
4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).

Reference Books:

1. K. Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry**", Pearson India Edn.
2. O.G. Palana, "**Engineering Chemistry**", Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) "Preparation and characterization of materials" Academic press, New York (latest edition)
4. B. S. Murthy, P. Shankar and others, "Textbook of Nanoscience and Nanotechnology", University press (latest edition)

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		L	T	P	C
I Year-I Semester		**3**	**0**	**0**	**3**
PROBLEM SOLVING AND PROGRAMMING USING C (R2011ES15)					

Course Objectives:
The objectives of this course is to acquire knowledge on the

- To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
- To enable effective usage of Control Structures and Implement different operations on arrays.
- To demonstrate the use of Strings and Functions.
- To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
- To understand structures and unions and illustrate the file concepts and its operations.
- To impart the Knowledge Searching and Sorting Techniques.

UNIT-I
Introduction to Computer Problem Solving: Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

UNIT-II
Introduction to C Programming: Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements.Operators, Type Conversion.
Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

UNIT-III
Arrays: Introduction, Operations on Arrays, Arrays as Function Arguments, Two dimensionalArrays,Multidimensionalarrays.
Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments,

UNIT-IV
Functions: Introduction, Function Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes. Recursion.

Strings: String Fundamentals, String Processing with and without Library Functions,Pointersand Strings.

UNIT-V
Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Typedef keyword, Bit Fields.
Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Course Outcomes:

At the end of the Course, Student should be able to:

i. Illustrate the Fundamental concepts of Computers and basics of computer programming.
ii. Use Control Structures and Arrays in solving complex problems.
iii. Develop modular program aspects and Strings fundamentals.
iv. Demonstrate the ideas of pointers usage.
v. Solve real world problems using the concept of Structures, Unions and File operations.

Text Books:

i. How to solve it by Computer, R. G. Dromey, and Pearson Education.
ii. Computer Programming. Reema Thareja, Oxford University Press
iii. Let us C , Yaswanth Kanetkar, 16th Edition,BPB Publication.

Reference Books:

i. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
ii. Programming In C A-Practia1 Approach. Ajay Mittal, Pearson.
iii. C Programming — A Problem Solving Approach, Forouzan, Gilberg, Cengage.
iv. The C Programming Language, Dennis Richie And Brian Kernighan, Pearson Education.
v. Programming In C, Ashok Kamthane, Second Edition, Pearson Publication.

WebLinks:

- http://www.c4learn.com/
- http://www.geeksforgeeks.org/c/
- http://nptel.ac.in/courses/122104019/
- http://www.learn-c.org/
- https://www.tutorialsyoint.com/cprogramming/

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		L	T	P	C
I Year-I Semester		**1**	**0**	**4**	**3**
ENGINEERING GRAPHICS (R2011ES07)					

Course Objectives:
The objectives of this course is to acquire knowledge on the:
i. Use of drawing instruments and to draw orthographic projections of points , projections of lines inclined to one plane and both the planes
ii. Make the students to draw the projections of the plane objects and inclined to both the reference planes.
iii. Make the students to draw the projections of the various types of solids in different positions inclined to one plane, inclined to both the planes.
iv. Make the students to understand the concepts of sections of solids and development of surfaces which are required in designing and manufacturing of the objects.
v. Make the students to represent and convert the isometric view to orthographic views and vice versa.

UNIT - I:
Orthographic Projections of Points and Lines: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

UNIT - II:

Polygons: Constructing regular polygons by general methods.
Projections of planes: Regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT - III: **Projections of Solids** – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one plane, Projections of Regular Solids inclined to both planes.

UNIT-IV

Sections of Solids: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone.

Development of Surfaces for Right Regular Solids: Right regular solids of Prism, Cylinder, Pyramid, Cone and their parts.

UNIT-V
Conversion of isometric views to orthographic views and Conversion of orthographic views to isometric views.

Course Outcomes:

The students should be able to:

i.Apply the orthographic projections to points, lines in different positions with reference planes.

ii. Prepare the drawings for construction of regular polygons and the projection of the planes inclined to both the planes.

iii.Prepare the drawings for the projections of the various types of solids in different positions inclined to one plane and both the planes

iv. Apply the concepts of sections of solids and development of surfaces.

v. Use the concepts of isometric view to orthographic views and vice-versa.

Text Books:

i. Engineering Drawing by N.D. Bhatt, Chariot Publications

ii. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

Reference Books:

i. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers

ii. Engineering Graphics for Degree by K.C. John, PHI Publishers

iii. Engineering Graphics by PI Varghese, McGrawHill Publishers

iv. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

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I Year –I Semester		L	T	P	C
		3	0	0	3
	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (R2011ES01)				

Course objectives:

The objectives of this course is to acquire knowledge on the

i. principle of operation and construction details of DC machines & Transformers.
ii. principle of operation and construction details of alternator and 3-Phase induction motor.
iii. PN junction diode, half wave, full wave rectifiers and zener diode.
iv. PNP and NPN transistors and various amplifiers.

Unit - I

Electrical Circuits

Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits –Numerical Problems.

Unit - II

DC Machines

Principle of operation of DC generator- types of DC machines - EMF equation- OCC & Load characteristics- principle of operation of DC Motor—torque equation – applications – three point starter – speed control methods of DC motor – Swinburne's Test and Brake Test.

Unit - III

AC Machines &Transformers

Transformers:

Principle of operation and construction of single phase transformers – EMF equation –OC & SC tests – losses & efficiency.

AC Machines

Principle of operation of 3-Phase induction motor– slip-torque characteristics – Brake Test - efficiency – applications - principle of operation and construction of alternators – types of alternators - principle of operation of synchronous motor.

Unit IV

Diodes and Rectifiers

Classification of Semiconductors–intrinsic-extrinsic-PN junction diode-Forward bias & Reverse Bias- V-I Characteristics- diode as rectifier-half wave and bridge rectifier (with and without filter)-Zener diode-characteristics, applications.

Unit V

Transistors

Transistors, transistor as an amplifier–CE & CB connections-characteristics, Basic principles of Feedback Amplifiers-Types, Basic principle and characteristics of operational amplifiers (OP-AMP) – application of OP-AMPs (inverting, non-inverting, integrator and differentiator).

Course Outcomes:

The student should be able to:

i. Understand the basics of series and parallel electrical circuits.
ii. Understandthe operation and performance of DC machines and testing of DC shunt motor by swinburne's test and brake test.
iii. Principle of operation, construction and performance of AC machines (transformers, synchronous machines and 3-phase &1-phase induction motors)
iv. Understand the concept of semiconductor diodes, operation of half wave, full wave bridge rectifiers, characteristics and applications of Zener diode.
v. Analyze the concept of transistors and amplifiers.

Text Books:

i. Electrical Technology by Surinder Pal Bali, Pearson Publications.
ii. Electronic Devices and Circuits by R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference Books:

i. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group
ii. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
iii. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.
iv. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.
v. Industrial Electronics by G.K. Mittal, PHI.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

I Year – I semester		L	T	P	C
		0	0	3	1.5
	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB (R2011ES01A)				

Course objectives:

The objectives of this course is to acquire knowledge on the

i. efficiency of dc shunt machine, transformer and 3-phase induction motor by conducting direct/indirect tests.
ii. speed control methods of DC shunt motor
iii. characteristics of various basic semiconductor devices.

Any Five Experiments are to be conducted from each section.

Section A: Electrical Engineering:

1. Verification of Kirchhoff's Laws (Kirchhoff's Current Law and Kirchhoff's Voltage Law).
2. Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C. shunt machine working as motor and generator).
3. Speed control of D.C. Shunt motor by
   a) Armature Voltage control b) Field flux control method
4. Brake test on D.C. Shunt Motor.
5. Magnetisation characteristics on DC Shunt generator
6. Load characteristics on DC Shunt generator
7. OC and SC tests on single phase transformer (predetermination of efficiency at given power factors).
8. Brake test on 3-phase Induction motor (determination of performance characteristics)

Section B: Electronics Engineering:

1. Static characteristics of PN junction diode
2. V-I characteristics of Zener-diode
3. Half and full wave rectifier with and without filters.
4. Transistor CB characteristics (input and output)
5. Transistor CE characteristics (input and output)
6. Study of amplifiers.
7. OP- Amp applications (inverting, non-inverting, integrator and differentiator)

Course Outcomes:

The student should be able to:

i. compute the efficiency of DC shunt machine with/without loading the machine.
ii. Estimate the efficiency at different load conditions and power factors for single phase transformer with OC and SC tests.
iii. analyze the performance characteristics of 3-Phase induction motor.
iv. control the speed of dc shunt motor using armature voltage and field flux control methods.
v. analyze the characteristics of PN junction diode, transistor and determine the ripple factor of half wave and full wave rectifiers.

Text books:

i. Principles of Electrical Machines by V.K. Mehta & Rohit Mehta, S.Chand publications
ii. Theory & performance of Electrical Machines by J.B.Guptha, S.K.Kataria & Sons
iii. Electrical Machinery by P.S. Bhimbra, Khanna Publishers.

Reference books:

i. Basic Electrical Engineering by M.S.Naidu & S.Kamakshiah, TMH Publications.
ii. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.
iii. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.

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B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
I Year-I Semester		**0**	**0**	**3**	**1.5**
ENGINEERING CHEMISTRY LAB (R2011BS05A)					

Course Objectives:

The objectives of this course is to acquire knowledge on the

(i) Normality, molaritiy, theory of indicators used in different volumetric and chemical analysis.

(ii) Alkalinity and hardness of water by E DTA method.

(iii)Volumetric analysis Red- Ox titrations of different chemical compounds.

(iv)Determination of concentration of acids and bases using conductometer and potentiometer

(v) Determination of P^H and color metric analysis

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, Volumetric titrations, quantitative analysis

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn^{+2} using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of Cu^{+2} using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Fe^{+3} by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of iso-electric point of amino acids using pH-metry method/conductometric method.
10. Determination of the concentration of strong acid vs strong base (by conductometric method).
11. Determination of strong acid vs strong base (by potentiometric method).
12. Determination of Mg^{+2} presentin an antacid.
13. Determination of $CaCO_3$ present in an egg shell.
14. Estimation of Vitamin C.
15. Determination of phosphoric content in soft drinks.
16. Adsorption of acetic acid by charcoal.
17. Preparation of nylon-6, 6 and Bakelite (demonstration only).

18. Determination of Lead in drinking water.

19. Determination of percentage of copper in Brass.

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Course Outcomes:

(i) Student is exposed to volumetric titrations acquires some volumetric skills.

(ii) Student is able to analyze hard and soft water.

(iii) Student is exposed to volumetric skills of red-ox titrations with different indicators

(iv) Students can handle the instruments like conductometer, potentiometer in determinening the concentrations of acids and bases.

(v) Student is able to analyze the different chemical concentrations using colorimeter and P^H meter.

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co. Latest edition

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
I Year-I Semester		**0**	**0**	**3**	**1.5**
PROBLEM SOLVING AND PROGRAMMING USING C LAB (R2011ES15A)					

Course Objectives:
The objectives of this course is to acquire knowledge on the

- To impart knowledge on basic Linux commands, various Editors, Raptor.
- To make the students understand the concepts of C programming.
- To nurture the students on Control Structures and develop different operations on arrays.
- To make use of String fundamentals and modular programming constructs.
- To implement programs using dynamic memory allocation.
- To explain the concepts of Structure, Unions and files for solving various problems.

Listof Experiments:

1. IntroductiontoAlgorithmsandFlowcharts

1.1) Implement Algorithm Development for Exchange the values of Two numbers.
1.2) Given a set of n student's examination marks (in the range 0-100) make a count of the number of students that passed the examination. A Pass is awarded for all of 50 and above.
1.3) Given a set of n numbers design an algorithm that adds these numbers and returns the resultant sum. Assume N is greater than or equal to zero.

2. IntroductiontoCProgramming

2.1) BasicLinuxCommands.
2.2) ExposuretoTurboC,Vi,Emacs,CodeBlocksIDE,DevC++.
2.3) Writingsimple programs usingprintf(),scanf().

3. Raptor

3.1) Installation and Introduction to Raptor.
3.2) Draw a flow chart to find the Sum of 2 numbers.
3.3) Draw a flow chart to find Simple interest.

4. BasicMath

4.1) Write a C Program to convert Celsius to Fahrenheit and vice versa.
4.2) Write a C Program to find largest of three numbers using ternary operator.
4.3) Write a C Program to Calculate area of a Triangle using Heron's formula.

5. ControlFlow-I

5.1) Write a C Program to Find Whether the Given Year is a Leap Year or not.
5.2) Write a C program to find the roots of a Quadratic Equation.
5.3) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or DivideUsingSwitch...case.

6. ControlFlow-II

6.1) Write a C Program to Find Whether the Given Number is Prime number or not.

6.2) Write a C Program to Find Whether the Given Number is Armstrong Number or not.
6.3) Write a C program to print Floyd Triangle.

7. ControlFlow-III

7.1) Write a C program to find the sum of individual digits of a positive integer.
7.2) Write a C program to check whether given number is palindrome or not.
7.3) Write a C program to read two numbers, x and n, and then compute the sum of the geometric progression $1+x^2+x'+x^3+\ldots\ldots\ldots\ldots+x^n$.

8. Arrays

8.1) Write a C program to search an element in the given array (Linear Search).
8.2) Write a C program to perform matrix addition.
8.3) Write a C program to perform matrix multiplication.

9. Pointers

9.1) Write a C Program to Perform Addition. Subtraction, Multiplication and Division of two numbers using Command line arguments.
9.2) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.
9.3) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

10. Functions,Array&Pointers

10.1) Write a C Program to demonstrate parameter passing in Functions.
10.2) Write a C Program to find Fibonacci. Factorial of a number with recursion and without recursion.
10.3) Write a C Program to find the sum of given numbers with arrays and pointers.

11. Strings

11.1) Implementation of string manipulation operations with library function:
a. copy
b. concatenate
c. length
d. compare

I1.2)Implementation of string manipulation operations without library function:
a. copy
b. concatenate
c. length
d. compare

12. Structures

12.1) Write a C Program to Store Information of a book Using Structure.
12.2) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function.

13. Files

13.1) WriteaCprogramtoopenafile andtoprintthecontentsofthefileonscreen.
13.2) WriteaCprogramtocopycontentofonefiletoanotherfile.
13.3) WriteaCprogramtomergetwofilesandstorecontentinanotherfile.

14. Application

Creating structures to capture the student's details save them in file in proper record format. search and prints the student details requested by the user.

Note:DrawtheflowchartsusingRaptorfromExperiment3 toExperiment6.

Course Outcomes:

- ImplementbasicprogramsinCanddesignflowchartsinRaptor.
- Use ConditionalandIterativestatementstosolverealtimescenariosinC.
- Implementthe concept ofArraysandModularityandStrings.
- ApplytheDynamicMemoryAllocationfunctionsusingpointers.
- Developprogramsusingstructures,andFiles.

Text Books:

i. Let us C , Yaswanth Kanetkar, 16th Edition,BPB Publication.
ii. How to solve it by Computer, R. G. Dromey, and Pearson Education.
iii. Computer Programming. Reema Thareja, Oxford University Press

Reference Books:

i. Programming in C A-Practical Approach Ajay Mittal. Pearson Education.
ii. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.
iii. Problem solving using C , K Venugopal,3'd Edition,TMG Publication.

WebLinks:

1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/
5. https://raptor.martincar1is1e.com/
6. httos://npte1.ac.in/courses/106105055/2

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
I Year-II Semester		**3**	**0**	**0**	**3**
LINEAR ALGEBRA AND NUMERICAL METHODS (R2012BS02)					

Course Objectives:
The objectives of this course is to acquire knowledge on the

(i) To instruct the concept of Matrices in solving linear algebraic equations
(ii) To elucidate the different numerical methods to solve nonlinear algebraic equations
(iii) To disseminate the use of different numerical techniques for carrying out numerical integration.
(iv) 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

UNIT – I: Systems of linear equations, Eigen values and Eigen vectors: (10 hrs)

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss Elimination method – Eigenvalues and Eigen vectors and their properties.

Applications: Free vibration of a two-mass system.

UNIT – II: Cayley-Hamilton theorem and Quadratic forms: (10 hrs)

Cayley-Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem –Reduction to Diagonal form– Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.

Singular values of a matrix, singular value decomposition (Ref. Book – 1).

UNIT – III: Iterative methods: (8 hrs)

Introduction– Solutions of algebraic and transcendental equations : Bisection method–Secant method – Method of false position– Iteration method – Newton-Raphson method (One variable and simultaneous Equations)

Solutions of system of equations - Jacobi and Gauss-Seidel methods

Evaluation of largest eigenvalue –eigenvector using Power Method.

UNIT – IV: Interpolation: **(10 hrs)**

Introduction - Errors in polynomial interpolation – Finite differences– Forward differences– Backward differences –Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula– Newton's divide difference formula.

UNIT–V:Numerical integration and solution of differential equations with initial conditions: **(10 hrs)**

Trapezoidal rule– Simpson's $1/3^{rd}$ and $3/8^{th}$ rule– Solution of differential equations with initial conditions by Taylor's series– Picard's method of successive approximations– Euler's method –Runge-Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

Course Outcomes: The student will be able to

(i) Develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)

(ii) Solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)

(iii) Evaluate approximating the roots of polynomial and transcendental equations by different algorithms (L5)

(iv) Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)

(v) Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)

Text Books:

(i) B. S. Grewal, Higher Engineering Mathematics, 43^{rd} Edition, Khanna Publishers.
(ii) B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

(i) David Poole, Linear Algebra- A modern introduction, 4^{th} Edition, Cengage.
(ii) Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science,Tata Mc. Graw Hill Education.
(iii)M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
(iv)Lawrence Turyn,Advanced Engineering Mathematics, CRC Press.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

I Year- II Semester		L	T	P	C
		3	0	0	3
	ENGINEERING PHYSICS (R2012BS03)				

Course Objectives:

The objectives of this course is to acquire knowledge on the

i. To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications

ii. Understand the mechanism for emission of light, utility of lasers as coherent light sources for low and high energy applications, study of propagation of light through optical fibers and their implications in optical communications.

iii. Open new avenues of utility for dielectric and magnetic materials as potential sources for micro devices.

iv. Familiarize the concepts of theoretical acoustics for their practical utility in engineering acoustics. Explanation for the significance of ultrasound and its application in NDT application.

v. Enlighten the periodic arrangement of atoms in Crystalline solids by Bragg's law – Learning the structural analysis through X-ray diffraction

UNIT I: Wave Optics **12hrs**

Interference: Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications -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, double slit - N-slits(Qualitative) – Grating - resolving power of Grating(Qualitative).

Polarization: Introduction-Types of polarization - Polarization by reflection and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II: Lasers and Fiber optics **10hrs**

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion –Lasing action- Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of optical fiber- Acceptance Angle-Numerical Aperture-Classification of optical fibers based on refractive index profile and modes – Block diagram of fiber optics communication.

UNIT III: Dielectric and Magnetic Materials **8hrs**

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field- Clausius-Mossotti equation.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Origin of permanent magnetic moment - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferrimagnetic materials - Domain concept for Ferromagnetism (Qualitative) - Hysteresis - soft and hard magnetic materials.

Unit-IV: Acoustics and Ultrasonics **10hrs**

Acoustics: Introduction – requirements of acoustically good hall– Reverberation – Reverberation time– Sabine's formula (Derivation using growth and decay method) - Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedial measures.

Ultrasonics: Introduction - Properties - Production by magnetostriction and piezoelectric methods – Detection - Acoustic grating - Non Destructive Testing-Transducers – pulse echo system through transmission and reflection modes - Applications.

Unit-V: Crystallography and X-ray diffraction **8hrs**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattice – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer– crystal structure determination by Laue's powder method-XRD pattern of amorphous, crystalline, and nanomaterials.

Course Outcomes:

The students should be able to

i. **Understand**the concepts of physical optics through the wave nature of light and **discuss** the phenomenal differences between interference, diffraction and polarization.
ii. **Describe** the basic laser physics, working of lasers, and principle of propagation of light in optical fibers.
iii. **Explain** the basics of dielectric and magnetic materials to synthesize new materials as per needs of engineering applications.
iv. **Apply** the knowledge of Ultrasonic to understand non destructive testing and **analyze** acoustic properties of typically used materials in buildings
v. **Recognize** various planes in a crystal and describe the structure determination using x-rays.

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.
3. Engineering Physics by P.K.Palanisamy SciTech publications.

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
2. Engineering Physics – M.R.Srinivasan, New Age Publications
3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

I Year-II Semester		L	T	P	C
		3	0	0	3
COMMUNICATIVE ENGLISH (R2012HS01)					

Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers

(i) Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials

(ii) Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations

(iii) Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information

(iv) Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Unit 1:

A Drawer full of happiness

Listening: Listening to short audio texts and identifying the topic.Listening to prose, prose and conversation.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests.Self introductions and introducing others.

Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information.

Reading for Writing: Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.

Pronunciation: Vowels, Consonants, Plural markers and their realizations

Unit 2:

Nehru's letter to his daughter Indira on her birthday

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings. **Reading**: Identifying sequence of ideas; recognizing verbal techniques

that help to link the ideas in a paragraph together.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

Grammar: Use of articles and zero article; prepositions.

Pronunciation: Past tense markers, word stress-di-syllabic words

Unit 3:

Stephen Hawking-Positivity 'Benchmark'

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing.E-mail etiquette, Writing CV's.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

Grammar: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Pronunciation: word stress-poly-syllabic words.

Unit 4:

Liking a Tree, Unbowed: Wangari Maathai-biography

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

Reading for Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.Writing SOP, writing for media.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

Grammar: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Pronunciation: Contrastive Stress

Unit 5:

Stay Hungry-Stay foolish

Listening: Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving.

Reading: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

Reading for Writing: Writing academic proposals- writing research articles: format and style.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Pronunciation: Stress in compound words

Course Outcomes:

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

(i) Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information

(ii) Ask and answer general questions on familiar topics and introduce oneself/others

(iii) Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information

(iv) Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs

(v) Form sentences using proper grammatical structures and correct word forms

Prescribed text books:

(i) "**Infotech English**", Maruthi Publications. (Detailed)

Reference Books

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2).* CUP, 2012
5. Martin Hewings , Advanced English Grammar, Cambridge university press
6. William Strunk JR. and E B White, Elements of Style, 4th Edition, Pearson
7. *Language and Life: A Skills Approach* Board of Editors, Orient Black Swan Publishers, India. 2018.
8. *Practical English Usage*, Michael Swan. OUP. 1995.
9. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
10. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
11. *Study Writing*, Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
12. *Communication Skills*, Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
13. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
14. *Advanced English Grammar*, Martin Hewings. Cambridge University Press. 2016
15. *Elements of Style*, William Strunk and EB White. Pearson. 1999.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
I Year-II Semester		**3**	**0**	**0**	**3**
ENGINEERING MECHANICS (R2012ES09)					

Course Objectives:
The objectives of this course is to acquire knowledge on the
i. The students are to be exposed to the concepts of force and friction, direction and its application.
ii. The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
iii. The students are to be exposed to concepts of centre of gravity. The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
iv. The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
v. The students are to be exposed to rigid motion kinematics and kinetics.

UNIT – I
Introduction to Engineering Mechanics – Basic Concepts.
Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.
Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

UNIT II
Equilibrium of Systems of Forces: Free Body Diagrams, , Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

UNIT – III
Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures
Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.
Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia:** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – IV
Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics-D'Alembert's Principle, Work Energy method and applications to particle motion- Impulse momentum method.

UNIT – V
Rigid body Motion: Kinematics and kineticsof translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse momentum method.

Course Outcomes:

The students should be able to:

i. To learn the principles (Axioms) of statics, able to find resultant & resolution of system of forces and resultant force.

ii. Explore the concepts of constraints, free body diagram and action-reaction.

iii. Estimate the geometric parameters like centroid, center of gravity and moment of inertia and identify their application.

iv. Learn the analysis of frames and trusses and know the importance of friction.

v. Able to determine solution to dynamic problems through D'Alembert equilibrium equations, Impulse-Momentum and work– energy method

Text Book:

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.
2. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
3. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best & W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.

Reference Books:

1. Engineering Mechanics , statics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
2. Engineering Mechanics , dynamics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics , statics and dynamics – I.H.Shames, – Pearson Publ.
4. Mechanics For Engineers , statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
5. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston –5th Edn Mc Graw Hill Publ.
6. Engineering Mechanics , Fedinand . L. Singer , Harper – Collins.
7. Engineering Mechanics statics and dynamics , A Nelson , Mc Graw Hill publications
8. Engineering Mechanics, Tayal. Umesh Publ.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
I Year-II Semester		**3**	**0**	**0**	**3**
MATERIAL SCIENCE AND METALLURGY (R2012ES10)					

Course Objectives:
The Students will acquire the knowledge

i. To analyze the basic fundamentals of metals, alloys.
ii. To understand the properties and classification of cast irons and steels.
iii. To analyze properties and applications of non-ferrous metals and understand the stability of phases, various heat treatment and strengthening processes.
iv. To understand the concepts of powder metallurgy.
v. To understand the concepts of ceramics, composite materials and nano materials.

UNIT – I
Structure of Metals and Constitution of alloys: Bonds in Solids, Metallic bond, crystallization of metals, Packing Factor for cubic structures - SC, BCC, FCC-line density, plane density. Grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Imperfections – point, line, Surface and volume. Slip and Twinning.
Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds
Equilibrium 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 and Fe-Fe_3C.

UNIT –II
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.

UNIT – III
Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.
Heat treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – IV
Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization-Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Sintering Secondary operations-Sizing, coining, machining -Factors determining the use of powder metallurgy-Application of this process.

UNIT – V
Ceramics and composite materials: Crystalline ceramics, glasses, cermets, abrasive materials
Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C

composites. Nano materials – definition, properties and applications.

Course Outcome: The student will be able to:

vi. Analyze the basic fundamentals of metals, alloys.
vii. Understand the properties and classification of cast irons and steels.
viii. Analyze properties and applications of non ferrous metals and understand the stability of phases, various heat treatment and strengthening processes.
ix. Understand the concepts of powder metallurgy.
x. Understand the concepts of ceramics, composite materials and nano materials.

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland - Cengage.

REFERENCES :

1. Material Science and Metallurgy – Dr. V.D.kodgire- Everest Publishing House
2. Materials Science and engineering - Callister & Baalasubrahmanyam- Wiley Publications
3. Material Science for Engineering students – Fischer – Elsevier Publishers
4. Material science and Engineering - V. Rahghavan-PHI Publishers
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

I Year- II Semester		L	T	P	C
		0	0	3	1.5
	ENGINEERING PHYSICS LAB (R2012BS03A)				

Course Objectives:

The objectives of this course is to acquire knowledge on the

i. To **impart skills** in measurements with accurate error propagation.
ii. To **plan** the experimental procedure, **design** and to record and **analysis** results.
iii. To reach non trivial conclusions of significant of the experiments.
iv. To **develop** the skills to handle different instruments without taking erroneous readings and ability to enhance the skills to fabricate engineering and technical equipments.

List of experiments:

1. Laser: Determination of wavelength using diffraction grating.
2. Study of variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's method.
3. Determination of ultrasonic velocity in given liquid (Acoustic grating).
4. Determination of dielectric constant for different materials.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of Planck's constant using reverse photoelectric effect.
7. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum).
8. Determination of numerical aperture and acceptance angle of an optical fiber.
9. Determination of thickness of thin object by wedge method.
10. Determination of radius of curvature of given plano convex lens by Newton's rings.
11. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
12. Determination of dispersive power of the prism.
13. Determining the velocity of ultrasonic waves by using an ultrasonic interferometer.
14. Measurement of magnetic susceptibility by Quinck's method.
15. Measurement of magnetic susceptibility by Kundt's tube method.

Course outcomes:

The students will be able to

i. **Describe** the methodology of science and the relationship between observation and theory.
ii. **Develop** scientific problem solving skills, including organization of given information, identification and application of pertinent principles, quantitative solutions, interpreting results, and evaluating the validity of results.
iii. **Discover** of physics concepts in other disciplines such as mathematics, computer science, engineering, and chemistry.
iv. **Learn** to minimize contributing variables and recognize the limitations of equipment.
v. **Apply** conceptual understanding of the physics to general real-world situations.
vi. **Develop** interpersonal and communication skills including communicating in small groups, writing, working effectively with peers.

Reference Books:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

I Year-II Semester		L	T	P	C
		0	0	3	1.5
ENGLISH COMMUNICATION SKILLS LAB (R2012HS01A)					

Course Objectives

(i) To impart grammar as well as communication through pronunciation. By introduction, pure vowels, consonants, diphthongs, phonetic transcription, common errors in pronunciation.

(ii) To impart better knowledge on Stress. Stress of kinds- mono syllabic, di syllabic, poly syllabic, strong and weak forms of stress along with contrastive stress.

(iii)To impart learner grammar as well as communication through compound words, rhythm, intonation and accent neutralization

(iv)To impart learner grammar as well as communication through listening, by identifying the context and specific pieces of information to answer a series of questions in speaking

(v) To improve the spoken skills of students by making them read news papers in order to understand and identify key terms context they read .

UNIT I:

Vowels, Consonants, Pronunciation, Phonetic Transcription, Common Errors in Pronunciation,

UNIT II:

Word stress-di-syllabic words, poly-syllabic words, weak and strong forms, contrastive stress (Homographs)

UNIT III:

Stress in compound words, rhythm, intonation, accent neutralisation.

UNIT IV:

Listening to short audio texts and identifying the context and specific pieces of information to answer a series of questions in speaking.

UNIT V:

Newspapers reading; Understanding and identifying key terms and structures useful for writing reports.

Course Outcomes:

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

(i) The learner will improve phonetic understanding, transcription, common errors both in pronunciation and written English.

(ii) The learner will improve syllabic division, and how to use right stress in their pronunciation.

(iii) The learner will improve speaking skills with right intonation and rhythm and intonation and how to reduce mother tongue influence in English.

(iv) The learner will Improve speaking skills as well as listening skills by listening through the audio clips prescribed.

(v) The learner will Improve speaking skills along with reading skills.

Prescribed text book:

(i) "**InfoTech English**", Maruthi Publications.

References:

1. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
2. English Pronunciation in use- Mark Hancock, Cambridge University Press.
3. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
4. English Pronunciation in use- Mark Hewings, Cambridge University Press.
5. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
6. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
I Year-II Semester		**0**	**0**	**3**	**1.5**
ENGINEERING WORKSHOP PRACTICE (R2012ES11A)					

Course Objectives:

The objectives of this course is to acquire knowledge on the

i. To impart hands-on practice on Carpentry trade and skills.

ii. To impart hands-on practice on Fitting trade and skills

iii. To impart hands-on practice on Black Smithy trade and skills

iv. To impart hands-on practice on House Wiring trade and skills

v. To impart hands-on practice on Tin Smithy trade and skills

Note: At least two exercises to be done from each trade.

Trade:

1.Carpentry
1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tenon Joint

2.Fitting
1. Vee Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

3.Black Smithy
1. Round rod to Square
2. S-Hook
3. Round Rod to Flat Ring
4. Round Rod to Square headed bolt

4.House Wiring
1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting
4. Measurement of Earth Resistance

5.Tin Smithy
1. Taper Tray
2. Square Box without lid
3. Open Scoop
4. Funnel

6. IT Workshop
1.Assembly & Disassembly of Computer

Course Outcomes:

The students should be able to:

i. Understand and practice Carpentry tools and trade.

ii. Apply various types of Fitting tools and practice the trade

iii. Understand and practice Black Smithy tools and trade

iv. Apply concepts of House Wiring trade

v. Analyze working of various tools of Tin Smithy trade

vi. Understand the basic hardware of computer

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
I Year-II Semester		**2**	**0**	**0**	**0**
ENVIRONMENTAL SCIENCE(R2012MC01)					

Course Objectives:

The objectives of this course is to acquire knowledge on the

(i) The natural resources and their sustenance of the life and recognize the need to conserve the natural resources.

(ii) The concepts of ecosystem and its functions in the environment. The need for protecting the producers and consumers and their role in the food web.

(iii) The biodiversity of India and the threats to biodiversity, and the conservation practices to protect the biodiversity.

(iv) Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management.

(v) Social issues both rural and urban environment and the possible means to combat the challenges.

UNIT - I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 7hrs

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,– Timber extraction - Mining, dams and other effects on forest and tribal people - Water resources - Use and over utilization of surface and ground water - dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources,Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modem agriculture, fertilizer-pesticide problems, water logging, salinity.

UNIT - II: ECOSYSTEMS, BIODIVERSITY AND ITS CONSERVATION 7hrs

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 ecosystems.

Biodiversity and its Conservation : 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 and solid waste Management 6hrs

Environmental pollution: Definition, Cause, effects and control measures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes -Role of an individual in prevention of pollution, Disaster management: floods, earthquake, cyclone and landslides.

UNIT - IV: SOCIAL ISSUES AND THE ENVIRONMBNT 6hrs

Social Issues and the Environment: From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain and ozone layer depletion, 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.

UNIT - V: HUMAN POPULATION AND THE ENVIRONMENT 6hrs

Human population and the Environment: Population growth, variation among nations' Population explosion - Family Welfare programme. - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of information Technology in Environment and human health.

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.

Course Outcomes:

The students should be able to:

(i) Gain a higher level of personal involvement and interest in understanding and solving environmental problems.

(ii) Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities.

(iii) Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 2lst century.

(iv) Influence their society in proper utilization of goods and services, Recognize the interconnectedness of human dependence on the earth's ecosystems.

(v) Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices.

Text Books:

(i)Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.

(ii)Environmental Studies by Palaniswamy - Pearson education.

(iii)Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company.

Reference Books:

(i)Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.

(ii)Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.

(iii)Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.

(iv) Environmental sciences and engineering - J. Glynn Henry and Gary W. Heinke – Prentice hall India Private limited.

(v) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House.

(vi) Introduction to Environmental engineering and science by Gilberl M. Masters and Wendell P.Ela - Prentice hall of India Private limited.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-I Semester		**3**	**0**	**0**	**3**
VECTOR CALCULUS, TRANSFORMS AND PDE (R2021BS01)					

Course Objectives:

(i) To familiarize the techniques in partial differential equations

(ii) To furnish the learners with basic concepts and techniques of vector calculus and apply to various real world applications

(iii) To understand the signal processing using Fourier series and transforms

UNIT – 1: Vector calculus: (10 hrs)

Differentiation of vectors – Scalar and vector point functions – Gradient – Directional derivative – Divergence – Curl.

Integration of vectors - Line integral – Circulation - Work done – Surface integral – Flux – Volume integral - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and their applications.

UNIT – II: Laplace Transforms: (10 hrs)

Definition of Laplace transform - Laplace transforms of standard functions – Properties of Laplace Transforms : Shifting theorems –Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (with out proof).

Applications: Solving ordinary differential equations (initial value problems) and integro differential equations using Laplace transforms.

UNIT – III: Fourier series and Fourier Transforms: (10 hrs)

Fourier series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties – inverse transforms – Finite Fourier transforms.

UNIT – IV: Partial differential equations of first order: **(8 hrs)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT – V: Second order PDE and Applications: (10 hrs)

Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

Applications of PDE: Method of separation of Variables – Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

Course Outcomes:

The students should be able to:

1. Interpret the physical meaning of different operators such as gradient, curl and divergence Estimate the work done against a field, circulation and flux using vector calculus
2. Apply the Laplace transform for solving differential equations
3. Find or compute the Fourier series of periodic signals
4. Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms
5. Identify solution methods for partial differential equations that model physical processes

Text Books:

(i) **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
(ii) **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

(i) **Erwin Kreyszig,**Advanced Engineering Mathematics, 10th Edition, Wiley-India.
(ii) **Dean. G. Duffy,**Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
(iii)**Peter O' Neil,** Advanced Engineering Mathematics, Cengage.
(iv)**Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-I Semester		**3**	**0**	**0**	**3**
MECHANICS OF SOLIDS (R202103PC01)					

Course Objectives:

The Students will acquire the knowledge

1. To find the stresses & deformations of a member due to axial loading under uniform and non-uniform conditions.
2. To interpret the variation of SF & BM in determinate beam.
3. To analyze the structural members subjected to bending stress and shear loads.
4. To identify the slope and deflection for different support arrangements by different methods and shear stresses induced in circular shafts.
5. To analyze the stresses induced in thin and thick cylinders subjected to internal and external pressures and analyze the columns in stability point of view with different end conditions.

UNIT – I

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

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, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at 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 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 beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV

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, Statically indeterminate Beams and solution methods.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT – V

THIN AND 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 – Riveted boiler shells – Thin spherical shells. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula,

TEXT BOOK:

1. Strength of materials /GH Ryder/ Mc Millan publishers India Ltd
2. Mechanics of materials by Gere & Timeshenko

REFERENCES :

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani- Khanna Publishers
3. Mechanics of Structures Vol-III, by S.B.Junnarkar- Charotar Publishing House
4. Strength of Materials by S.Timshenko- D. VAN NOSTRAND Company- PHI Publishers
5. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman- Harpercollins College Division
6. Solid Mechanics, by Popov.
7. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Find the stresses & deformations of a member due to axial loading under uniform and non-uniform conditions. (BL-1)
2. Interpret the variation of SF & BM in determinate beams. (BL-2)
3. Analyze the structural members subjected to bending stress and shear loads.(BL-4)
4. Identify the slope and deflection for different support arrangements by different methods and shear stresses induced in circular shafts.(BL-3)
5. Analyze the stresses induced in thin and thick cylinders subjected to internal and external pressures and analyze the columns in stability point of view with different end conditions (BL-4)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-I Semester		**3**	**0**	**0**	**3**
PRODUCTION TECHNOLOGY (R202103PC02)					

Course Objectives:
The Students will acquire the knowledge

1. To identify the steps involved in casting, requirements and applications of casting
2. To illustrate the insight into sand casting, types of furnaces, melting and solidification of casting and application of other casting processes
3. To demonstrate the basic knowledge on gas welding and arc welding processes and their applications.
4. To identify appropriate bulk forming processes on materials for suitable applications
5. To identify various sheet metal forming operations and their principles

UNIT – I
CASTING : Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding – ingredients of molding – molding methods. Molding materials, Properties of molding sand, Testing of molding sand. Types of molding – hand molding – Machine molding. Core – different types of cores – materials – properties of core sand – core manufacturing.

UNIT – II
Principles of Gating, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations. Methods of melting and types of furnaces - cupola, electric arc, resistance and induction furnace.Solidification of castings, Solidification of pure metals and alloys, short & long freezing range alloys.Fettling.Casting defects. Basic principles and applications of special casting processes - Centrifugal casting – True, semi and centrifuging. Die casting and Investment casting.
Plastics and their processing: Different types of plastics-thermo sets and thermo plastics, injection moulding, blow moulding, compression moulding.

UNIT – III
Welding : Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, Submerged arc welding, TIG & MIG welding. Electro – slag welding.

Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing.
Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds.

UNIT – IV

Plastic deformation in metals and alloys, recovery, recrystallization and grain growth. Hot working and Cold working, Strain hardening and Annealing. Bulk forming processes: Forging - Types of Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics.Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

UNIT – V

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Springback and its remedies, Coining, Spinning, Types of presses and press tools.**Thermo forming of plastic sheets.**

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

TEXT BOOKS:

1. Manufacturing Processes for Engineering Materials – Kalpakjain S and Steven R Schmid- Pearson Publ , 5th Edn.
2. Manufacturing Technology -Vol I- P.N. Rao- TMH

REFERENCES :

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd
2. Process and materials of manufacture- Lindberg- PHI
3. Production Technology- R.K. Jain- Khanna
4. Production Technology-P C Sharma-S. Chand
5. Manufacturing Processes- H.S. Shaun- Pearson
6. Manufacturing Processes- J.P. Kaushish- PHI
7. Workshop Technology -WAJ Chapman/CBS Publishers&Distributors Pvt.Ltd.
8. Production Technology-HMT- Tata McGrawHill

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Identify the steps involved in casting, requirements and applications of casting (BL-3)
2. Illustrate the insight into sand casting, types of furnaces, melting and solidification of casting and application of other casting processes (BL-2)
3. Demonstrate the basic knowledge on gas welding and arc welding processes and their applications.(BL-2)
4. Identify appropriate bulk forming processes on materials for suitable applications (BL-2)
5. Identify various sheet metal forming operations and their principles (BL-2)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

II Year-I Semester		L	T	P	C
		3	0	0	3
THERMODYNAMICS (R202103ES01)					

Course Objectives:
The Students will acquire the knowledge

1. To apply the concepts of heat, work, and energy and zeoreth law of thermodynamics
2. To apply the first law of thermodynamics for closed and open systems undergoing different thermodynamic processes.
3. To demonstrate the equivalence of two statements of second law of thermodynamics and the propositions regarding efficiency of Carnot cycle and understand the concept of availability and inequality of Clausius.
4. To identify ideal gas and pure substance and solve thermodynamic properties using tables of thermodynamic properties and analyze the processes on T-v diagrams to solve the engineering problems
5. To illustrate the fundamental concepts of gas mixtures and psychometric properties of air.

UNIT – I
Introduction: Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process - Reversible, Quasi static & Irreversible Processes, cycle, Causes of Irreversibility. Energy in State and in Transition - Types, Work and Heat, Point and Path function.
Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale.

UNIT – II
Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. Energy balance for closed systems-Specific heats- Internal energy, Enthalpy and Specific heats of Ideal gases- Internal energy, Enthalpy and Specific heats of Solids and liquids
Conservation of mass- Flow work and Energy of a flowing fluid- Energy analysis of steady flow systems- Some steady flow engineering devices, PMM-I.

UNIT III
Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, Corollaries, PMM of Second kind, Carnot cycle and its specialties, Carnot's theorem, Thermodynamic scale of Temperature.
Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT IV

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point and critical point, properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables. Various Thermodynamic processes and energy Transfer – Steam Calorimetry.
Ideal Gas equation of state- Compressibility factor- Van der waals equation of state- Beattie-Bridgeman equation of state- Benedict-Webb-Rubin equation of state- Viral equation of state- compressibility charts – variable specific heats – gas tables.

UNIT – V

Mixtures of perfect Gases – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes-Equivalent Gas constant and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour.
Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

TEXT BOOKS:

1. Engineering Thermodynamics, PK Nag 6th Edn , McGraw Hill.
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke, Van Wylen, 6th Edn, Wiley

REFERENCES:

1. Engineering Thermodynamics – Jones & Dugan PHI
2. Thermodynamics, an Engineering Approach, Yunus A Cenegel, Michael A Boles, 8th Edn in SI Units, McGraw Hill.
3. Thermodynamics – J.P.Holman , McGrawHill
4. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.
5. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.
6. Engineering Thermodynamics – D.P.Misra, Cengage Publ.
7. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Apply the concepts of heat, work, and energy and zeoreth law of thermodynamics (BL-3)
2. Apply the first law of thermodynamics for closed and open systems undergoing different thermodynamic processes. (BL-3)
3. Demonstrate the equivalence of two statements of second law of thermodynamics and the propositions regarding efficiency of Carnot cycle and understand the concept of availability and inequality of Clausius (BL-2)
4. Identify ideal gas and pure substance and solve thermodynamic properties using tables of thermodynamic properties and analyze the processes on T-v diagrams to solve the engineering problems (BL-3)
5. Illustrate the fundamental concepts of gas mixtures and psychometric properties of air. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

II Year-I Semester		L	T	P	C
		3	0	0	3
	INDUSTRIAL MANAGEMENT(R2021HS01)				

Course Objectives:

- To impart knowledge on scientific principles of management to improve productivity in manufacturing Industry.
- To impart knowledge on fundamentals of functional management to improve performance in industry.
- To introduce basic tools of operations management
- To teach concepts of personnel management and value engineering
- To provide fundamental principles of project management

Unit – I

Introduction: Definition of Industrial Engineering, Development, Applications, Role of an industrial engineer, Quantitative tools of IE and productivity measurement, Concepts of Management, Importance, Functions of management, Scientific management, Taylor's principles, Douglas McGregor's Theory X andTheory Y, Fayol's principles of management.

Unit-II:

Functional Management: Human Resource management: Concept and functions of Human Resource Management, Concept of HRM and HRD Industrial relations, Job-evaluation and merit rating, wage and salary administration.- Marketing Management: Marketing mix and elements of marketing, strategies.- Financial management: objective and functions of Financial Management.

Unit – III

Operations Management: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

Unit – IV

Plant location and layout: Types and principles of plant layouts, Factors affecting plant location and layout, -Statistical Quality Control: Types of control charts, control charts for variables and control charts for attributesand its applications with numerical examples.

Unit – V

Project management: Basics for construction of network diagram,Program Evaluation and Review Technique (PERT), Critical Path Method (CPM) – PERT Vs. CPM, determination of floats, Project crashing and its procedure.

Course Outcomes:

Upon successful completion of this course you should be able to:

- The learner is able to analyses, interpret data and gain knowledge of Industrial Management.
- The knowledge of designing a system, component or process and synthesize solutions to achieve desired needs.
- The learner can use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints through work study.
- The learner can able to know about the application of statistics in quality control and management.The student can know their role as engineers in the present modern society and function effectively within multi-disciplinary teams.
- The learner can understand the fundamental concepts of effective project management design and conduct experiments.

Text Books:

1. Industrial Engineering and Management by O.P Khanna, KhannaPublishers
2. Industrial Engineering and Management by N.V.S. Raju, Cengage Learning

Reference Books:

1. Industrial Engineering and Production Management, Martand Telsang,S.Chand& Company Ltd. New Delhi
2. Operations Management by J.G Monks, Mc Graw Hill Publishers.
3. Production and Operations Management – R.Panneerselvam- PHI- 3rdEdition
4. Principles of Management by Koontz O' Donnel, McGraw Hill Publishers.
5. PERTandCPM by L.S Srinath, East west Press.
6. Production and operations management by K.C Arora.

7. Statistical Quality Control by Gupta.
8. Manufacturing Organization and Management, Harold T. Amrine, John

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-I Semester		**0**	**0**	**3**	**1.5**
MATERIAL TESTING LAB (R202103ES01A)					

Course Objective: To impart practical exposure on the microstructures of various materials and their hardness evaluation. Also to impart practical knowledge on the evaluation of material properties through various destructive testing procedures.

NOTE: Any 6 experiments from each section A and B.

Section A:

1. Direct tension test
2. Bending test on
a) Simple supported
b) Cantilever beam
3. Torsion test
4. Hardness test
a) Brinells hardness test
b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

Section B:

1. Preparation and study of the Microstructure 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:

Upon successful completion of this course, the students will be able to:

1. Solve the ultimate stress of mild steel and bending stress for simply supported and cantilever beam (BL-2)
2. Solve the hardness of different materials and compressive stress on cube (BL-2)
3. Solve the Modulus of rigidity of spring materials and impact strength for engineering materials (BL-2)
4. Find microstructure of different materials and analyze the properties of materials based on microstructure (BL-1)
5. Find hardness test and heat treatment of steels (BL-1)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-I Semester		**0**	**0**	**3**	**1.5**
PRODUCTION TECHNOLOGY LAB (R202103PC01A)					

Course Objective: To impart hands-on practical exposure on manufacturing processes and equipment.

1. Design and making of pattern
   i. Single piece pattern
   ii. Split pattern
2. Sand properties testing
   i. Sieve analysis (dry sand)
   ii. Clay content test
   iii. Moisture content test
   iv. Strength test (Compression test & Shear test)
   v. Permeability test
3. Mould preparation
   i. Straight pipe
   ii. Bent pipe
   iii. Dumble
   iv. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
   i. Lap joint
   ii. Butt joint
   iii. Spot welding
   iv. Brazing and soldering
6. Injection Molding
7. Blow Molding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations
10. Study of Basic powder compaction and sintering
11. Study of TIG/MIG Welding
12. Study of Plastic Moulding Process.

Course Outcomes:
Upon successful completion of this course the student should be able to:

1. Make single piece and split piece pattern making and prepare components using sand casting (BL-3)
2. Find sand properties and able to apply metal forming operations (BL-1)
3. Make single piece and split piece patterns using wood turning lathe machine (BL-3)
4. Make use of plastics materials with injection moulding technique and blow moulding technique (BL-3)
5. Make use of resistance spot welding, manual metal arc welding operations and soldering(BL-3)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

II Year-I Semester		L	T	P	C
		0	0	3	1.5
MACHINE DRAWING (R202103PC02A)					

Course Objective: The student will acquire knowledge in national and International standards while drawing machine components students will also familiarize in drawing assembly, orthographic and sectional views of various machine components.

Machine Drawing Conventions:
Need for drawing conventions – introduction to IS conventions-Standardization-Interchangeability-Selective assembly-Tolerance
a) Conventional representation of materials, common machine elements and parts such asscrews, nuts, bolts, keys, gears, webs, ribs.
b) Types of sections – selection of section planes and drawing of sections and auxiliarysectional views. Parts not usually sectioned.
c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes,centers, curved tapered features and surface finish indication
d) Title boxes, their size, location and details - common abbreviations & their liberal usage
e) Types of Drawings – working drawings for machine parts.

PART-A

I. Drawing of Machine Elements and simple parts
Selection of Views, additional views for the following machine elements and parts with every drawing proportions.
a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cottered joints, knuckle joint, Hook's joints
c) Rivetted joints for plates
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, pivot and collar and foot step bearings.

PART-B

II. Assembly Drawings:
Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.
a) Engine parts –Gear pump, Fuel pump, petrol Engine connecting rod, piston, stuffing box and eccentric assembly.
b) Other machine parts - Screws jack, Machine swivel vice, Plummer block, Tailstock and Tool post.

III. Manufacturing Drawing
Introduction of Limits and fits, fundamental deviations for Hole based and Shaft based systems, alpha numeric designation of limits & fits. Types of Fits.Form and positional tolerances.
Conventional practices of indicating limits and fits, geometrical form and position tolerances, surface finish and surface treatments requirements. Study of Examples involving selection of fits and calculation of limits. Suggestion of suitable fits for mating parts.

Representation of limits fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

TEXT BOOKS:

1. Machine Drawing – N.Siddeswar, K.Kannaiah&V.V.S.Sastry - TMH
2. Machine Drawing –K.L.Narayana, P.Kannaiah& K. Venkata Reddy / New Age/ Publishers
3. Production Drawing- K.L.Narayana, P.Kannaiah& K. Venkata Reddy / New Age/ Publishers

REFERENCES:

1. Machine Drawing – P.S.Gill,
2. Machine Drawing – Luzzader
3. Machine Drawing – Rajput
4. Machine Drawing – N.D. Junnarkar, Pearson
5. Machine Drawing – Ajeeth Singh, McGraw Hill
6. Machine Drawing – KC John, PHI
7. Machine Drawing – B Battacharya, Oxford
8. Machine Drawing – Gowtham and Gowtham, Pearson
9. Machine Drawing- Dhawan R K- S.chand&Company

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Illustrate the method of representing basic machine elements like screws, nuts, bolts etc. (BL-2)
2. Outline the engine parts like gear & fuel pump, Connecting rod etc. (BL-2)
3. Outline the machine parts like Joints, bearings, Plummer block, etc. (BL-2)
4. Construct assembly drawing from the individual machine component as well as engine components. (BL-3)
5. Illustrate limits, fits & Tolerances in manufacturing drawing. (BL-2)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-I Semester		**0**	**0**	**3**	**2**
COMPUTER AIDED DRAFTING AND MODELING LAB (R202103SC01)					

Course Objective:
The student will acquire knowledge
1.To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.
2. To introduce various commands in AutoCAD to draw the geometric entities and to create 2D wire frame models.
3.To introduce various commands in AutoCAD to draw the geometric entities and to create 3D wire frame models.
4. To create geometrical model of simple solids, machines & machine parts
5. To interpret view points and view ports, view point coordinates and views displayed and develop computer aided solid models with isometric and orthographic projections.

COMPUTER AIDED DRAFTING:
1.Generation of points, lines, curves, polygons, dimensioning. Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files
2.Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands in 2D modeling
3. Object selection commands – edit, zoom, cross hatching, pattern filling, utility commands in 3D modeling.
4.Development of part drawings for various components in the form of orthographic representation of dimensioning and tolerances using wire frame and surface modeling.
5.Development of part drawings for various components in the form of isometric representation of dimensioning and tolerances using wire frame and surface modeling.
6. View point coordinates and view ports displayed, examples to exercise different options like save, restore, delete , joint , single option.
7.**COMPUTER AIDED SOLID MODELING**: Development of part drawings for various components in the form of isometric representation.
PART MODELING: Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.
8. Development of part drawings for various components in the form of orthographic projections.
9. Modeling of simple solids,
10. Modeling of Machines & Machine Parts.**Assembly drawings**: (Any four of the following using solid model software) Generation of various Parts/assemblies: like Screw Jack, Oldham's Coupling, Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder.

Course outcomes:
Upon successful completion of this course, the students will be able to:

1. Understand skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling. (BL-2)
2. Utilize various commands in AutoCAD to draw the geometric entities and to create 2D wire frame models. (BL-3)
3. Interpret various commands in AutoCAD to draw the geometric entities and to create 3D wire frame models. (BL-3)
4. Construct geometrical model of simple solids, machines & machine parts. (BL-3)

5. Understand view points and view ports, view point coordinates and views displayed and develop computer aided solid models with isometric and orthographic projections. (BL-2)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-I Semester		**2**	**0**	**0**	**0**
CONSTITUTION OF INDIA(R2021MC01)					

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- 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.
- To understand the central and state relation financial and administrative.

UNIT-I

Introduction 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.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

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

Course Outcomes:

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

1. Know the sources, features and principles of Indian Constitution.

2. Learn about Union Government, State government and its administration.
3. Get acquainted with Local administration and Pachayati Raj.
4. Be aware of basic concepts and developments of Human Rights.
5. Gain knowledge on roles and functioning of Election Commission

References:

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
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans
7. J. Raj IndianGovernment and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

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

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**3**	**0**	**0**	**3**
COMPLEX VARIABLES AND STATISTICAL METHODS (R2022BS01)					

Course Objectives:

(i) To familiarize the complex variables.

(ii) To familiarize the students with the foundations of probability and statistical methods.

(iii)To equip the students to solve application problems in their disciplines.

UNIT – I: Functions of a complex variable and Complex integration: (10 hrs)

Introduction – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method. Complex integration: Line integral - Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs).

UNIT – II: Series expansions and Residue Theorem: (10 hrs)

Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated – pole of order m – Essential – Residues – Residue theorem (without proof) – Evaluation of real integral of the type $\int_{-\infty}^{\infty} f(x)dx$, $\int_{0}^{2\pi} f(\cos\theta, \sin\theta)d\theta$.

UNIT – III: Probability and Distributions: (10 hrs)

Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory: (8 hrs)

Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, χ^2 and F-distributions – Point and Interval estimations – Standard error and Maximum error of estimate.

UNIT – V: Tests of Hypothesis: (10 hrs)

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance- Confidence limits-Test of significance for large samples-single and two means – single and two proportions- Student's t- distribution- significance test of a sample mean – significance test of difference between sample means. F-test, chi-square test (χ^2) and test of goodness of fit.

Course Outcomes:
The students should be able to

(i) Apply Cauchy-Riemann equations to complex valued functions in order to determine whether a given continuous function is analytic

(ii) Find the differentiation and integration of complex valued functions used in engineering problems and Make use of the Cauchy residue theorem to evaluate certain integrals

(iii) Apply discrete and continuous probability distributions.
(iv) Design the components of a classical hypothesis test
(v) Infer the statistical inferential methods based on small and large sampling tests

Text Books:

(i) **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
(ii) **Miller and Freund's,** Probability and Statistics for Engineers, 7/e, Pearson, 2008.

Reference Books:

(i) **S. C. Gupta and V. K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
(ii) **Jay l. Devore,** Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
(iii) **Shron L. Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
(iv) **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**3**	**0**	**0**	**3**
FLUID MECHANICS & HYDRAULIC MACHINES (R202203PC01)					

Course Objectives:

The Students will acquire the knowledge

1. To summarize the basic knowledge of principles in fluid properties, manometry and hydrostatic forces.
2. To interpret the basic laws of fluids, flow patterns and viscous flow through ducts.
3. To interpret the principles of boundary layer formation and dimensional analysis.
4. To compare and contrast different types of pumps and their performance.
5. To compare and contrast different types of turbines and their performance.

UNIT I

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies.Calculation of metacenter height.Stability analysis and applications.

UNIT II

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed 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.

Introduction to Compressible fluid flow (Qualitative Treatment only)

UNIT III

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

UNIT IV

Basics of 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 and efficiency, flow over radial vanes.

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

UNIT V

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: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling.

TEXT BOOKS:

1. Fluid Mechanics- Fundementals and Applications by Y.A. Cengel, J.M.Cimbala, 6th Edn, McGrawHill
2. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.

REFERENCE BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery Modi and Seth
2. Fluid Mechanics and Hydraulic Machines/ RK Bansal/Laxmi Publications (P) Ltd.
3. Fluid Mechanics and Hydraulic Machines by Rajput
4. Fluid Mechanics & Turbo machinery by Dixon, 7th Edn, Elesvier
5. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Summarize the basic knowledge of principles in fluid properties, manometry and hydrostatic forces (BL-2)
2. Interpret the basic laws of fluids, flow patterns and viscous flow through ducts.(BL-2)
3. Interpret the principles of boundary layer formation and dimensional analysis (BL-2)
4. Compare and contrast different types of pumps and their performance (BL-2)
5. Compare and contrast different types of turbines and their performance (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**3**	**0**	**0**	**3**
KINEMATICS OF MACHINERY (R202203PC02)					

Course Objectives:

The Students will acquire the knowledge

1. To interpret the mechanisms from the basic concepts for kinematic pairs, joints and mechanisms
2. To evaluate the straight line motion mechanisms and conditions for correct steering
3. To interpret the concepts of velocity and acceleration diagrams for the applications of various mechanisms
4. To analyze cams for producing a desired motion and cams with specified contours and belt and rope drives for the rated conditions of the machines.
5. To find the efficiency of different types of gears for automobile and machine tools

UNIT – I

MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained.

Grashoff's law , Degrees of freedom ,Kutzbach criterian for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversions of quadric cycle chain – single and double slider crank chains.

UNIT – II

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

Conditions for correct steering – Davis Steering gear, Ackerman's steering gear – velocity ratio; Hooke's Joint:Single and double – Universal coupling–application–problems.

UNIT – III

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Klein's construction, determination of Coriolis component of acceleration.

PLANE MOTION OF BODY: Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

CAMS

Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers:Roller follower – circular cam with straight, concave and convex flanks.

BELT DRIVES: Introduction, Belt and rope drives, selection of belt drive- types of belt drives,V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

UNIT – V

GEARS

Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of 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 to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains. Selection of gear box-Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines & Mechanisms - P.L Ballaney- Khanna Publishers
2. Theory of Machines by Thomas Bevan/ CBS Publishers

REFERENCES:

1. Theory of Machines – S. S Rattan- TMH Publishers
2. Theory of machines and Machinery /Vickers / Oxford .
3. Theory of Mechanisms and machines – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd.
4. Kinematics and dynamics of Machinery by R.L Norton; TATA McGraw-Hill

Course Outcomes:

1. Upon successful completion of this course, the students will be able to:
2. Interpret the mechanisms from the basic concepts for kinematic pairs, joints and mechanisms(BL-2)
3. Evaluate the straight line motion mechanisms and conditions for correct steering (BL-5)
4. Interpret the concepts of velocity and acceleration diagrams for the applications of various mechanisms (BL-2)
5. Analyze cams for producing a desired motion and cams with specified contours.(BL-4)
6. Find the efficiency of different types of gears for automobile and machine tools (BL-1)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**3**	**0**	**0**	**3**
THERMAL ENGINEERING-I (R202203PC03)					

Course Objectives:
The Students will acquire the knowledge

1. To understand the different processes in air-standard cycles and differences between Air Standard and Actual Cycles
2. To interpret the working principle and various components of IC engine
3. To analyze the combustion phenomenon of CI and SI engines and their impact on engine variables.
4. To demonstrate the performance of an IC engine and gas turbine based on the performance parameters.
5. To interpret the working principles of jet propulsion and rockets.

UNIT – I
Air standard Cycles: Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles, Brayton cycle
Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down -Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT – II
I. C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems – Fuel, Carburettor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of supercharging and turbo charging.

UNIT – III
Combustion in S.I. Engines : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Types of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.
Combustion in C.I. Engines : Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – IV
Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.
GAS TURBINES: Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –closed cycle type gas turbines.

UNIT –V
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 engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance evaluation (Definitions and Simple Problems).

ROCKETS: Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines (only Theoretical concepts).

Text Books:

1. I.C. Engines - V. Ganesan- Tata McGraw Hill Publishers
2. Gas Turbines – V.Ganesan – Tata McGraw Hill Publishers

References:

1. Thermal Engineering - Mahesh Rathore- McGraw Hill publishers
2. I.C.Engines–AppliedThermosciences–C.R.Ferguson&A.T.Kirkpatrick-2ndEdition-Wiley Publishers
3. I.C. Engines - J.B.Heywood /McGrawHIll.
4. Heat engines, Vasandani & Kumar - Thermal publications
5. Gas Turbine Theory – HIH Saravanamuttoo, Cohen, Rogers –Pearson Publishers

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Understand the different processes in air-standard cycles and differences between Air Standard and Actual Cycles (BL-2)
2. Interpret the working principle and various components of IC engine (BL-2)
3. Analyze the combustion phenomenon of CI and SI engines and their impact on engine variables.(BL-4)
4. Demonstrate the performance of an IC engine and gas turbine based on the performance parameters. (BL-2)
5. Interpret the working principles of jet propulsion and rockets(BL-2)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

II Year-II Semester		L	T	P	C
		3	0	0	3
METAL CUTTING & MACHINE TOOLS(R202203PC04)					

Course Objectives:

The Students will acquire the knowledge

1. To apply the elementary theory of metal cutting and principles in material removal processes
2. To understand the working principles and operations that can be performed on lathe machines.
3. To identify the working principles and operations that can be performed on shaper, slotter, planner machines and drilling machines calculate the material removal rates.
4. To understand the working principles and operations that can be performed for producing various features using milling machine tool and select appropriate machining processes for finishing operation with the desired quality
5. To apply appropriate jigs and fixtures on machine tools and write simple CNC programs and conduct CNC machining

UNIT – I

FUNDAMENTAL OF MACHINING: Elementary treatment of metal cutting theory – element of cutting process – geometry of single point cutting tool, tool 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, tool life, tool wear, machinability, economics of machining, coolants, tool materials and properties.

UNIT – II

LATHE MACHINES: Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, constructional features of speed gear box and feed gear box. 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 for automats.

UNIT – III

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT – IV

MILLING MACHINES: Principles of working – specifications – classification of Milling Machines – principal features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

FINISHING PROCESSES: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

UNIT - V

JIGS & FIXTURES: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

CNC MACHINE TOOLS: CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines.

Text Books:

1. Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition
2. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill

References:

1. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis
2. Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).
3. Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers
4. Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/ TMH
5. Manufacturing Processes for Engineering Materials-Kalpakjian S & Steven R Schmid/Pearson Publications 5th Edition

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Apply the elementary theory of metal cutting and principles in material removal processes (BL-3)
2. Understand the working principles and operations that can be performed on different lathe machines (BL-2)
3. Identify the working principles and operations that can be performed on shaper, slotter, planner machines and drilling machines calculate the material removal rates (BL-3)
4. Understand the working principles and operations that can be performed for producing various features using milling machine tool and select appropriate machining processes for finishing operation with the desired quality (BL-2)
5. Apply appropriate jigs and fixtures on machine tools and write simple CNC programs and conduct CNC machining (BL-3)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**0**	**0**	**3**	**1.5**
FLUID MECHANICS & HYDRAULIC MACHINES LAB (R202203PC01A)					

Course Objective: To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.
13. Determination of boundary layer thickness over an object using wind tunnel setup

Course outcomes:
Upon successful completion of this course the student should be able to:

1. Find minor and major losses in the pipe lines.(BL-1)
2. Solve the coefficient of discharge through various devices like venturimeter and orifice meter and test the impact of jet on vanes. (BL-2)
3. Estimate the performance of Centrifugal pumps, Reciprocating pumps & Hydraulic Turbines(BL-5)
4. Estimate friction factor for pipes (BL-5)
5. Find the performance of Turbine flow meter (BL-1)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**0**	**0**	**3**	**1.5**
THEORY OF MACHINES LAB (R202203PC02A)					

Course objective:
The Students will acquire the knowledge
To analyze gyroscope, frequency of free and forced vibration and study static and dynamic balancing.

List of experiments:

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyze the motion of a motorized gyroscope when the couple is applied along its spin axis
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel
8. To plot follower displacement vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage , velocity ratio and efficiency
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears

Course outcomes:
Upon successful completion of this course the student should be able to:

1. Examine the motion of a motorized gyroscope when the couple is applied along its spin axis. (BL-4)
2. Find the frequency of undamped and damped free vibration of an equivalent spring mass system. (BL-1)
3. Find the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation (BL-1)
4. Interpret the static and dynamic balancing using rigid blocks (BL-2)
5. Interpret the moment of inertia of a flywheel and Determine whirling speed of shaft theoretically and experimentally (BL-2)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**0**	**0**	**3**	**1.5**
MACHINE TOOLS LAB(R202203PC03A)					

Course Objectives:

The Students will acquire the knowledge to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on these machine tools.

1. Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on lathe machine.
4. Drilling and tapping
5. Shaping and planning
6. Slotting
7. Milling
8. Cylindrical surface grinding
9. Grinding of tool angles.

Course outcome:
Upon successful completion of this course the student should be able to:

1. Make use of Lathe machine tool to produce step turning, taper turning, knurling and threading features on the given workpiece. (BL-3)
2. Understand the working of Milling machine tool to produce grooves. (BL-2)
3. Utilize Drilling machine tool to produce features of cylindrical holes on flat and round surfaces and perform tapping operation(BL-3)
4. Make use of Shaper and Planer machine tools to produce features of slots and pockets on flat surfaces to the desired quality. (BL-3)
5. Utilize Grinding machine tool to produce finished surfaces and grind cutting tools (BL-3)

CO-PO Mapping

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

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
II Year-II Semester		**0**	**0**	**3**	**2**
ADVANCED COMMUNICATION SKILLS LAB(R202203SC01)					

Course Objectives:

The objectives of this course are:

i. To enable the students develop advanced communication skills in English for academic and social purposes.
ii. To make the students to understand the significance of group discussion and various modalities of a group discussion.

iii. To make the students to excel in opinion giving and argue confidently and logically during Debates.

iv. To expose the students to the nuances involved in oral presentation skills and Public Speaking skills.

V. To train the students in job interviews by exposing them to the prerequisites, types, FAQ's and various preparatory techniques in job interviews.

UNIT - I: JAM: Do's and Don'ts of JAM, speaking practice with various topics

UNIT - II: Group Discussion: Importance, modalities, types, do's and don'ts of a GD

UNIT - III: Debate: Importance of a Debate, General rules for participation in debate, Useful phrases, Sample debates-Activities

UNIT - IV: Oral Presentation & public Speaking:

- Make Effective presentations using posters, Flash cards and PPTs
- Tips for making a presentation
- Do's and Don'ts of a presentation
- Dealing with nerves
- Simulated topics/situations for public speaking

UNIT - V: Interview Skills:

- Significance of job interviews
- Understanding preparatory techniques for job interviews
- Know and answer frequently asked questions (FAQs) at job interviews
- Mock interviews

Course Outcomes:

The students should be able to:

i. improve their speaking ability by using context -specific vocabulary.
ii. Learn how to communicate in a group discussion confidently and fluently by using appropriate expressions.

iii. Expose the learners to various speaking activities and enable them to argue logically and develop critical thinking skills.

iv. Apply various techniques for making effective oral presentation skills and improve public speaking skills.

v. acquire employability skills by integrating communication skills and to excel in job interviews

Reference Books:

1. Effective Technical Communication | 2nd Edition Paperback – 27 July 2017 by M. Ashraf Rizvi (Author).
2. Sanjay Kumar and Pushp Lata. ―Communications Skills‖. Oxford University. Press. 2011.
3. Video /you tube links: Muniba Mazari, Malala Yousuf Zahi, Abdul Kalam, Steve Jobs, Mark Zuckerberg…

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester		**3**	**0**	**0**	**3**
ENGINEERING METROLOGY (R203103PC01)					

Course Objectives:
The students will acquire the knowledge:

1. To interpret the principles of different types of limits and fits and explain the operating principles of linear measurements. (BL-2)
2. To illustrate the operating principles of angle and taper measurements and limit gauges. and study the basic principles of optical measuring instruments and interferometry. (BL-2)
3. To classify the different types of comparators and understanding the principles of surface roughness measurement (BL-2)
4. To illustrate the concepts of gear and screw thread measurements. (BL-2)
5. To apply the knowledge of flatness measurement principles and machine tool alignment tests (BL-3)

UNIT-I
SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, fits - Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, deterministic & statistical tolerances, selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning.
LINEAR MEASUREMENT: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micrometers.

UNIT-II
MEASUREMENT OF ANGLES AND TAPERS:
Different methods – bevel protractor, angle slip gauges- angle dekkor- spirit levels- sine bar- sine table, rollers and spheres used to measure angles and tapers.
LIMIT GAUGES:
Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.
OPTICAL MEASURING INSTRUMENTS: Tools maker's microscope and uses- autocollimators, optical projector, optical flats and their uses.

INTERFEROMETRY:
Interference of light, Michelson's interferometer, NPL flatness interferometer, and NPL gauge interferometer.

UNIT-III
SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness –Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, Method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish.
COMPARATORS: Types - mechanical, optical, electrical and electronic, pneumatic comparators and their uses.
Introduction to Geometric Dimensioning and Tolerance(GD&T) and Coordinate Measuring Machines (CMM)

UNIT – IV

GEAR MEASUREMENT: Nomenclature of gear tooth, tooth thickness measurement with gear tooth vernier & flange micro meter, pitch measurement, total composite error and tooth to tooth composite errors, rolling gear tester, involute profile checking.

SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads- concept of virtual effective diameter, measurement of effective diameter, angle of thread and thread pitch, and profile thread gauges.

UNIT – V

FLATNESS MEASUREMENT:

Measurement of flatness of surfaces- instruments used- straight edges- surface plates – auto collimator.

MACHINE TOOL ALIGNMENT TESTS: Principles of machine tool alignment testing on lathe, drilling and milling machines.

Text Books:

1. Dimensional Metrology/Connie Dotson/Cengage Learning
2. Engineering Metrology / R.K.Jain / Khanna Publishers

References:

1. Engineering Metrology / Mahajan / Dhanpat Rai Publishers
2. Engineering Metrology / I.C.Gupta / Dhanpat Rai Publishers
3. Precision Engineering in Manufacturing / R.L.Murthy / New Age
4. Engineering Metrology and Measurements / NV Raghavendra, L Krishna murthy/ Oxford publishers.
5. Engineering Metrology / KL Narayana/Scitech publishers

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Interpret the principles of different types of limits and fits and explain the operating principles of linear measurements. (BL-2)
2. Illustrate the operating principles of angle and taper measurements and limit gauges. and study the basic principles of optical measuring instruments and interferometry. (BL-2)
3. Classify the different types of comparators and understanding the principles of surface roughness measurement (BL-2)
4. Illustrate the concepts of gear and screw thread measurements. (BL-2)
5. Apply the knowledge of flatness measurement principles and machine tool alignment tests (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester		**3**	**0**	**0**	**3**
DESIGN OF MACHINE MEMBERS-I (R203103PC02)					

Course Objectives:

The Students will acquire the knowledge

1. To find the selection of proper materials to different machine elements based on their physical and mechanical properties and understand the different types of failure modes and criteria. (BL-1)
2. To apply the design for fluctuating stresses and strength of various machine elements. (BL-3)
3. To select procedure for the different machine elements such as riveted, welded joints, keys, cotters and knuckle joints. (BL-3)
4. To understand the design of solid and hollow shafts for strength and rigidity. (BL-2)
5. To identify stresses and deflections of mechanical springs. (BL-3)

UNIT – I

INTRODUCTION: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design, tolerances and fits –BIS codes of steels.

STRESSES IN MACHINE MEMBERS: Simple stresses – combined stresses – torsional and bending stresses – impact stresses – stress strain relation – various theories of failure – factor of safety – design for strength and rigidity – preferred numbers. the concept of stiffness in tension, bending, torsion and combined situations – static strength design based on fracture toughness.

UNIT – II

STRENGTH OF MACHINE ELEMENTS: Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor notch sensitivity – design for fluctuating stresses – endurance limit – estimation of endurance strength – goodman's line – soderberg's line – modified goodman's line.

UNIT – III

RIVETED AND WELDED JOINTS – design of joints with initial stresses – eccentric loading.

Bolted joints – design of bolts with pre-stresses – design of joints under eccentric loading – locking devices – both of uniform strength, different seals.

KEYS, COTTERS AND KNUCKLE JOINTS: Design of keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints- knuckle joints.

UNIT – IV

SHAFTS: Design of solid and hollow shafts for strength and rigidity – design of shafts for combined bending and axial loads – shaft sizes – BIS code. Use of internal and external circlips, gaskets and seals (stationary & rotary).

SHAFT COUPLING: Rigid couplings – muff, split muff and flange couplings, flexible couplings – flange coupling (modified).

UNIT – V

MECHANICAL SPRINGS:

Stresses and deflections of helical springs – extension -compression springs – springs for fatigue loading, energy storage capacity – helical torsion springs – co-axial springs, leaf springs.

Note: Design data book is NOT Permitted for examination

TEXT BOOKS:

1. Machine design / NC Pandya & CS Shah/Charotar Publishing House Pvt. Limited
2. Machine Design/V.B.Bhandari/ McGrawHill Education

REFERENCES:

1. Design of Machine Elements / V.M. Faires/McMillan
2. Machine design / Schaum Series/McGrawHill Professional
3. Machine Design/ Shigley, J.E/McGraw Hill.
4. Design data handbook/ K.Mahadevan & K. Balaveera Reddy/ CBS publishers.
5. Design of machine elements-Spotts/Pearson Publications
6. Machine Design –Norton/ Pearson publishers

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Find the selection of proper materials to different machine elements based on their physical and mechanical properties and understand the different types of failure modes and criteria. (BL-1)
2. Apply the design for fluctuating stresses and strength of various machine elements. (BL-3)
3. Select procedure for the different machine elements such as riveted, welded joints, keys, cotters and knuckle joints. (BL-3)
4. Understand the design of solid and hollow shafts for strength and rigidity. (BL-2)
5. Identify stresses and deflections of mechanical springs. (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester		**3**	**0**	**0**	**3**
THERMAL ENGINEERING-II (R203103PC03)					

(Use of steam tables and Mollier chart is allowed)

Course objectives:

The Students will acquire the knowledge:

1. To understand the basic principles of vapour power cycles
2. To understand combustion phenomenon and identify the functions of boilers and draught systems and evaluate their performance.
3. To analyze the performance of the steam nozzles and steam turbines in a steam power plant.
4. To study the basic principles of reaction turbines and steam condensers.
5. To understand the classification and basic principles of compressors.

UNIT – I

VAPOUR POWER CYCLES: Carnot,Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

UNIT II

COMBUSTION: Fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, Stoichiometry, flue gas analysis.

BOILERS : Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – Draught: classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

UNIT – III

STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow - its effects, degree of super saturation and degree of under cooling, Wilson line.

STEAM TURBINES: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency.

UNIT IV

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 – calculation of blade height.

STEAM CONDENSERS: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump, cooling water requirement.

UNIT – V

COMPRESSORS – Classification – fan, blower and compressor - positive displacement and non positive displacement type – reciprocating and rotory types.

Reciprocating: Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, saving of work, minimum work condition for two stage compression.

Rotary (Positive displacement type)

Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Rotary (non positive displacement type)

Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

TEXT BOOKS:

1. Heat Engineering (MKS and SI units), VP Vasandani, DS Kumar, Metropolitan books
2. Basics & Applied Thermodynamics- P.K.Nag – 4th edition- McGraw Hill

REFERENCES:

1. Thermal Engineering- Mahesh Rathore, TataMcGrawHill
2. Applied Thermodynamics by R Yadhav
3. Applied Thermodynamics by Eastop & McConkey, 5th Edn, Pearson
4. Fluid Mechanics Fundementals and Applications by Y.A.Cengel, J.M.Cimbala, McGrawHill
5. Thermal Engineering-M.L.Marthur & Mehta/Jain bros. Publishers
6. Thermal Engineering / RK Rajput/ Lakshmi Publications

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Understand the basic principles of vapour power cycles (BL-2)
2. Understand combustion phenomenon and identify the functions of boilers and draught systems and evaluate their performance (BL-2)
3. Analyze the performance of the steam nozzles and steam turbines in a steam power plant. (BL-4)
4. Apply the basic principles of reaction turbines and steam condensers. (BL-3)
5. Understand the classification and basic principles of compressors (BL-2)

CO-PO Mapping:

S.NO	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
OPERATIONS RESEARCH (R203103OE01)					

Course Objectives:
The Students will acquire the knowledge

1. Understand Linear Programming models (BL-2)
2. Interpret Transportation and sequencing problems (BL-2)
3. Solve replacement problems and analyze queuing models (BL-3)
4. Understand game theory and inventory problems (BL-2)
5. Interpret dynamic programming and simulation. (BL-2)

UNIT – I
Development – definition– characteristics and phases – types of operation research models – applications.
ALLOCATION: Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II
TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- travelling salesman problem.
SEQUENCING – Introduction – flow –shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT – III

REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

UNIT – IV
WAITING LINES: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.
INVENTORY : Introduction – single item – deterministic models – purchase inventory 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. ABC & VED Analysis.

UNIT – V
DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

Text Books:

1. Operations Research-An Introduction/Hamdy A Taha/Pearson publishers
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

References:

1. Introduction to O.R/Hiller & Libermann/TMH
2. Operations Research /A.M. Natarajan, P. Balasubramani, A. Tamilarasi /Pearson Education.
3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman/Wiley
4. Operations Research / R.Pannerselvam/ PHI Publications.
5. Operations Research / Wagner/ PHI Publications.
6. Operation Research /J.K.Sharma/MacMilan Publ.
7. Operations Research/ Pai/ Oxford Publications
8. Operations Research/S Kalavathy / Vikas Publishers
9. Operations Research / DS Cheema/University Science Press
10. Operations Research / Ravindran, Philips, Solberg / Wiley publishers

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Understand Linear Programming models (BL-2)
2. Interpret Transportation and sequencing problems (BL-2)
3. Solve replacement problems and analyze queuing models (BL-3)
4. Understand game theory and inventory problems (BL-2)
5. Interpret dynamic programming and simulation. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
ENERGY CONSERVATION MANAGEMENT (R203103OE01)					

Course Objectives:
The students will acquire the knowledge:

1. To illustrate the importance and role of energy
2. To analyze the energy audit methods
3. To interpret the economics of energy conversion
4. To apply the methods of evaluation of projects.
5. To understand various types of alternative energy sources

UNIT-I: INTRODUCTION: Principles of energy management Managerial organization,Functional areas for i) manufacturing industry, ii) Process industry, iii) Commerce, iv)Government, Role of Energy manager in each of these organizations. Initiating, Organizing and managing energy management programs

UNIT-II: ENERGY AUDIT: Definition and concepts. Types of energy audits, Basic energyconcepts, Resources for plant energy studies.Data gathering, Analytical techniques. EnergyConservation: Technologies for energy conservation, Design for conservation of energy materials, Energy flow networks. Critical assessment of energy usage. Formulation of objectives and constrains, Synthesis of alternative options and technical analysis of options. Process integration.

UNIT-III: ECONOMIC ANALYSIS: Scope, Characterization of an investment project. Types of depreciation, Time value of money. Budget considerations, Risk analysis.

UNIT-IV: METHODS OF EVALUATION OF PROJECTS: Payback, Annualized costs,Investor's rate of retum, Present worth, Internal rate of return. Pros and cons of the commonmethod of analysis.Replacement analysis.

UNIT-V: ALTERNATIVE ENERGY SOURCES: SOLAR ENERGY: Types of devices for solar energy collections, Thermal storage system, Control systems. Wind Energy. Availability, Wind Devices. Wind Characteristics, performance of turbines and systems.

TEXT BOOKS:

1. Energy Management by Murfy.
2. General Aspects of Energy Management and Audit, National Productivity Council of India,Chennai (Course Material- National Certification Examination for Energy Management)

REFERENCE BOOKS:

1. Energy Management Handbook, W.C. Turner, 5th Edition, Marcel Dekker, Inc, New York, 2005.
2. Guide to Energy Management, B. L. Capehart, W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005.
3. Energy Management by O.P. Collagan

Course Outcomes:

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

1. Illustrate the importance and role of energy (BL-2)
2. Analyze the energy audit methods(BL-4)
3. Interpret the economics of energy conversion(BL-2)
4. Apply the methods of evaluation of projects.(BL-3)
5. Understand various types of alternative energy sources (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
DESIGN OF EXPERIMENTS (R203103OE01)					

Course Objectives:

The students will acquire the knowledge:

1. To understand Probability laws, Baye's theorem and Probability distributions.
2. To understand normal and t-distributions and Central limit theorem.
3. To interpret randomization, blocking with paired comparisons and Analysis of variance
4. To develop two-way factorial designs and understand Yate's algorithm
5. To understand simple modeling with least squares

UNIT-I:

Introduction to probability, Probability laws, Baye's theorem, Probability distributions, Parameters and statistics.

UNIT-II:

Normal and t-distributions, Central limit theorem, Random sampling and declaration of independence significance tests.

UNIT-III:

Randomization and blocking with paired comparisons significance tests and confidence interval for means, variances, proportions and frequencies. Analysis of variance, Experiments to compare k-treatment means.

UNIT-IV:

Two-way factorial designs, blocking, Yate's algorithm Fractional factorial designs at two levels, Concept of design resolution.

UNIT-V:

Simple modeling with least squares (Regression analysis), Matrix versions of normal equations.

Text Book

1. Statistics for Experimenters, G.E.P. Box, William G. Hunter and J.S. Hunter, John Wiley & Sons.

Reference Books

1. Design and Analysis of Experiments, D.C. Montgomery, 2nd Edition John Wiley and Sons.
2. Design of Experiments in Chemical Engineering: A Practical Guide, Zivorad R. Lazic, Wiley-VCH publications.

Course Outcomes

After completing this course students will be able to:

1. Illustrate Probability laws, Baye's theorem and Probability distributions. (BL-2)
2. Understand normal and t-distributions and Central limit theorem. (BL-2)
3. Analyze randomization, blocking with paired comparisons and Analysis of variance(BL-4)
4. Develop two-way factorial designs and understand Yate's algorithm (BL-3)
5. Understand simple modelling with least squares(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
TOTAL QUALITY MANAGEMENT (R203103OE01)					

Course Objectives

The students will acquire the knowledge:

1. To understand the concepts of TQM, Quality and Business performance
2. To understand importance of customer satisfaction and loyalty
3. To analyze Organizing for quality implementation
4. To learn the concept of cost of quality
5. To understand ISO 9000 universal standards of quality

UNIT – I:

INTRODUCTION: The concept of TQM, Quality and Business performance, attitude andinvolvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT – II:

CUSTOMER FOCUS AND SATISFACTION: The importance of customer satisfaction and loyalty-Crating satisfied customers, Understanding the customer needs, Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marketing: Evolution of Bench Marketing, meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

UNIT – III:

ORGANIZING FOR TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT – IV:

THE COST OF QUALITY: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT – V:

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOKS:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI

REFERENCES:

1. 1 Beyond TQM / Robert L.Flood
2. 2 Statistical Quality Control / E.L. Grant / McGraw Hill.
3. 3 Total Quality Management- A Practical Approach/H. Lal
4. 4 Quality Management/KanishkaBedi/Oxford University Press/2011

5. 5 Total Engineering Quality Management/Sunil Sharma/Macmillan

Course Outcomes:
On completion of this course, the students will be able to:

1. Understand the concepts of TQM, Quality and Business performance(BL-2)
2. Understand importance of customer satisfaction and loyalty(BL-2)
3. Analyze Organizing for quality implementation(BL-3)
4. Summarize the concept of cost of quality(BL-2)
5. Understand ISO 9000 universal standards of quality(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
NON DESTRUCTIVE EVALUATION (R203103PE01)					

Course Objectives:

The Students will acquire the knowledge

1. To learn basic concepts of non-destructive testing and industrial applications
2. To learn the elements of ultrasonic test and limitations of ultrasonic test
3. To learn the concepts involved in the liquid penetrant test and eddy current test
4. To learn the basic principles and operating procedures of magnetic particle testing
5. To learn the basic concepts involved in the infrared and thermal testing
   (At least, two equipments on Non-destructive evaluation process are to be demonstrated)

UNIT–I

Introduction to non-destructive testing and industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions.

Radiographic test**,** Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography

UNIT–II

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT–III

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing**,**

Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing

UNIT–IV

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials , Demagnetization of Materials,Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test

UNIT–V

Infrared And Thermal Testing: Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –-thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings – Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behaviour of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

TextBooks:

1. Non destructive test and evaluation of Materials/J Prasad, GCK Nair/TMH Publishers
2. Ultrasonic testing of materials/ H Krautkramer/Springer
3. Non destructive testing/Warren, J Mc Gonnagle / Godan and Breach Science publishers
4. Nondestructive evaluation of materials by infrared thermography / X. P. V. Maldague, Springer-Verlag, 1st edition, (1993)

References:

1. Ultrasonic inspection training for NDT/E.A.Gingel/PrometheusPress,
2. ASTMStandards,Vol3.01,Metalsandalloys
3. Non-destructive, Hand Book – R. Hamchand

Course Outcomes

At the end of the course the students shall be able to:

1. Understand the concepts of various NDE techniques and the requirements of radiography techniques and safety aspects. (BL-2)
2. Interpret the principles and procedure of ultrasonic testing (BL-2)
3. Understand the principles and procedure of Liquid penetration and eddy current testing (BL-2)
4. Illustrate the principles and procedure of Magnetic particle testing (BL-2)
5. Interpret the principles and procedure of infrared testing and thermal testing (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
UNCONVENTIONAL MACHINING PROCESSES (R203103PE01)					

Course Objectives:

The Students will acquire the knowledge

1. To understand basic concepts of modern machining processes and ultrasonic machining.
2. Tointerpret the principles and procedure of principles of electro chemical machining.
3. To apply the principles and procedure of thermal metal removal processes.
4. To illustrate the principles and procedure of electron beam machining, laser beam machining and plasma machining.
5. To interpret the principles and procedure of abrasive jet machining.

UNIT – I

INTRODUCTION: Need for non-traditional machining methods-classification of modern machining processesconsiderations in process selection,applications.

Ultrasonic machining – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT – II

ELECTRO – CHEMICAL MACHINING: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate, fundamentals of chemical, machining, advantages andapplications.

UNIT - III

Thermal Metal Removal Processes: General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface.

UNIT – IV

Electron Beam Machining, Laser Beam Machining - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications

Plasma Machining: Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

UNIT – V

Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations, agnetic abrasive finishing, abrasive flow finishing, Electrostream drilling, shaped tube electrolytic machining.

Text Books:

1. Fundamentals of Machining Processes-Conventional and non – conventional processes/Hassan Abdel – Gawad El-Hafy/CRCPress-2016.

References:

1. Modern Machining Process / Pandey P.C. and Shah H.S./TMH.
2. New Technology / Bhattacharya A/ the Institution of Engineers, India1984.
3. Non Traditional Manufacturing Processes / Benedict

Course Outcomes

At the end of the course the students shall be able to:

1. Understand the concepts of modern machining processes and ultrasonic machining. (BL-2)
2. Interpret the principles and procedure of principles of electro chemical machining. (BL-2)
3. Apply the principles and procedure of thermal metal removal processes. (BL-3)
4. Illustrate the principles and procedure of electron beam machining, laser beam machining and plasma machining (BL-2)
5. Interpret the principles and procedure of abrasive jet machining (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
COMPOSITE MATERIALS (R203103PE01)					

Course Objectives
The students will acquire the knowledge:

1. To classify the composite materials and identify the applications
2. To understand strengthening mechanisms of fiber composites
3. To understand Major composite classes and role of interfaces in composites
4. To interpret the Fabrication of PMC's, CMC's and MMC'S
5. To understand applications of advanced composite materials.

UNIT-I

Introduction to Composites: Matrices, Reinforcements, Classifications, Applications, Comparison with Metals and Importance over other materials, design fabrication and economic consideration, General requirements. Classification of composites on the basis of reinforcement and matrix, Classification of Reinforcement, Form and functions of reinforcement, Functions of matrices. Dispersion strengthened, particle strengthened and fiber-reinforced composites. Fibres and resin materials.

UNIT-II
Strengthening mechanisms, Aspect Ratio, Rule of Mixture, discontinuous and continuous fiber composites and their comparison, Characteristics and materials of reinforcements and matrices. Critical Fiber Length, Short and Continuous Fibers, Fiber Orientation.

UNIT-III
Major composite classes: polymer matrix, métal matrix, ceramic matrix, carbon-carbon, and intermetallic composites. Hybrid composites, Laminated composites. Polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications.
Role of interfaces in composites, Interfacial Bonding Mechanisms.Pullout & Push-out Testing.Control of Bond Strength.Toughening mechanisms in PMCs, MMCs, and CMCs.

UNIT-IV
Fabrication of PMC's :- Fabrication of Fibers, Plastic Fiber Forms, Prepregs, Molding Compounds-Processes, Lay-Ups, Filament Winding,Pultrusion, and Recycling. ; Matrix –Reinforcement Interface, Wettability.
Fabrication of CMC's: Hot-Pressing, Infilration,In Situ Chemical reaction Techniques.CVD & CVI, Sol-gel.
Fabrication of MMC'S: Liquid Infiltration- Casting, Solid State Processes-Diffusion Bonding &In Situ Technique.

UNIT-V
Applications of advanced composite materials.Environmental effects in Composites, Green composites, Synthesis and Properties of Nanocomposites. Surface Composites & Surface metal matrix composites: Need, Synthesis, Properties and applications
.

Text Books:

1. Nano material /A.K. Bandyopadyay/New age Publishers
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH
3. Engineering Mechanics of Composite Materials / Isaac and M Daniel/Oxford University Press

References:

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY 1969
3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience,New York, 1980
4. Mechanics of Composite Materials - Second Edition (Mechanical Engineering) /Autar K.Kaw / CRC Press

Course Outcomes:

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

1. Classify the composite materials and identify the applications (BL-2)
2. Apply strengthening mechanisms of fiber composites (BL-3)
3. Understand Major composite classes and role of interfaces in composites(BL-2)
4. Interpret the Fabrication of PMC's, CMC's and MMC'S(BL-5)
5. Utilize applications of advanced composite materials.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
MECHANICAL VIBRATIONS (R203103PE01)					

Course Objectives:

The Students will acquire the knowledge

1. To learn basic principles of mathematical modeling of vibrating systems
2. To learn the basic concepts free and forced multi degree freedom systems
3. To learn concepts involved in the torsional vibrations
4. To learn the principles involved in the critical speed of shafts
5. To learn the basic concepts of transient vibrations

UNIT-I: INTRODUCTION

Relevance of and need for vibrational analysis – Basics of SHM - Mathematical modelling of vibrating systems - Discrete and continuous systems - single-degree freedom systems - free and forced vibrations, damped and undamped systems.

UNIT-II: MULTI DEGREE FREEDOM SYSTEMS

Free and forced vibrations of multi-degree freedom systems in longitudinal, torsional and lateral modes - Matrix methods of solution- normal modes - Orthogonality principle-Energy methods, Eigen values and Eigen vectors, modal analysis.

UNIT-III: CONTINUOUS SYSTEMS

Torsional vibrations - Longitudinal vibration of rods - transverse vibrations of beams – Governing equations of motion - Natural frequencies and normal modes - Energy methods, Introduction to non linear and random vibrations.

UNIT-IV:CRITICAL SPEEDS OF SHAFTS: Critical speed of a light shaft having a single disc without damping and with damping, critical speeds of shaft having multiple discs, secondary critical speed, critical speeds light cantilever shaft with a large heavy disc at its end.

UNIT-V: TRANSIENT VIBRATIONS:

Laplace transformations response to an impulsive input, response to a step input, response to pulse(rectangular and half sinusoidal pulse), phase plane method.

Text books:

1. S.S.Rao, “Mechanical Vibrations ", 5th Edition, Prentice Hall, 2011.
2. L.Meirovitch, “Elements of vibration Analysis", 2nd Edition, McGraw-Hill, New York, 1985.

References:

1. W.T. Thomson, M.D. Dahleh and C Padmanabhan, “Theory of Vibration with Applications”, 5th Edition,Pearson Education, 2008.

2. M.L.Munjal, “Noise and Vibration Control”, World Scientific, 2013.
3. Beranek and Ver, “Noise and Vibration Control Engineering: Principles and Applications”,JohnWiley and Sons, 2006.
4. Randall F. Barron, “Industrial Noise Control and Acoustics”, Marcel Dekker, Inc., 2003.

Course Outcomes:

1. At the end of the course the students shall be able to:
2. Understand the concepts of vibrational analysis (BL-2)
3. Understand the concepts of free and forced multi degree freedom systems(BL-2)
4. Summarize the concepts of torsional vibrations (BL-2)
5. Solve the problems on critical speed of shafts (BL-3)
6. Analyze the systems subjected to transient vibrations (BL-4)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
MOOCs (NPTEL/Swayam) Course (12 Week duration) (R203103PE01)					

MOOCS course will be evaluatedas per the R20 regulations.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester		**0**	**0**	**3**	**1.5**
THERMAL ENGINEERING LAB (R203103PC01A)					

Course Objective: To provide hands on experience in operating various types of internal combustion engines and understands their functioning and performance.

List of experiments:

1. I.C. Engines valve / port timing diagrams.
2. Testing of Fuels – Viscosity, flash point/fire point, carbon residue, calorific value.
3. I.C. Engines performance test and Exhaust emission measurements (4 -stroke diesel engine)
4. I.C. Engines performance test and Exhaust emission measurements (2-stroke petrol engine)
5. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
6. Determination of FP by retardation and motoring test on IC engine.
7. I.C. Engines heat balance at different loads and show the heat distribution curve.
8. Economical speed test of an IC engine.
9. Performance test on variable compression ratio engines.
10. Performance test on reciprocating air compressor unit.
11. Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor & Heavy duty engines covering 2-stroke and 4 stroke, SI and CI engines.
12. Study of boilers, mountings and accessories

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Identify the valves and ports opening and closing of IC engines and Assembly and Dis-assembly of IC Engines. (BL-3)
2. Find the performance characteristics of an internal combustion engines (BL-1)
3. Solve the heat load by drawing the Heat Balance sheet (BL-3)
4. Demonstrate the performance of engine by economical speed tests and Study of Boilers (BL-2)
5. Understand the performance parameters like IP, BP and FP for multi cylinder engines (BL-2)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-I Semester		**0**	**0**	**3**	**1.5**
ENGINEERING METROLOGY LAB (R203103PC02A)					

Course Objectives:

The students will acquire the knowledge:
The Engineering Metrology Lab course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements. The student can learn the measurements with and calibration of instruments.

List of Experiments

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 tooth vernier caliper for tooth thickness inspection and flange micro meter for checking the chordal thickness of spur gear.
4. Measurement using Mechanical comparator.
5. Measurements using Optical Projector.
6. Measurement of alignment using Autocollimator.
7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Thread inspection with two wire/ three wire method & tool makers microscope.
10. Surface roughness measurement with roughness measuring instrument.

Course Outcomes:
Upon successful completion of this course student should be able to:

1. Measure length, height, diameter and angles using various instruments (BL-5)
2. Measure surface roughness with roughness measurement instrument and alignment tests on Lathe Machine tool (BL-5)
3. Apply resistant temperature detector for temperature measurement (BL-3)
4. Utilize LVDT transducer and of rotameter (BL-3)
5. Utilize displacement strain measurement trainer and capacitance measurement trainer (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

III Year-I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
SIMULATION LAB-I (R203103SC01)					

Course Objectives:

The Students will acquire the knowledge:

1. To impart the fundamental knowledge on using various analytical tools like ANSYS, FLUENT, etc., for Engineering Simulation
2. To know various fields of engineering where these tools can be effectively used to improve the output of a product.
3. To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.

1. **PART MODELING:** Generation of various 3D models through protrusion, revolve, shell sweep. creation of various features. study of parent child relation. feature based and boolean based modelling surface and assembly modelling. study of various standard translators. design simple components.
2. **ANALYSIS:**
   a) Determination of deflection and stresses in 2D and 3D trusses and beams.
   b) Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
   c) Determination of stresses in 3D and shell structures (at least one example in each case)
   d) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
   e) Steady state heat transfer Analysis of plane and Axisymmetric components.

Packages to be provided to cater to drafting, modelling & analysis from the following:

CATIA, Pro-E, I-DEAS, ANSYS, NISA, etc

Course outcomes:

Upon successful completion of this course student should be able to:]

1. Understand the concepts of part drawings and assembly of various mechanical parts (BL-2)
2. Understand the concepts of surface and assembly modeling .(BL-2)
3. Solve displacements, stress and reactions in a the 2D bar, beam and truss elements(BL-3)
4. Solve displacements, stress and reactions in a the 3D bar, beam and truss elements(BL-3)
5. Understand the steady state heat transfer analysis of plane and Axisymmetric components. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

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III Year-I Semester		L	T	P	C
		2	0	0	0
PROFESSIONAL ETHICS & HUMAN VALUES (R2031MC01)					

Course Objectives:

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of others.
- To create awareness on assessment of safety and risk
- Provide depth knowledge on framing of the problem and determining the facts, provide depth knowledge on codes of ethics.

Unit I: Human Values:
Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others –Living Peacefully –Caring –Sharing –Honesty -Courage-Cooperation–Commitment – Empathy –Self Confidence Character –Spirituality.

Unit II: Engineering Ethics:
Senses of 'Engineering Ethics-Variety of moral issued –Types of inquiry –Moral dilemmas –Moral autonomy –Kohlberg's theory-Gilligan's theory-Consensus and controversy –Models of professional roles-Theories about right action-Self-interest -Customs and religion –Uses of Ethical theories –Valuing time –Cooperation –Commitment.

Unit III: Engineering as Social Experimentation
Engineering As Social Experimentation –Framing the problem –Determining the facts –Codes of Ethics –Clarifying Concepts –Application issues –Common Ground -General Principles –Utilitarian thinking respect for persons
.

UNIT IV: Engineers Responsibility for Safety and Risk:
Safety and risk –Assessment of safety and risk –Risk benefit analysis and reducing risk-Safety and the Engineer-Designing for the safety-Intellectual Property rights (IPR).

UINIT V: Global Issues
Globalization –Cross-culture issues-Environmental Ethics –Computer Ethics –Computers as the instrument of Unethical behavior –Computers as the object of Unethical acts –Autonomous Computers-Computer codes of Ethics –Weapons Development -Ethics and Research –Analyzing Ethical Problems in research.

Course outcomes:

Students will be able to:

- Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field,Articulate what makes a particular course of action ethically defensible
- Identify the multiple ethical interests at stake in a real-world situation or practice,Assess their own ethical values and the social context of problems

- Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
- Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
- Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

Text Books:

1. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and, V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009
2. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
3. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger –Tata McGraw-Hill–2003.
4. "Professional Ethics and Morals" by Prof.A.R.Aryasri, DharanikotaSuyodhana-Maruthi Publications.
5. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran-LaxmiPublications.
6. "Professional Ethics and Human Values" by Prof.D.R.Kiran-
7. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication

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		L	T	P	C
III Year-II Semester		**3**	**0**	**0**	**3**
HEAT TRANSFER (R203203PC01)					

(Heat transfer data book allowed)

Course Objectives:

The Students will acquire the knowledge

1. To learn the different modes of heat transfer and conduction heat transfer through various solid bodies
2. To learn the one dimensional steady state heat conduction heat transfer and one dimensional transient heat conduction
3. To learn the basic concepts of convective heat transfer and forced convection heat transfer of external flows and internal flows
4. To learn the free convection heat transfer concepts and heat transfer processes in heat exchangers
5. To learn the concepts of film wise condensation, drop wise condensation and radiation heat transfer

UNIT – I:

Introduction

Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about 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 – Initial and boundary conditions

One Dimensional Steady State Conduction Heat Transfer

Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation. Variable Thermal conductivity – systems with heat sources or Heat generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

UNIT – II:

One Dimensional Transient Conduction Heat Transfer

Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies-Chart solutions of transient conduction systems- Concept of Semi infinite body.

Convective Heat Transfer

Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham π Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations

UNIT – III:

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Forced convection: External Flows:

Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

Internal Flows:

Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Free Convection:

Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

UNIT – IV:

Heat Transfer with Phase Change:

Boiling: – Pool boiling – Regimes – Calculations on 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 and 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:

Radiation 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 grey bodies – radiation shields – electrical analogy for radiation networks.

TEXT BOOKS:

1. Heat Transfer by HOLMAN, Tata McgrawHill
2. Heat Transfer by P.K.Nag, TMH

REFERENCE BOOKS:

1. Fundamentals of Heat Transfer by Incropera& Dewitt, John wiley
2. Fundamentals of Engineering, Heat& Mass Transfer by R.C.Sachdeva, NewAge.
3. Heat& Mass Transfer by Amit Pal – Pearson Publishers
4. Heat Transfer by Ghosh dastidar, Oxford University press.
5. Heat Transfer by a Practical Approach, YunusCengel, Boles, TMH
6. Engineering Heat and Mass Transfer by Sarit K. Das, DhanpatRai Pub

Note: Heat and Mass transfer Data Book by C P Kothandaraman and Subrahmanyan is used to design and

analyze various thermal processes and thermal equipment.

Course Outcomes:

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

1. Find heat transfer rate for 1D, steady state composite systems with heat generation and performance of pins. (BL-1)
2. Understand the concepts transient heat conduction and basic laws involved in the convection heat transfer. (BL-2)
3. Apply the empirical equations for forced convection and free convection problems (BL-3)
4. Examine the rate of heat transfer with phase change and in the heat exchangers. (BL-4)
5. Illustrate the concepts of radiation heat transfer (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

		L	T	P	C
III Year-II Semester		**3**	**0**	**0**	**3**
DESIGN OF MACHINE MEMBERS-II (R203203PC02)					

Course Objectives:

The Students will acquire the knowledge

1. Understand to select the suitable bearing based on the application of the loads and predict the life of the bearing
2. Design of engine parts such as connecting rod, crank, crank shaft and engine parts such as piston, cylinder and cylinder liners
3. Design of curved beams with various cross sections and crane hooks
4. Design power transmission elements such as belts, chains, ropes. power screws and gear drives
5. Design of the machine tool elements such as levers and brackets

UNIT – I

BEARINGS: Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT – II

ENGINE PARTS: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners,

UNIT – III

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c –clamps**.**

UNIT – IV

POWER TRANSMISSIONS SYSTEMS, PULLEYS: Transmission of power by belt and rope drives, transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives

DESIGN OF POWER SCREWS: Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

SPUR & HELICAL GEAR DRIVES: Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

UNIT – V

MACHINE TOOL ELEMENTS: Levers and brackets: design of levers – hand levers-foot lever – cranked lever – lever of a lever loaded safety valve- rocker arm straight – angular- design of a crank pin –

brackets- hangers- wall boxes.
Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums.

Note: Design data book is permitted for examination

Text Books:

1. Machine Design/V.Bandari/TMH Publishers
2. Machine Design/ NC Pandya & CS Shaw/ Charotar publishers
3. Design data book.

References:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education
3. Design of machine elements- spots/Pearson Publications
4. Machine Design-Norton/Pearson Publications

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Select the suitable bearings based on the application of the loads and predict the life of the bearing (BL-3)
2. Interpret engine parts such as connecting rod, crank, crank shaft and engine parts such as piston, cylinder and cylinder liners (BL-2)
3. Analyze curved beams with various cross sections and crane hooks (BL-4)
4. Analyze power transmission elements such as belts, chains, ropes.power screws and gear drives(BL-4)
5. Interpret machine tool elements such as levers and brackets (BL-2)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester		**3**	**0**	**0**	**3**
DYNAMICS OF MACHINERY (R203203PC03)					

Course Objectives:
The Students will acquire the knowledge

1. To analyze stabilization of sea vehicles, aircrafts and automobile vehicles
2. To solve frictional losses, torque transmission of mechanical systems.
3. To analyze dynamic forces of slider crank mechanism and design of flywheel
4. To understand the methods of balancing reciprocating and rotary masses.
5. To understand the concept of vibrations and its significance on engineering design

UNIT – I
PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms, (Demonstration of models in video show).

UNIT – II
FRICTION: Inclined plane, friction of screw 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, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission,

UNIT – III
TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism**,** inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.
GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.

UNIT – IV
BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples –examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – V
VIBRATIONS: Free Vibration of spring mass system –Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

Text Books :

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill
2. Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

References :

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shigley / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of machines / Khurmi/S.Chand.

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Understand the stabilization of sea vehicles, aircrafts and automobile vehicles (BL-2)
2. Solve frictional losses, torque transmission of mechanical systems. (BL-3)
3. Analyze dynamic forces of slider crank mechanism and design of flywheel (BL-4)
4. Understand the methods of balancing reciprocating and rotary masses. (BL-2)
5. Illustrate the concept of vibrations and its significance on engineering design (BL-2)

CO-PO Mapping

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

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
INDUSTRIAL ROBOTICS(R203203OE01)					

Course Objectives:
The students will acquire the knowledge:

1. To understand various applications of robotics and classification of coordinate system and control systems
2. To build the concepts of components of industrial robotics.
3. To determine kinematic analysis with D-H notation, forward and inverse kinematics and Solve dynamic analysis with Lagrange – Euler and Newton – Euler formulations
4. To model trajectory planning for a manipulator by avoiding obstacles
5. To understand different types of actuators and applications of robots in manufacturing

UNIT-I
INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT – II
COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – III
MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.
MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.Differential transformation and manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT IV
General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT V
ROBOT ACTUATORS AND FEED BACK COMPONENTS:
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.
ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Robotics / John J. Craig/ Pearson

REFERENCE BOOKS:

1. Theory of Applied Robotics /Jazar/Springer.
2. Robotics / Ghosal / Oxford

Course outcomes:

Upon successful completion of this course student should be able to:

1. Understand various applications of robotics and classification of coordinate system and control systems (BL-2)
2. Build the concepts of components of industrial robotics. (BL-3)
3. Apply kinematic analysis with D-H notation, forward and inverse kinematics and Solve dynamic analysis with Lagrange – Euler and Newton – Euler formulations. (BL-3)
4. Model trajectory planning for a manipulator by avoiding obstacles. (BL-3)
5. Understand different types of actuators and applications of robots in manufacturing. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
SUPPLY CHAIN MANAGEMENT (R203203OE01)					

Course Objectives:
The students will acquire the knowledge:

1. To explain the importance of Supply chain management frame work in business management
2. To understand basic concepts of Supply Chain Drivers and Metrics
3. To interpret the Design of Supply Chain Network and factors influencing distribution network design
4. To understand role of forecasting in a supply chain
5. To analyze aggregate Planning and inventories in supply chain

Unit-I
Strategic Framework: Introduction to Supply Chain Management, Decision phases in a supply chain, Process views of a supply chain: push/pull and cycle views, Achieving Strategic fit, Expanding strategic scope.

Unit-II
Supply Chain Drivers and Metrics: Drivers of supply chain performance, Framework for structuring Drivers, Obstacles to achieving strategic fit.

Unit-III
Designing Supply Chain Network: Factors influencing Distribution Network Design, Design options for a Distribution network, E-Business and Distribution network, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation.

Unit-IV
Forecasting in SC: Role of forecasting in a supply chain, Components of a forecast and forecasting methods, Risk management in forecasting.

Unit-V
Aggregate Planning and Inventories in SC: Aggregate planning problem in SC, Aggregate Planning Strategies, Planning Supply and Demand in a SC, Managing uncertainty in a SC: Safety Inventory. Coordination in SC: Modes of Transportation and their performance characteristics, Supply Chain IT framework, Coordination in a SC and Bullwhip Effect.

Text Books:

1. Sunil Chopra and Peter Meindl, Supply Chain Management - Strategy, Planning and Operation, 4th Edition, Pearson Education Asia, 2010.
2. David Simchi-Levi, PhilpKamintry and Edith Simchy Levy, Designing and Managing the Supply Chain - Concepts Strategies and Case Studies, 2nd Edition, Tata-McGraw Hill, 2000.

Course Outcomes:

Up on completion of course students will be able to

1.Illustrate the importance of Supply chain management frame work in business management.(BL-2)

2. Understand basic concepts of Supply Chain Drivers and Metrics.(BL-2)

3. Interpret the Design of Supply Chain Network and factors influencing distribution network design.(BL-3)

4. Apply role of forecasting in a supply chain.(BL-3)

5. Analyze aggregate Planning and inventories in supply chain.(BL-4)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
CONDITION MONITORING(R203203OE01)					

Course Objectives:
The students will acquire the knowledge:

1. To introduce the basics of vibration
2. To analyze vibration measurement and analysis using transducers and mounting methods
3. To understand fault diagnosis andinterpret vibration measurements
4. To understandoil and wear debris analysis
5. To interpret Ultrasonic monitoring and analysis

UNIT-I
BASICS OF VIBRATION: Basic motion: amplitudes, period, frequency, basic parameters: displacement, velocity, acceleration, units (including dB scales) and conversions, Mass, spring and damper concept, Introduction to SDOF and MDOF systems, Natural frequencies and resonance, Forced response.

UNIT-II
VIBRATION MEASUREMENTS AND ANALYSIS: Transducers and mounting methods, data acquisition using instrumentation recorders/data loggers, time domain signal analysis, orbit analysis, Filters, Frequency domain analysis (Narrow band FFT analysis), Nyquist criteria, Sampling, aliasing, windowing and averaging.

UNIT-III
Fault Diagnosis, Interpreting vibration measurements for common machine faults , imbalance, misalignment, mechanical looseness, bearing and gearing faults, faults in induction motors, resonances, some case studies, static and dynamic balancing, international standards for vibration condition monitoring.

THERMOGRAPHY: The basics of infrared thermography, differences in equipment and specific wave length limitations, application of ir to: electrical inspection, mechanical inspection, energy conservation, how to take good thermal images, hands-on demonstrations focusing on proper camera settings and image interpretation, analysis of thermal images and report generation, study of thermography applications.

UNIT-IV

OIL AND WEAR DEBRIS ANALYSIS: Basics of oil analysis, monitoring condition of oil, lubricant analysis, physio – chemical properties, moisture, tan tbn, wear debris analysis, particle counting, spectroscopy, uses & limitations, ferrography wear particle analysis, concept of ferrography, principle particle classification, size, shape, composition, concentration, analysis procedure, sampling & analytical ferrography equipments, severity rating.

UNIT-V

ULTRASONIC MONITORING AND ANALYSIS: Ultrasonic monitoring (leak, crack and thickness) basics of ultrasonic monitoring , ultrasonic theory, test taking philosophy, ultrasonic theory, mathematics of

ultrasound, equipment and transducers, inspection parameters and calibration, immersion theory, equipment quality control, flaw origins and inspection methods, UT Procedure familiarization, and study recommendations, application of ultrasound to: air leaks, steam trap testing, bearing lubrication, electrical inspection, case studies.

Text Books:

1. The Vibration Analysis Handbook/J I Taylor (1994)/Vibration consultants Incorporate Publishers
2. Machinery Vibration Condition Monitoring/Lynn/Butterworth(1989)

References:

1. Machinery Vibration: Measurement and Analysis/Victor Wowk/Mc GrawHill Professional
2. Mechanical fault diagnosis and condition monitoring/RA Collacott(1977) /Chapman and Hall
3. The Vibration Monitoring Handbook/Charles W Reeves/Coxmoor publishing company

Course outcomes:
Upon successful completion of this course the student should be able to:

1. Understand the basics of vibration (BL-2)
2. Analyze vibration measurement and analysis using transducers and mounting methods (BL-3)
3. Understand fault diagnosis andinterpret vibration measurements (BL-2)
4. Understand oil and wear debris analysis (BL-2)
5. Interpret Ultrasonic monitoring and analysis(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

III Year-II Semester	Open Elective Course	L	T	P	C
		3	0	0	3
ENTREPRENEURSHIP(R203203OE01)					

COURSE OBJECTIVE:

The students will acquire the knowledge:

1. To understand concept of entrepreneurship and its characteristics
2. To recognize entrepreneurial environment and policies
3. To understand business plan preparation
4. To interpret finance and Human Resource mobilization and operations planning
5. To understand management of small business

UNIT- I: ENTREPRENEURAL COMPETENCE

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur.

UNIT- II: ENTREPRENEURAL ENVIRONMENT AND POLICIES

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services – Central and State Government Industrial Policies and Regulations - International Business.

UNIT- III: BUSINESS PLAN PREPARATION

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

UNIT- IV: LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection -Growth Strategies - Product Launching – Incubation, Venture capital, IT startups.

UNIT- V: MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

Text Books:

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001.

References

1. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition 2005
2. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3. P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai -1997.

COURSE OUTCOME:

Up on completing this course, students are able to

1. Understand concept of entrepreneurship and its characteristics(BL-2)
2. Identifyentrepreneural environment and policies (BL-3)
3. Analyze business plan preparation (BL-4)
4. Interpret finance and Human Resource mobilization and operations planning (BL-2)
5. Develop management of small business (BL-6)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
CAD/CAM (R203203PE01)					

Course Objectives:
The Students will acquire the knowledge

1. To understand the basic fundamentals of computer aided design and manufacturing.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc
3. To understand the different geometric modeling techniques like solid modeling,surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT – I
Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.
COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II
GEOMETRIC MODELING: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.
DRAFTING AND MODELING SYSTEMS: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modelling.

UNIT – III
PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control

UNIT – IV
GROUP TECHNOLOGY: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types. FMS-Introduction, Equipment, Tool management systems, Layouts, FMS Control.

UNIT – V
COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

Text Books:

1. CAD / CAM Principles and Applications/PN Rao / McGraw-Hill
2. Automation, Production systems & Computer integrated Manufacturing/ M.P. Groover/Pearson Education

References:

1. Mastering CAD / CAM / Ibrahim Zeid / McGraw-Hill
2. Principles of Computer Aided Design and Manufacturing / FaridAmirouche / Pearson
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson learning, Inc
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang/Elsevier Publishers

Course Outcome:

At the end of the course the students shall be able to:

1. Understand the basic fundamentals of computers in industrial manufacturing and applications of computer graphics. (BL-2)
2. Interpret geometric modeling techniques and requirements. (BL-2)
3. Develop part programming for NC and CNC machines. (BL-3)
4. Illustrate the concepts of group technology and computer aided process planning for the product development.(BL-2)
5. Understand the concepts of computer aided quality control and Computer Integrated Manufacturing Systems. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
FINITE ELEMENT METHODS(R203203PE01)					

1. To learn basic principles of finite element analysis procedure

Course Objectives:

The Students will acquire the knowledge

2. To learn the theory and characteristics of finite elements that represent engineering structures of trusses and beams
3. To learn finite element modeling of two dimensional stress analysis
4. To learn the finite modelling for high order and isoparametric elements
5. To learn the usage of finite element method for the steady state heat transfer analysis

UNIT-I

Introduction to finite element method, stress and equilibrium, strain –displacement relations, stress–strain relations, plane stress and plane strain conditions, Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – II

Analysis of Trusses: Finite element modelling coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations.

Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – III

Finite element modelling of two dimensional stress analysis with constantstrain trianglesand treatment of boundary conditions, formulation of axi-symmetric problems.

UNIT-IV

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT – V

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of Eigen values and Eigen vectors, free vibration analysis.

TextBooks:

1. The Finite Element Methods in Engineering /SSRao/Pergamon.

References:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho& Shah /Pearson publishers
2. An introduction to Finite Element Method /JNReddy/McGrawHill
3. The Finite Element Method for Engineers–KennethH.Huebner, Donald L. Dewhirst, Douglas E. Smith and TedG. Byrom/John Wiley & sons (ASIA)PteLtd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education
5. Finite Element Methods / Chen
6. Finite Element Analysis: for students & Practicing Engineers / G.Lakshmi Narasaiah / BSP Books Pvt. Ltd.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts discretization procedures and convergence requirements (BL-2)
2. Identify the application and characteristics of FEA elements such as bars and beams. (BL-3)
3. Understand the finite element method for the two dimensional stress analysis.(BL-2)
4. Apply FEM for one dimensional and two dimensional higher order and isoparametric elements.(BL-3)
5. Identify how the finite element method can apply for steady state heat transfer analysis.(BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
INDUSTRIAL HYDRAULICS AND PNEUMATICS (R203203PE01)					

Course Objectives:
The students will acquire the knowledge:

1. To learn basic concepts of fluid power
2. To learn the functions and working of basic elements of Hydraulic and Pneumatic systems
3. To learn the basic components and their functions of Hydraulic and Pneumatic circuits
4. To learn the operating principles and working of hydraulic and pneumatic devices
5. To learn the procedures of installation, Maintenance and Trouble shooting of Hydraulic and pneumatic systems

Unit – I:

Fluid Power: Power transmission modes, hydraulic systems, pneumatic systems, laws governing fluid flow: Pascal's law, continuity equation, Bernoulli's theorem, Boyle's, Charles', Gay-lussec' laws, flow through pipes - types, pressure drop in pipes, Working fluids used in hydraulic and pneumatic systems- types, ISO/BIS standards and designations, properties.

Unit– II:

Hydraulic and Pneumatic Elements:

Hydraulic pipes-Types, standards, designation methods and specifications, pressure ratings, applications and selection criteria, pumping theory, Hydraulic Pumps - types, construction, working principle, applications, selection criteria and comparison, hydraulic Actuators, Control valves, Accessories - their types, construction and working, pneumatic Pipes - materials, designations, standards, properties and piping layout, air compressors, Air receivers, air dryers, Air Filters, Regulators, Lubricators (FRL unit): their types, construction, working, specifications and selection criteria of following air preparation and conditioning elements, pneumatic Actuators and Control valves - types, construction, working, materials and specifications

Unit– III:

Hydraulic and Pneumatic Circuits:

ISO symbols used in hydraulic and pneumatic circuit, basic Hydraulic Circuits – types (such as intensifier, regenerative, synchronizing, sequencing, speed control, safety), circuit diagram, components, working and applications, basic Pneumatic Circuits – types (such as speed control, two step feed control, automatic cylinder reciprocation, time delay, quick exhaust), circuit diagram, components, working and applications, pneumatic Logic circuit design - classic method, cascade method, step counter method, karnaughveitch maps and combinational circuit design.

Unit-IV

Hydraulic and Pneumatic Devices:

Hydraulic and Pneumatic devices – Concept and applications, construction, working principle, major elements, performance variables of: Automotive hydraulic brake, Industrial Fork lift, Hydraulic jack, Hydraulic press, Automotive power steering, Automotive pneumatic brake, Automotive air suspension, Pneumatic drill, Pneumatic gun.

Unit-V

Installation, Maintenance and Trouble-Shooting:

Installation of hydraulic and pneumatic system causes and remedies for common troubles arising in hydraulic elements, maintenance of hydraulic systems, causes and remedies for troubles arising in pneumatic elements, maintenance of pneumatic systems.

Textbooks:

1. Majumdar, S.R. Oil Hydraulic Systems Tata Mcgraw-Hill Publication, New Delhi,3/e, 2013
2. Majumdar, S.R. Pneumatic Systems Tata Mcgraw-Hill Publication, New Delhi,3/e, 2013

References:

1. Srinivasan, R. Hydraulic and Pneumatic Controls Vijay Nicole Imprints Private, New Delhi, Limited, 2/e, 2008
2. Jagadeesha, T. Fluid Power Generation, Transmission and Control Universities Press (India) Private Limited, New Delhi,1/e, 2014
3. Jagadeesha, T. Pneumatics Concepts, Design And Applications Universities Press (India) Private Limited, New Delhi,1/e, 2014
4. Parr, Andrew Hydraulic And Pneumatics A Technician’s and Engineer’s Guide Jaico Publishing House, New Delhi,2/e, 2013
5. Shanmuga Sundaram, K . Hydraulic And Pneumatics Controls - Understanding Made Easy S. Chand Company Ltd., New Delhi, 1/e, 2006

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Illustrate the basic concepts of fluid power (BL-2)
2. Understand the functions of elements of Hydraulic and Pneumatic systems (BL-2)
3. Analyze the functions of hydraulic and Pneumatic circuits (BL-4)
4. Illustrate the working of various hydraulic and pneumatic devices. (BL-2)
5. Interpret the procedure of installation, maintenance and trouble shooting of hydraulic and Pneumatic systems (BL-5)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

III Year-II Semester		L	T	P	C
	Professional Elective Course	3	0	0	3
NOISE & VIBRATION CONTROL(R203203PE01)					

Course Objectives:

The students will acquire the knowledge:

1. To understand the concept of two degree of freedom system with free and forced vibrations
2. To interpret the concept of multi degree of freedom system and perform free un-damped analysis
3. To understand the concept of numerical methods and continuous systems
4 To perform analysis and measurement of sound for one dimensional waves in a gas
5. To understand the noise criteria and noise controlling techniques

UNIT- I

Two degree of freedom system:

Free vibrations of spring coupled system, general solution, torsional vibrations, two degree of freedom, mass coupled system, bending vibrations in two degree of freedom system, forced vibrations of an undampedtwo degree of freedom system, dynamic vibration absorber, forced damped vibrations.

Vibration measurement devices and analysers, balancing of rigid rotors, Experimental methods in vibration analysis

UNIT- II

Multi-degree of freedom system:

Free un-damped analysis and forced vibrations of multi-degree freedom systems in longitudinal, torsional and lateral modes - Matrix methods of solution- normal modes - Orthogonality principle-Energy methods, Eigen values and Eigen vectors, Modal analysis

UNIT-III:

NUMERICAL METHODS: Dunkerley's, Rayleigh, Holzer methods. Stodola methods

CONTINUOUS SYSTEMS: Torsional vibrations - Longitudinal vibration of rods - transverse vibrations of beams – Governing equations of motion - Natural frequencies and normal modes - Energy methods, Introduction to non linear and random vibrations.

UNIT- IV

Analysis and measurement of sound:

One dimensional waves in a gas, sound perception and the decibel scale, the ear, combining sound levels in decibels, octave bands, loudness, weightings, directionality of acoustic sources and receivers, directivity index

Noise: Noise dose level, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT- V

Noise control:

Noise criteria, sound absorption and insulation, noise barriers, acoustic enclosures, silencers

Text Books

1. Mechanical Vibrations – W.T. Thomson W.T.- Prentice Hill India
2. Theory & Practice of Mechanical Vibrations – J.S. Rao, Gupta – New Age International.

Reference Books

1. Mechanical Vibrations – G.K. Grover – S. Chand & CO.
2. Acoustics for Engineers – Turner &Pretlove – Macmillan
3. Acoustics and Noise Control – Smith, Peters & Owen – Addison-Wesley-Longman, 2nd Edition
4. Industrial Noise Control: Fundamentals and Applications – Bell and Bell, Marcel-Dekker

Course Out comes:

Upon successful completion of this course student should be able to:

1. Understand the concept of two degree of freedom system with free and forced vibrations (BL-2)
2. Interpret the concept of multi degree of freedom system and perform free un-damped analysis (BL-2)
3 .Analyze the concepts of numerical methods and continuous systems (BL-4)
4. Understand the noise levels and impact on environment (BL-2)
5. Interpret the noise criteria and noise controlling techniques (BL-2)

CO-PO Mapping

S.N	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO1
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
MOOCs (NPTEL/Swayam) Course (12 Week duration)(R203203PE01)					

MOOCs course will be evaluatedas per the R20 regulations.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester		**0**	**0**	**3**	**1.5**
COMPUTER AIDED MANUFACTURING LAB (R203203PC01A)					

Course Objectives:

The Students will acquire the knowledge

1. To model of simple machine parts and assemblies from the part drawings using standard CAM packages.
2. To generate CNC Turning codes for different operations using standard CAM packages.
3. To generate CNC Milling codes for different operations using standard CAM packages.
4. To learn various fields of engineering where these tools can be effectively used to improve the output of a product.
5. To impart knowledge on how these tools are used in Industries by solving some real time problems using 3-D printing equipment.

List of Experiments:

1. Study and prepare the Manual Part program for CNC Turn machine
2. Study and prepare the Manual Part program for CNC Mill machine
3. Study of various post processors used in NC Machines.
4. Machining of simple components on NC lathe by transferring NC Code / from a CAM package through RS 232.
5. Machining of simple components on NC Mill by transferring NC Code / from a CAM package through RS 232.
6. Automated CNC Tool path, G-Code & M-Code generation using CAM.
7. Study and prepare the Computer Aided Part-program for CNC Milling machine with APT (Automatically programmed Tools) language
8. Study and prepare the Computer Aided Part-program for CNC Turning machine with APT (Automatically programmed Tools) language
9. Study on 3-D printing equipment and prepare 3D Model to print using Idea maker software on 3-D printing equipment.
10. Prepare and create a simple boxusing 3-D printing equipment.

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Understand the concepts of simple machine parts and assemblies from the part drawings using standard CAM packages. (BL-2)
2. Understand the concepts of CNC Turning codes for different operations using standard CAM packages. (BL-2)
3. Solve CNC Milling codes for different operations using standard CAM packages. (BL-3)
4. Analyze the concepts of CNC programming for various operations of milling(BL-4)

5. Interpret the study of tools that are used in Industries by solving some real time problems using 3-D printing equipment.(BL-5)

CO-PO Mapping

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

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester		**0**	**0**	**3**	**1.5**
INSTRUMENTATION & CONTROL SYSTEMSLAB(R203203PC02A)					

Course Objectives:

To study and calibrate displacement, temperature, speed, capacitance and pressure measuring instruments

List of Experiments

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

Course Outcomes:
At the end of the course the students shall be able to:

1. Understand the usage of pressure gauge, Mcleod gauge and temperature measurement transducer.(BL-2)

2. Analyze the usage of LVDT transducer and strain gauge (BL-3)

3. Illustrate concept of applications of thermo couple and capacitive transducer (BL-2)

4. Demonstrate the usage of photo and magnetic speed pickups and resistance temperature detector. (BL-2)

5. Understand the calibration of Rotameter and seismic pickup for measurement of vibrational amplitude.

(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester		**0**	**0**	**3**	**1.5**
HEAT TRANSFER LAB (R203203PC03A)					

Course objectives:

The student will acquire

The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

1. Determination of overall heat transfer co-efficient of a composite slab
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere
4. Determination of thermal conductivity of a metal rod.
5. Determination of efficiency of a pin-fin
6. Determination of heat transfer coefficient in natural and forced convection
7. Determination of effectiveness of parallel and counter flow heat exchangers.
8. Determination of emissivity of a given surface.
9. Determination of Stefan Boltzman constant.
10. Determination of heat transfer rate in drop and film wise condensation.
11. Determination of critical heat flux.
12. Determination of Thermal conductivity of liquids and gases.
13. Investigation of Lambert's cosine law.

Course Outcomes:

At the end of the course the students shall be able to:

1. Find the thermal conductivity of different materials, composite slabs and powders. (BL-1)
2. Solve heat transfer coefficient for free and forced convectionand pin fin efficiency for forced and free convection (BL-2)
3. Examine the Stefan Boltzmann Constant and emissivity of grey body.(BL-4)
4. Compare parallel and counter flow heat exchanger performance characteristics and investigation of Lambert's cosine law (BL-2)
5. Solve the heat transfer rate through lagged pipes and heat transfer rate in film and drop wise condensation (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester		**0**	**0**	**3**	**1.5**
COMPUTATIONAL FLUID DYNAMICS LAB (R203203SC01)					

Course Objectives:

The Students will acquire the knowledge

1. To solve problems of fluid mechanics and heat transfer by writing programs in C-language andMATLAB.
2. To solve ANSYS-FLUENT build a geometry, mesh that geometry, Perform CFD method on the mesh, perform the calculation, and post-process theresults.
3. To understand the validation of the numerical result by comparison with known analyticalresults.
4. To analyze the numerical result by invoking the physical principles of fluid mechanics and heat transfer.
5. To solve Elliptical, Parabolic, Partial and Hyperbolic partial differentialequations.

PART-A

Writing Programs in C and MATLAB for the following:

1. Solution of Transcendentalequations
2. Solution of Simultaneous algebraicequations
3. Numerical differentiation andIntegration
4. Solution of Ordinary DifferentialEquation
5. Solution of a Tri-diagonal matrix using ThomasAlgorithm.
6. Solution of Partial differential equations relatedto
   i) Elliptical Partial differentialequations
   ii) Parabolic Partial differentialequations
   iii) Hyperbolic Partial differentialequations
7. Solution of 1-D and 2-D heat conduction with (Finite Differencemethod)
   i) Constant temperature boundaryconditions
   ii) Constant heat flux boundaryconditions
   iii) Convective boundaryconditions
8. Solution of Incompressible Navier-Stokes equations (Finite difference and Finite Volumemethods)
9. Solution of Inviscid incompressible fluid flows.(Finite difference and Finite Volumemethods)

PART-B

Using ANSYS-FLUENT solve the following problems of heat transfer analysis

1. Steady stateconduction
2. Lumped heattransfer
3. Convective heat transfer – Internal flow (study both velocity and thermal boundarylayers)
4. Convective heat transfer – External flow (study both velocity and thermal boundarylayers)
5. Radiation heat transfer–Emissivity

Course Outcomes:

At the end of the course the students shall be able to:

1. Solve problems of fluid mechanics and heat transfer by writing programs in C-language andMATLAB. (BL-2)
2. Solve ANSYS-FLUENT build a geometry, mesh that geometry, Perform CFD method on the mesh, perform the calculation, and post-process theresults. (BL-2)
3. Understand the validation of the numerical result by comparison with known analyticalresults. (BL-2)
4. Analyze the numerical result by invoking the physical principles of fluid mechanics and heat transfer. (BL-4)
5. Solve Elliptical, Parabolic, Partial and Hyperbolic partial differentialequations. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
III Year-II Semester		**2**	**0**	**0**	**0**
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE(R2032MC01)					

Objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
- To know the student traditional knowledge in different sector.

Unit-I:
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

Unit-II:
Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Unit-III:
Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

Unit-IV:
Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit-V:
Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Course Outcomes: After completion of the course, students will be able to:

1. Understand the concept of Traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge
5. Evaluate food security and protection of TK in the country.

Reference Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

E-Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM 2.http://nptel.ac.in/courses/121106003/

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
PRODUCTION PLANNING AND CONTROL (R204103PE01)					

Course objectives:

The students will acquire the knowledge:

1. To understand the different types of production systems and the internal organization of production planning and control
2. To estimate forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques
3. To understands the importance and function of inventory and to be able to apply for its control and management
4. To apply routing procedures and differentiate schedule and loading and interpret scheduling policies and aggregate planning
5. To understand dispatching procedure and applications of computers in production planning and control

UNIT – I

Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department.

UNIT – II

Forecasting – Importance of forecasting –types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.

UNIT – III

Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.

UNIT – IV

Routing –definition – routing procedure –route sheets – bill of material – factors affecting routing procedure, schedule –definition – difference with loading. Scheduling policies – techniques, standard scheduling methods.

Line Balancing, aggregate planning, chase planning, expediting, controlling aspects.

UNIT – V

Dispatching – activities of dispatcher – dispatching procedure – follow up – definition – reason for existence of functions – types of follow up, applications of computer in production planning and control.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon/Universal BookCorp.
2. Manufacturing, Planning and Control/Partik Jonsson Stig- ArneMattsson/TataMcGrawHill

References:

1. Inventory Control Theory and Practice / Martin K. Starr and David W.Miller/Prentice-Hall
2. Production Planning andControl/Mukhopadyay/PHI.
3. Production Control A Quantitative Approach / John E.Biegel/Prentice-Hall
4. Production Control / Franklin G Moore & Ronald Jablonski/Mc-GrawHill
5. Production and Operations Management/Shailendra Kale/McGraw-Hill
6. Production and Operations Management/Ajay K Garg/McGraw-Hill

.**TEXT BOOKS:**

1. Elements of Production Planning and Control / Samuel Eilon/Universal Book Corp.
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REFERENCES:

1. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/Prentice-Hall
2. Production Planning and Control/Mukhopadyay/PHI.
3. Production Control A Quantitative Approach / John E. Biegel/Prentice-Hall
4. Production Control / Franklin G Moore & Ronald Jablonski/ Mc-GrawHill
5. Production and Operations Management/Shailendra Kale/McGraw Hill
6. Production and Operations Management/Ajay K Garg/McGraw Hill

Course Outcomes:

1. Understand the different types of production systems and the internal organization of production planning and control. (BL-2)
2. Identify forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques. (BL-3)
3. Understands the importance and function of inventory and to be able to apply for its control and management. (BL-2)
4. Apply routing procedures and differentiate schedule and loading and interpret scheduling policies and aggregate planning. (BL-4)
5. Interpret dispatching procedure and applications of computers in production planning and control. (BL-5)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
GAS DYNAMICS AND JET PROPULSION (R204103PE01)					

Course Objectives:

The students will acquire the knowledge:

1. To learn basic concepts of compressible fluid flow
2. To learn the isentropic flow of an ideal gas and effects of back pressure on nozzles
3. To learn the simple frictional flow in constant area duct of adiabatic and isothermal flows
4. To learn the conditions to form the shock waves due to the effect of heat transfer in convergent-divergent nozzle
5. To learn the basic concepts of jet propulsions systems and working of liquid propellant engines and Rockets

UNIT-I

Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity - Mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - general features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

UNIT-II

Isentropic flow of an ideal gas: basic equation - stagnation enthalpy, temperature, pressure and density stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function.

Steady one dimensional isentropic flow with area change-effect of area change on flow parameters chocking-convergent nozzle - performance of a nozzle under decreasing back pressure -De lavel nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

UNIT- III

Simple frictional flow: adiabatic flow with friction in a constant area duct-governing equations – fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions.

Steady one dimensional flow with heat transfer in constant area ducts- governing equations – Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy.

UNIT-IV

Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

UNIT-V

Propulsion: Air craft propulsion: - types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems.

Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion –rocket

engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse–rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

Text Books:

1. Compressible fluid flow /A. H. Shapiro / Ronald Press Co., 1953
2. Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers
3. Fundamental of Gas dynamics-2nd edition/ M J Zucker/ Wiley publishers

References:

1. Elements of gas dynamics / HW Liepman &A Roshko/Wiley
2. Aircraft & Missile propulsion /MJ Zucrow/Wiley
3. Gas dynamics / M.J. Zucrow & Joe D.Holfman / Krieger Publishers

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Illustrate fluid flow systems (BL-2)
2. Analyze the isotropic flow of an ideal gas and its parameter (BL-4)
3. Solve frictional flow with heat transfer problems (BL-3)
4. Analyze the impact of heat transfer on flow parameters. (BL-4)
5. Interpret the working of different propulsion systems.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
JOINING PROCESSES (R204103PE01)					

Course Objectives:
The Students will acquire the knowledge

1. To learn basic principles of metal joining process
2. To learn the theory and procedure involved in the fusion welding process
3. To learn the basic concepts of the pressure welding
4. To learnthe basic steps of soldering operational steps of brazing.
5. To learn the concepts of modern welding processes

Unit-I:
Metal Joining Processes: Joining process as a manufacturing route, relevance of joining process to metallurgy. Different types of joining process, classification of joining process, safety aspects in Metal joining processes, types of joints used in welding.

Unit – II:
Fusion Welding Process: Classification of welding process, gas welding, arc welding process (equipments, fluxes, electrodes, procedures, limitations and advantages of various arc welding process), relative advantages and limitations and applications of gas welding and arc welding, thermit welding.

Unit – III:

PressureWelding: Resistance welding, cold welding.forge welding. relative advantages, limitation and applications of pressure welding. spot welding, explosion welding, flash welding.

Unit – IV: Soldering and Brazing: Basic operational steps of Soldering, Basic operational steps of Brazing, flux and its role in joining process, different types of fluxes, metallurgical aspects of soldering and brazing, applications of soldering and brazing, soldering and Brazing Alloys, adhesive joining.

Unit – V: Modern Welding Processes: Electron beam welding. Laser beam welding.Submerged arc welding.Ultrasonic welding.Under water welding.Magnetic pulse welding.

Text Books:

1. Welding technology O.P.KhannaDhanpatRai Publications Ltd. New Delhi

2. Soldering, welding and brazing Lankester George Allen and Unwin, London.

3. Modern arc welding techniques S.V. Nadkarni Oxford IBH Publishers.

References:

1. Engineering metallurgy I and II R.A.Higgins The English University Press Ltd.

2. Welding technology R.S.Parmar Khanna Publishers, NewDelhi

3. Welding engineering Richard little Tata McGraw Hill, NewDelhi

Course Outcomes

At the end of the course the students shall be able to:
1. Understand the concepts of various types of metal joining process (BL-2)
2. Interpret the principles and procedure of fusion welding process (BL-2)
3. Understands the principles and procedure of pressure welding (BL-2)
4. Illustrate the principles and procedure of brazing and soldering(BL-2)
5. Apply the principles and procedures of different modern welding processes (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
STATISTICAL QUALITY CONTROL (R204103PE01)					

Course objectives:

The students will acquire the knowledge:
1. To understand the approaches and techniques of quality value and engineering
2. To interpret statistical process control with $\overline{X}$, R, p, c charts and other types of control charts.
3. To understand tolerance design and quality function deployment
4. To understand techniques of modern reliability engineering tools.
5. To interpret the concepts of complex system and reliability techniques

UNIT-I
Quality value and engineering – quality systems – quality engineering in product design and production process – system design – parameter design – tolerance design, quality costs – quality improvement.

UNIT-II
Statistical process control $\overline{X}$, R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. (SQC tables can be used in the examination)
Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plans

UNIT-III
Loss function, tolerance design – N type, L type, S type; determination of tolerance for these types.online quality control – variable characteristics, attribute characteristics, parameter design.
Quality function deployment – house of quality, QFD matrix, total quality management concepts.quality information systems, quality circles, introduction to ISO 9000 standards.

UNIT-IV
Reliability – Evaluation of design by tests - Hazard Models, Linear, Releigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement.

UNIT-V
Complex system, reliability, reliability of series, parallel & standby systems & complex systems & reliability prediction and system effectiveness.

Maintainability, availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

Text Books:

1. Quality Engineering in Production Systems / G Taguchi /McGraw Hill
2. Reliability Engineering/ E.Bala Guruswamy/Tata McGraw Hill,
3. Statistical Quality Control : A Modern Introduction/ Montgomery/Wiley

References:

1. Jurans Quality planning & Analysis/ Frank.M.Gryna Jr. / McGraw Hill.
2. Taguchi Techniques for Quality Engineering/ Philipposs/ McGraw Hill,
3. Reliability Engineering / LS Srinath / Affiliated East West Pvt. Ltd.,

4. Statistical Process Control/ Eugene Grant, Richard Leavenworth / McGraw Hill.
5. Optimization & Variation Reduction in Quality / W.A. Taylor / Tata McGraw Hill
6. Quality and Performance Excellence/ James R Evans/ Cengage learning

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Understand the approaches and techniques of quality value and engineering (BL-2)
2. Identify significance of statistical process control with $\overline{X}$, R, p, c charts and other types of control charts.(BL-3)
3. Understand tolerance design and quality function deployment (BL-2)
4. Illustrate techniques of modern reliability engineering tools.(BL-2)
5. Interpret the concepts of complex system and reliability techniques (BL-5)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
MOOCs (NPTEL/Swayam) Course (12 Week duration) (R204103PE01)					

MOOCs course will be evaluatedas per the R20 regulations.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
INSTRUMENTATION AND CONTROL SYSTEMS (R204103PE02)					

Course Objectives:

The Students will acquire the knowledge

1. To learn basic principles of measurement systems, errors occurred in measurement systems and measurement of displacement
2. To learn the operating principles and working of different instruments used for temperature and pressuremeasurement
3. To learn the operating principles and working of different instruments used for level, flow and speed measurement
4. To learn the operating principles and working of different instruments used for acceleration, strain and humidity measurement
5. To learn the operating principles and working of different instruments used for force, torque and power and concepts of control systems

UNIT – I

Definition–Basic principles of measurement-measurement systems, generalized configuration and functional descriptions of measuring instruments – examples.Dynamic performance characteristics–sources of error, classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.

UNIT – II

MEASUREMENT OF TEMPERATURE: Classification – ranges – various principles of measurement – expansion, electrical resistance – thermister – thermocouple – pyrometers.

MEASUREMENT OF PRESSURE: Units – classification – different principles used. Manometers, bourdon pressure gauges, bellows – diaphragm gauges. Low pressure measurement – thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

MEASUREMENT OF LEVEL: Direct method – indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubbler level indicators.

FLOW MEASUREMENT: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser Doppler anemometer (LDA).

MEASUREMENT OF SPEED: Mechanical tachometers – electrical tachometers – stroboscope, noncontact type of tachometer

UNIT – IV

Measurement of Acceleration and Vibration: Different simple instruments – principles of seismic instruments – Vibrometer and accelerometer using this principle.

STRESS STRAIN MEASUREMENTS:

Various types of stress and strain measurements – 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 HUMIDITY – Moisture content of gases, sling psychrometer, absorption psychrometer, dew point meter.

UNIT – V

MEASUREMENT OF FORCE, TORQUE AND POWER- Elastic force meters, load cells, torsion meters, dynamometers.

ELEMENTS OF CONTROL SYSTEMS : Introduction, importance – classification – open and closed systems, servomechanisms–examples with block diagrams–temperature, speed & position control systems.

Text Books:

1. Measurement Systems: Applications & design / D.S Kumar/
2. Mechanical Measurements / BeckWith, Marangoni,Linehard, Pearson

References:

1. Measurement systems: Application and design/Doeblin Earnest. O. Adaptation/ TMH
2. Experimental Methods for Engineers / J.P.Holman/McGraw Hill
3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
4.Instrumentation, measurement & analysis / B.C.Nakra&K.K.Choudhary/TMH

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Build the principles of measurement systems and construction of various transducers for displacement measurement (BL-3)
2. Classify and study the different types of temperature and pressure measuring devices (BL-2)
3. Understand the working principles of level, flow and speed measuring instruments (BL-2)
4. Utilize the principles of various types of acceleration and vibration, stress and strain and humidity measuring instruments (BL-3)
5. Illustrate the operating principles of force, torque and power measurements and different types of control systems and application of servo mechanisms (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
TRIBOLOGY (R204103PE02)					

Course Objectives:
The Students will acquire the knowledge

1. To learn basic concepts of friction and wear mechanisms, lubrication and Lubrication systems
2. To learn the selection process for rolling element bearings
3. To learn the design of the various types of hydrostatic bearings
4. To learn the design of the various types of hydrodynamic bearings
5. To learn the operating principles of various mechanical seals, failure of bearings and dry rub bearings

UNIT – I
Introduction: Nature of surfaces and contact-Surface topography-friction and wear mechanisms,wear maps, effect of lubricants- methods of fluid film formation.

Lubrication: Choice of lubricants, types of oil, Grease and solid lubricants- additives- lubricationsystems and their selection.

UNIT – II
Selection of rolling element bearings: Nominal life, static and dynamic capacity-Equivalent load,probabilities of survival- cubic mean load- bearing mounting details, pre loading of bearings,conditioning monitoring using shock pulse method.

UNIT – III
Hydrostatic Bearings: Thrust bearings – pad coefficients- restriction- optimum film thicknessjournalbearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings –design procedure.

UNIT – IV
Hydrodynamic bearings: Fundamentals of fluid formation – Reynold's equation; Hydrodynamicjournal bearings – Sommerfield number- performance parameters – optimum bearing with maximumload capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings;Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiplepad bearings-optimum condition with largest minimum film thickness.

UNIT – V
Seals: different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical pistonrod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection ofmechanical seals.
Failure of Tribological components: Failure analysis of plain bearings, rolling bearings, gears andseals, wear analysis using soap and Ferrography.
Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approachonly.

TEXT BOOKS:
1. .Rowe WW& O' Dionoghue,"Hydrostatic and Hybrid bearing design " Butterworths& Co.Publishers Ltd,1983.
2. Collacott R.A," Mechanical Fault diagnosis and condition monitoring", Chapman and Hall, London 1977.

3. Bernard J.Hamrock, " Fundamentals of fluid film lubricant", McGraw-Hill Co.,1994.

REFERENCES:

1.Neale MJ, (Editor) " Tribology hand Book"NeumannButterworths, 1975.
2.Connor and Boyd JJO (Editors) " Standard hand book of lubrication engineers " ASLE,Mc Graw Hill Book & Co.,1968
3. Shigley J, E Charles," Mechanical Engineering Design", McGraw Hill Co., 198

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Build the basic concepts of friction and wear mechanisms, lubrication and Lubrication systems (BL-3)
2. Illustrate the selection process for rolling element bearings (BL-2)
3. Understandthe design of the various types of hydrostatic bearings (BL-2)
4. Analyze the design of the various types of hydrodynamic bearings (BL-3)
5. Illustrate the operating principles of various mechanical seals, failure of bearings and dry rub bearings (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
ADVANCED MATERIALS (R204103PE02)					

Course Objectives

The students will acquire the knowledge:

1. To classify the composite materials and identify the applications
2. To understand manufacturing methods of PMC, MMC & CCC and their applications
3. To understand macro-mechanical analysis of a lamina
4. To interpret the functionally graded materials and their properties
5. To understand types of nano materials and their properties

UNIT-I

INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber-reinforced composites and nature-made composites, and applications

REINFORCEMENTS: Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and borncarbide fibres.

UNIT-II

AEROSPACE MATERIALS: Metallic materials- super alloys, Aluminium, Magnesium, titanium and Nickel based alloys and intermetallics, High temperature polymers, Materials for cryogenic application, Materials for space environment, Evaluation of materials for extreme environment, Materials processing and manufacturing in zero gravity.

UNIT-III

MACROMECHANICAL ANALYSIS OF A LAMINA: Introduction, generalized Hooke's law, reduction of Hooke's law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

UNIT-IV

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification different systems-preparation-properties and applications of functionally graded materials.

SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloys-composition-properties and applications of shape memory alloys.

UNIT-V

NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages applications in comparison with bulk materials (nano – structure, wires, tubes, composites). state of art nano advanced- topic delivered by student.

Text Books:

1. Nano material /A.K. Bandyopadyay/New age Publishers
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH
3. Engineering Mechanics of Composite Materials / Isaac and M Daniel/Oxford University Press

References:

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY 1969
3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-

Interscience, New York, 1980
4. Mechanics of Composite Materials - Second Edition (Mechanical Engineering) /Autar K.Kaw /CRC Press

Course Outcomes

After learning the course the students should be able to

1. Classify the composite materials and identify the applications (BL-2)
2. Identify the aerospace materials and their applications (BL-3)
3. Understand macro-mechanical analysis of a lamina (BL-2)
4. Interpret the functionally graded materials and their properties (BL-2)
5. Understand types of nano materials and their properties (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
COMPUTATIONAL FLUID DYNAMICS (R204103PE02)					

Course Objectives:

The students will acquire the knowledge:
1. To explain elementary details and numerical techniques for solving various engineering problems involving fluid flow.
2. To solve problems of fluid flow using applied numerical methods and understand equations governing fluid flow and heat transfer
3. To interpret fluid flow problems with steady flow and finite difference in heat conduction and convention
4. To understand the concepts of finite differences, discretization, consistency, stability and fundamentals of fluid flow modelling
5. To understand the concepts of first order wave equation and finite volume method.

UNIT-I

ELEMENTARY DETAILS AND NUMERICAL TECHNIQUES Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT – II
APPLIED NUMERICAL METHODS: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, directmethods for banded matrices.
REVIEWOFEQUATIONSGOVERNINGFLUIDFLOWANDHEATTRANSFER: Introduction, conservation of mass, Newton's second law of motion, expanded form sofnavier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

UNIT –III
Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields,stream function -vorticity formulation.
Finite difference applications in heat conduction and convention –heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT – IV
Finite differences, discretization, consistency, stability and fundamentals of fluid flow modelling: introduction, elementary finite difference quotients, implementation aspectsoffinite-differenceequations, consistency, explicit and implicit methods.

UNIT –V
Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme.

FINITE VOLUMEMETHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TextBooks:

1. Numericalheat transferandfluidflow/SuhasV.Patankar/Butter-worthPublishers
2. Computationalfluiddynamics-Basics with applications/John.D.Anderson/McGrawHill.

References:

1.ComputationalFluidFlowand Heat Transfer/ Niyogi/Pearson Publications
2.FundamentalsofComputationalFluidDynamics /TapanK.Sengupta/Universities Press.
3.Computationalfluiddynamics: An introduction, 3rd edition/John.F Wendt/Springer publishers

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Find elementary details and numerical techniques for solving various engineering problems involving fluid flow. (BL-1)
2. Solve problems of fluid flow using applied numerical methods and understand equations governing fluid flow and heat transfer (BL-3)
3. Interpret fluid flow problems with steady flow and finite difference in heat conduction and convention (BL-2)
4. Understand the concepts of finite differences, discretization, consistency, stability and fundamentals of fluid flow modelling (BL-2)
5. Understand the concepts of first order wave equation and finite volume method. (BL-2)

CO-PO Mapping

S.N	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO1
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
MOOCs (NPTEL/Swayam) Course (12 Week duration) (R204103PE02)					

MOOCs course will be evaluatedas per the R20 regulations.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
AUTOMATION IN MANUFACTURING (R204103PE03)					

Course Objectives:

The students will acquire the knowledge:

1.To understands the types and strategies and various components in Automated Systems
2.To classify the types of automated flow lines and analyze automated flow lines
3.To solve the line balancing problems in the various flow line systems with and without buffer storage
4. To interpret different automated material handling systems, storage and retrieval systems and automated inspection systems
5.To understand the principles of Adaptive Control systems and recognize the types of automated inspection techniques and their applications

UNIT-I

INTRODUCTION: Types and strategies of automation, pneumatic andhydraulic components, circuits, automation in machine tools, mechanicalfeeding and tool changing and machine tool control.

UNIT – II

AUTOMATED FLOW LINES: Methods of part transport, transfermechanism, buffer storage, control function, design and fabricationconsiderations.Analysis of automated flow lines - General terminology and analysis oftransfer lines without and with buffer storage, partial automation,implementation of automated flow lines.

UNIT – III

ASSEMBLY SYSTEM AND LINE BALANCING: Assembly process andsystems, assembly line, line balancing methods, ways of improving linebalance, flexible assembly lines.

UNIT – IV

AUTOMATED MATERIAL HANDLING and STORAGE SYSTEMS:

Types of equipment, functions, analysis and design of material handlingsystems, conveyor systems, automated guided vehicle systems. Automatedstorage and retrieval systems; work in process storage, interfacing handlingand storage with manufacturing.

UNIT – V

ADAPTIVE CONTROL SYSTEMS: Introduction, adaptive control withoptimization, adaptive control with constraints, application of adaptivecontrol in machining operations. Consideration of various parameters such ascutting force, temperatures, vibration and acoustic emission in the adaptivecontrols systems.

AUTOMATED INSPECTION: Fundamentals, types of inspectionmethods and equipment, Coordinate

Measuring Machines, Machine Vision

TEXT BOOK:

1. Automation, Production Systems and Computer IntegratedManufacturing : M.P. Groover./ PE/PHI.

REFERENCES:

1. Computer Control of Manufacturing Systems by YoramCoren.
2. CAD / CAM/ CIM by Radhakrishnan.
3. Automation by W. Buekinsham.

Course outcomes:

Upon successful completion of this course student should be able to :
1. Understands the types and strategies and various components in Automated Systems.(BL-2)
2. Classify the types of automated flow lines and analyze automated flow lines (BL-2)
3. Solves the line balancing problems in the various flow line systems with and withoutbuffer storage (BL-3)
4. Interpret different automated material handling systems, storage and retrieval systems and automated inspection systems (BL-2)
5. Understand the principles of Adaptive Control systems and recognize the types of automated inspection techniques and their applications (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
NANO MATERIALS (R204103PE03)					

Course Objectives:

The students will acquire the knowledge:

1. To understand historical development and classification of nano materials
2. To interpret structure and bonding in nano materials
3. To analyze the size dependence of properties
3. To understand nano material Synthesis techniques
5. To interpret nano material characterization techniques

Unit-I.

Introduction: Definitions, historical development of nano materials, classification of nano materials, Size & Scale Units Scaling Atoms, Molecules, Clusters and Supramolecules

Unit-II

Structure and Bonding in Nano materials

Chemical Bonds (types and strength), intermolecular forces, molecular and crystalline structures, hierarchical structures, bulk to surface transition, surface reconstruction

Unit-III

Properties and Size dependence of properties: Chemical Optical, vibrational, thermal, Electrical, Magnetic, Mechanical, Theoretical Aspects-e.g. density functional theory

Unit-IV

Nano material Synthesis: Chemical routes, Electrochemical methods, Vapour growth, Thin films methods: chemical vapour deposition, physical vapor deposition (sputtering, laser ablation), Langmuir-Blodgett growth Mechanical methods: ball milling, mechanical attrition Sol-gel methods , Special nanomaterials: carbon nanotubes, fullerenes, nanowires, porous silicon, Bio-inspired synthesis, Nanocomposite fabrication, Nanolithography

Unit-V

Nano material characterization techniques: Scanning and Transmission Electron Microscopy, Scanning Probe Microscopies: Atomic Force, scanning tunneling microscopy, Diffraction and scattering techniques, Vibrational spectroscopy, Surface techniques

Applications: Nano-electronics, Nano optics, Nanoscale chemical- and bio-sensing, Biological/bio-medical applications, Photovoltaic, fuel cells, batteries and energy-related applications, High strength nanocomposites, Nanoenergetic materials

Textbook

1.The Physics and Chemistry of NanoSolids by Frank J. Owens and Charles P. Poole Jr, Wiley-Interscience, 2008.

Reference Books

1.Nanomaterials- Synthesis, Properties and Applications, Edited by A.S. Edelstein and R.C. Cammarata, Institute of Physics Publishing, London, 1998 (paper back edition)
2.Nanochemistry: A Chemical Approach to Nanomaterials, by G. Ozin and A. Arsenault, RSC Publishing, 2005
3.Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, Edward L. Wolf, Wiley-VCH, 2nd Reprint (2005)

Course Outcomes:

Upon successful completion of this course the student should be able to:
1. Understand historical development and classification of nanomaterials (BL-2)

2. Interpret structure and Bonding in nanomaterials (BL-2)

3. Analyze the size dependence of properties (BL-4)

4. Understand nanomaterial Synthesis techniques (BL-2)

5. Interpret nanomaterial characterization techniques (BL-5)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
AUTOMOBILE ENGINEERING (R204103PE03)					

Course Objectives:

The Students will acquire the knowledge

1. To learn basic components and functions of automobile
2. To learn the various elements and working of transmission system of automobile
3. To learn the working of steering system, suspension system and braking system of automobile
4. To learn the concepts involved in the electrical system of automobile, engine specifications and safety systems
5. To learn the concepts involved in the emission control and engine service of different parts

UNIT – I

INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

UNIT – II

TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT – III

STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle toein, centre point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

UNIT – IV: BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

ELECTRICAL SYSTEM: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – V

ENGINE SPECIFICATION AND SAFETY SYSTEMS: Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc.

SAFETY: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control

ENGINE EMISSION CONTROL: Introduction – types of pollutants, mechanism of formation, concentration measurement, methods of controlling-engine modification, exhaust gas treatment-thermal and catalytic converters-use of alternative fuels for emission control – National and International pollution standards

ENGINE SERVICE: Introduction, service details of engine cylinder head, valves and valve mechanism, piston-connecting rod assembly, cylinder block, crank shaft and main bearings, engine reassembly-precautions.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2.Automobile Engineering / William Crouse/TMH Distributors
3.Automobile Engineering/P.S Gill/S.K. Kataria& Sons/New Delhi.

References:

1.Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr.,/ Pearson education inc.
2. Automotive Engineering / K Newton, W.Steeds& TK Garrett/SAE
3. Automotive Mechanics : Principles and Practices/ Joseph Heitner/Van Nostrand Reinhold 4. Automobile Engineering / C Srinivasan/McGrawHill

Course Outcomes:

At the end of the course the students shall be able to:

1. Acquire the basic knowledge of anatomy of an automobile and its components. (BL-2)
2. Analyze the systems of automobile transmission systems. (BL-3)
3. Realize the functions of various steering systems, suspension and braking systems (BL-2)
4. Illustrate the functions of electrical systems and understands the concepts of engine specifications and safety systems. (BL-2)
5. Analyze the systems of engine servicing and emission control systems. (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
HEAT TRANSFER EQUIPMENT & DESIGN (R204103PE03)					

Course Objectives:
The students will acquire the knowledge:

1. To learn different types of heat exchangers
2. To learn the calculation of design parameters for the different flows in the heat exchanger
3. To learn the basic components and design procedure for shell and tube heat exchanger
4. To learn the design calculations of condensers, Vaporizers, Evaporators and reboilers
5. To learn the basic design calculations of cooling towers

UNIT - I:
Classification of heat exchangers: Introduction, Recuperation & Regeneration – Tubular heat exchangers: double pipe, shell & tube heat exchanger, Plate heat exchangers, Gasketed plate heat exchanger, spiral plate heat exchanger, Lamella heat exchanger, extended surface heat exchanger, Plate fin, and Tubular fin.

UNIT - II:
Basic Design Methods of Heat Exchanger: Introduction, Basic equations in design, Overall heat transfer coefficient – LMTD method for heat exchanger analysis – parallel flow, counter flow, multipass, cross flow heat exchanger design calculations.
Double Pipe Heat Exchanger: Film Coefficient for fluids in annulus, fouling factors, calorific temperature, average fluid temperature, the calculation of double pipe exchanger, Double pipe exchangers in series-parallel arrangements.

UNIT - III:
Shell & Tube Heat Exchangers: Tube layouts for exchangers, baffle Heat exchangers, calculation of shell and tube heat exchangers – shell side film coefficients, Shell side equivalent diameter, the true temperature difference in a 1-2 heat exchanger, influence of approach temperature on correction factor, shell side pressure drop, tube side pressure drop, Analysis of performance of 1-2 heat exchanger, and design calculation of shell & tube heat exchangers. Flow arrangements for increased heat recovery, the calculations of 2-4 exchangers.
UNIT - IV:
Condensation of single vapours: Calculation of a horizontal condenser, vertical condenser, De-super heater condenser, vertical condenser – sub-cooler, horizontal condenser – sub cooler, vertical reflux type condenser, condensation of steam.
Vaporizers, Evaporators and Reboilers: Vaporizing processes, forced circulation vaporizing exchangers, natural circulation vaporizing exchangers, calculations of a reboiler.
UNIT - V:
Direct Contact Heat Exchanger: Cooling towers, relation between wet bulb & dew point temperatures, the Lewis number, and classification of cooling towers, cooling tower internals and the roll of fill, Heat balance, heat transfer by simultaneous diffusion and convection. Analysis of cooling tower requirements, Design of cooling towers, Determination of the number of diffusion units, calculation of cooling tower performance.

Text Books

1. Process Heat Transfer – D.Q. Kern, TMH.
2. Heat Exchanger Design – A.P.Fraas and M.N. Ozisick. John Wiely & sons, New York.
3. Cooling Towers by J.D. Gurney

Reference Book:

1. Thermal system design and optimization by C.Balaji, 2nd edition, Springer publishers

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Illustrate the different types of heat exchangers (BL-2)
2. Understand the design principles for different flows in the heat exchanger(BL-2)
3. Analyze the design parameters of shell and tube heat exchanger (BL-4)
4. Interpret the design procedures of different condensers, Vaporizers, Evaporators and Reboilers.(BL-2)
5. Understands the design parameters of the cooling towers.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Professional Elective Course**	**3**	**0**	**0**	**3**
MOOCs (NPTEL/Swayam) Course (12 Week duration) (R204103PE03)					

MOOCs course will be evaluatedas per the R20 regulations.

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
REFRIGERATION AND AIR CONDITIONING (R204103OE01)					

(Refrigeration and Psychrometric tables and charts allowed)

Course Objectives:

The students will acquire the knowledge:

1. To illustrate the operating cycles and different systems of refrigeration
2. To analyze cooling capacity and coefficient of performance of vapour compression refrigeration systems and understand the properties of refrigerants
3. To identify VCR system components and calculate coefficient of performance by conducting test on vapour absorption and steam jet refrigeration systems
4. To calculate cooling load for air conditioning systems and identify the requirements of comfort air conditioning
5. To describe different component of refrigeration and air conditioning systems

UNIT – I

INTRODUCTION TO REFRIGERATION: Necessity and applications – unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration. air refrigeration: Bell Coleman cycle - open and dense air systems – refrigeration systems used in air crafts and problems.

UNIT – II

VAPOUR COMPRESSION REFRIGERATION: Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems.

VCR SYSTEM COMPONENTS: Compressors – general classification – comparison – advantages and disadvantages. condensers – classification – working principles evaporators – classification – working principles expansion devices – types – working principles

REFRIGERANTS – Desirable properties – classification - refrigerants used – nomenclature – ozone depletion – global warming

UNIT III

VAPOR ABSORPTION SYSTEM: Calculation of maximum COP – description and working of NH_3 – water system and Li Br –water (Two shell & Four shell) System, principle of operation three fluid absorption system, salient features.

STEAM JET REFRIGERATION SYSTEM: Working Principle and basic components.principle and operation of thermoelectric refrigerator and vortex tube.

UNIT IV

INTRODUCTION TO AIR CONDITIONING: Psychometric properties & processes – characterization of sensible and latent heat loads — need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF- problems, concept of ESHF and ADP temperature.

Requirements of human comfort and concept of effective temperature- comfort chart –comfort air conditioning – requirements of industrial air conditioning, air conditioning load calculations.

UNIT – V

AIR CONDITIONING SYSTEMS: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. heat pump – heat sources – different heat pump circuits

Text Books:

1. A Course in Refrigeration and Air conditioning / SC Arora &Domkundwar / Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.

References:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration /Dossat / Pearson Education.
3. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Illustrate the operating cycles and different systems of refrigeration (BL-2)
2. Analyze cooling capacity and coefficient of performance of vapour compression refrigeration systems and understand the properties of refrigerants (BL-3)
3. Identify VCR system components and calculate coefficient of performance by conducting test on vapour absorption and steam jet refrigeration systems (BL-3)
4. Solve cooling load for air conditioning systems and identify the requirements of comfort air conditioning. (BL-2)
5. Demonstrate different component of refrigeration and air conditioning systems.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
NANO TECHNOLOGY (R204103OE01)					

Course Objectives:
The students will acquire the knowledge:
1. To understand the classification of nano structured Materials (BL-2)
2. To understand the unique properties of nano materials (BL-2)
3. To interpret the Synthesis Routes - Bottom up and Top down approaches (BL-3)
4. To identify the tools to characterize nano materials(BL-2)
5. To understand the applications of nano materials (BL-2)

Unit I

Introduction: History and Scope, Classification of Nano structured Materials, Fascinating Nanostructures, applications of nanomaterials, challenges and future prospects.

Unit II

Unique Properties of Nano materials: Microstructure and Defects in Nano crystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations. Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility. Magnetic Properties: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit III

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation,Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self assembly. Top down approaches: Mechanical alloying, Nano-lithography.Consolidation of Nano powders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressingSpark plasma sintering.

Unit IV

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP),Nano indentation

Unit V

Applications of Nano materials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS),Nano sensors, Nano catalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defense and Space Applications, Concerns and challenges of Nanotechnology

TEXT BOOKS:

1. Introduction to Nano Technology by Charles. P. Poole Jr& Frank J. Owens.Wiley India Pvt. Ltd.
2. Nano Materials- A.K.Bandyopadhyay/ New Age Publishers.
3. Nano Essentials- T.Pradeep/TMH

REFERENCE BOOKS:

1. Solid State physics by Pillai, Wiley Eastern Ltd.
2. Introduction to solid state physics 7th edition by Kittel. John Wiley & sons (Asia) Pvt Ltd.

Course Outcomes:

After completing this course students will be able to:

1. Understand the classification of nanostructuredMaterials (BL-2)
2. Understand the unique properties of nano materials (BL-2)
3. Interpret the Synthesis Routes - Bottom up and Top down approaches (BL-3)
4. Identify the tools to characterize nano materials(BL-2)
5. Understand the applications of nano materials (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
OPERATIONS MANAGEMENT (R204103OE01)					

Course Objectives:
The students will acquire the knowledge:
1. To identify types of forecasting techniques and their principles
2. To analyze plant and process layout
3. To understand about material management and MRP logic
4. To apply the concepts of aggregate planning and scheduling
5. To understand the concepts of inventory control, MRP-II, JIT, ERP and supply chain Management

UNIT-I
Forecasting: Introduction, types of forecasting and their uses, General principles of forecasting, forecasting techniques: qualitative and quantitative methods of Forecasting.
Production Systems: Types of production systems: job, batch, mass and flow type production.
UNIT-II
Plant Location: Factors affecting the plant location, comparison of rural and urban sites.
Plant Layout: Introduction, principles of plant layout, types of plant layouts
UNIT-III
Materials Management: Introduction, functions of materials management, inventory, inventory management, types of inventories, Selective inventory control techniques: ABC analysis, VED analysis. Material Requirement Planning: Introduction, Inputs, outputs and MRP logic
UNIT-IV
Aggregate Planning: Introduction, aggregate planning strategies, aggregate planning methods mathematical planning models, heuristic and computer search models, problems. Scheduling: Introduction, difference with loading, scheduling policies, techniques, standard scheduling methods.
UNIT-V
Inventory Control: Deterministic models, safety stock inventory control systems Contemporary management techniques: Introduction to MRP-II, JIT, ERP and Supply chain management

TEXT BOOKS:
1. Operations Management /Joseph. G.Monks, International (3rd) Edition
2. Elements of Production Planning and Control / Samuel Eilon.
3. Modern Production/ operation managements / Baffa& Rakesh Sarin
REFERENCES:
1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
3. Production And Operation Management / MartandTelsang
4. Production Control A Quantitative Approach / John E. Biegel.
5. Production Control / Moore.
Course Out comes:

Upon successful completion of this course student should be able to:

1. Identify types of forecasting techniques and their principles (BL-2)
2. Analyze plant and process layout (BL-4)
3. Understand about material management and MRP logic (BL-2)
4. Applythe concepts of aggregate planning and scheduling (BL-3)

5. Understand the concepts of inventory control, MRP-II, JIT, ERP and supply chain management (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
PRODUCT DESIGN AND DEVELOPMENT (R204103OE01)					

COURSE OBJECTIVES:
The students will acquire the knowledge:
1. Apply the principles of generic development process; conduct customer need analysis; and set product specification for new product design and development.
2. Generate, select, screen, and test concepts for new product design and development.
3. Apply the principles of product architecture and industrial design to design and develop new products.
4. Apply the principles of DFMA and Prototyping to design and develop new product.
5. Apply the concepts of economics principles sustainable product development and life cycle assessment.

UNIT I
INTRODUCTION – A Generic Development Process – Adapting the Generic Product Development Process - Product Development Process Flows- Digital tools for product design– Identifying Customer Needs - Product Specifications: Establishing Target Specifications; Setting the Final Specifications.

UNIT II
CONCEPT GENERATION
Concept Generation: The Activity of Concept Generation - Concept Selection: ConceptScreening; Concept Scoring – Concept Testing – Concept innovation using TRI

UNIT III
PRODUCT ARCHITECTURE
Implications of the Architecture; Establishing the Architecture; Delayed Differentiation;
Platform Planning; Related System-Level Design Issues – Industrial Design: Assessing the Need for Industrial Design; Impact of Industrial Design; The Industrial Design Process; Management of the Industrial Design Process; Assessing the Quality of Industrial Design.

UNIT IV
DFM AND PROTOTYPING
Design for Manufacturing: Estimate the Manufacturing Costs; Reduce the Costs of Components; Reduce the Costs of Assembly; Reduce the Costs of Supporting Production; Consider the Impact of DFMA– Prototyping: Type; Uses; Principles; Technologies; Planning for Prototypes.

UNIT V
PRODUCT DEVELOPMENT ECONOMICS
Elements of Economic Analysis; Economic Analysis Process – sustainable productdevelopment: framework and metrics – life cycle assessment of a product: stages and impact.

TEXT BOOK:
1. Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press, 2018.
2. Karl, T. Ulrich and Steven, D. Eppinger, “Product Design and Development”, McGraw Hill, 2003.
REFERENCES:
1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013.
3. Pugh S., “Total Design – Integrated Methods for successful Product Engineering”, Addison Wesley Publishing, 1991.

4. Rosenthal S., "Effective Product Design and Development", Business One, 1992.
5. Silva, A., Handbook of Research on Trends in Product Design and Development: Technological and Organizational Perspectives: Technological and Organizational Perspectives,IGI Global, 2010.
6. Devdas Shetty, "Product design for Engineers", Cengage Learning

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the principles of generic development process; conduct customer need analysis; and set product specification for new product design and development. (BL-3)
2. Select, screen, and test concepts for new product design and development. (BL-3)
3. Apply the principles of product architecture and industrial design to design and develop new products. (BL-3)
4. Apply the principles of DFMA and Prototyping to design and develop new product. (BL-3)
5. Apply the concepts of economics principles sustainable product development and life cycle assessment. (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
POWER PLANT ENGINEERING (R204103OE02)					

Course Objectives:
The students will acquire the knowledge:

1. To learn the working of different circuits of the steam power plant.
2. To learn the layout and auxiliaries of the diesel and gas power plants.
3. To learn the different elements in the hydro electric and nuclear power plants.
4. To learn the basic concepts for power production in combined plants and usage of different instrument to measure the operating parameters of the power plant.
5. To learn the concepts of power plant economics and pollution standards to be observed in the power plants.

UNIT – I
Introduction to the sources of energy – resources and development of power in india.
STEAM POWER PLANT: Plant layout, working of different circuits, fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems. Combustion: properties of coal – overfeed and underfeed fuel beds, traveling 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. corrosion and feed water treatment.

UNIT – II
INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:
DIESEL POWER PLANT: Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.
GAS TURBINE PLANT: Introduction – classification - construction – layout with auxiliaries, combined cycle power plants and comparison.

UNIT – III
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.
NUCLEAR POWER STATION: Nuclear fuel – 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.

UNIT – IV
COMBINED OPERATIONS OF DIFFERENT POWER PLANTS: Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant, run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro-electric and gas turbine stations, co-ordination of hydro-electric and nuclear power stations, co-ordination of different types of power plants.

POWER PLANT INSTRUMENTATION AND CONTROL: Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis, O2 and CO2 measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

UNIT – V

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 – related exercises. effluents from power plants and Impact on environment – pollutants and pollution standards – methods of pollution control.

Text Books:

1. A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai & Co.
2. Power Plant Engineering /P.C.Sharma / S.K.Kataria Pub

References:

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power station Engineering – ElWakil / McGrawHill.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Identify the different circuits of the steam power plant for power production (BL-3)
2. Illustrate the layouts and different auxiliaries used in the diesel and gas power plant for power production(BL-2)
3. Understand how the power can be produced by hydro-electric and nuclear power plants(BL-2)
4. Interpret the power production by combined power plants and operating principles ofdifferent instruments used in power plants. (BL-5)
5. Analyze power plant economics and implementation of pollution standards and control of pollution caused by the power plants. (BL-4)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
RENEWABLE ENERGY SOURCES (R204103OE02)					

Course Objectives:
The students will acquire the knowledge:

1. To demonstrate the importance and solar radiation, solar energy collection and storage
2. To understand the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy
3. To interpret energy efficient electrical and mechanical systems
4. To develop energy efficient processes
5. To understand features and benefits of green buildings

UNIT-I
SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells.
SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.
SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – II
WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.
BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.
GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy.
OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.

UNIT –III
ENERGY EFFICIENT SYSTEMS:
(A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.
(**B) MECHANICAL SYSTEMS**: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps**.**

UNIT-IV
ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

UNIT – V

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013

References:

1. Alternative Building Materials and Technologies - K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international
2. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth & John F Kreider / Taylor &Francis
3. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
4. Renewable Energy Technologies -Ramesh & Kumar /Narosa
5. Non conventional Energy Source- G.D Roy/Standard Publishers
6. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
7. Fuel Cell Technology -Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd

Course Outcomes:

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

1. Illustrate the importance and solar radiation, solar energy collection and storage. (BL-2)
2. Understand the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy. (BL-2)
3. Analyze energy efficient electrical and mechanical systems. (BL-4)
4. Develop energy efficient processes. (BL-3)
5. Understand features and benefits of green buildings. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
OPTIMIZATION TECHNIQUES (R204103OE02)					

Course Objectives:
The students will acquire the knowledge:

1. To understand classification of optimization problem and apply classical optimization techniques
2. To apply unconstrained optimization techniques using various methods
3. To understand the characteristics and approaches of constrained optimization techniques
4. To obtain optimized solutions using constrained and unconstrained geometric programming
5. To understand integer programming methods

UNIT I
INTRODUCTION TO OPTIMIZATION: Engineering applications of optimization- statement of an optimization problem- classification of optimization problem- optimization techniques.
CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization- multivariable optimization with equality constraints- multivariable optimization with inequality constraints.

UNIT-II
UNCONSTRAINED OPTIMIZATION TECHNIQUES: Pattern search method- Rosenbrock's method of rotating coordinates- Simplex method- Descent methods- Gradient of function- Steepest Descent method.

UNIT-III
CONSTRAINED OPTIMIZATION TECHNIQUES: Characteristics of constrained problem methods of feasible directions - basic approach in the penalty function method- interior penalty function method- convex programming problem- exterior penalty function method.

UNIT-IV
GEOMETRIC PROGRAMMING (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. primal dual relationship and sufficiency conditions.
Solution of a constrained geometric programming problem (G.P.P). Complimentary geometric programming (C.G.P)

UNIT-V
INTEGER PROGRAMMING (I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem.Integer non linear programming.

TEXT BOOK:
1. Optimization Theory and Applications/ S.S.Rao/Wiley Eastern Limited, New Delhi.
REFERENCES:
1. Engineering Optimization / Kalyanmanai Deb/Prentice Hall of India, New Delhi.
2. Optimization Techniques-Theory and applications/C.Mohan&Kusum Deep/New Age International
3. Operations Research /S.D.Sharma / MacMillan Publishers

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Understand classification of optimization problem and apply classical optimization techniques (BL-2)
2. Apply unconstrained optimization techniques using various methods (BL-3)
3. Understand the characteristics and approaches of constrained optimization techniques (BL-2)
4. Identify optimized solutions using constrained and unconstrained geometric programming (BL-3)
5. Understand integer programming methods (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester	**Open Elective Course**	**3**	**0**	**0**	**3**
ADVANCED MECHANICS OF SOLIDS (R204103OE02)					

Course Objectives:

The students will acquire the knowledge:

1. To understand theories of stress and strain and Stress –strain temperature relations
2. To determine failure criteria and elastic deflections for statically indeterminate members and structures
3. To study the effect of unsymmetrical bending and curved beam theory
4. To determine the effect of Torsion with Linear elastic solution and Prandtl elastic membrane (Soap-Film) Analogy

5. To solve the problems for determining contact stresses and deflections of bodies with point contact.

UNIT I

A brief review onfailure criteria andmodes of failure, Excessive deflections, Yield initiation, fracture, Progressive fracture, High Cycle fatigue for number of cycles N > 10^6, buckling.Concept of Creep. Application of energy methods: Elastic deflections and statically indeterminate members and structures: Principle of stationary potential energy, Castiglione's theorem on deflections, Castiglione's theorem on deflections for linear load deflection relations, deflections of statically determinate structures.

UNIT II

Unsymmetrical bending: Bending stresses in Beams subjected to Non-symmetrical bending; Deflection of straight beams due to non-symmetrical bending.

UNIT III

Curved beam theory: Winkler Bach formula for circumferential stress – Limitations – Correction factors – Radial stress in curved beams – closed ring subjected to concentrated and uniform loads-stresses in chain links.

UNIT IV

Torsion : Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section ;Hollow thin wall torsion members ,Multiply connected Cross Section.

UNIT V

Contact stresses: Introduction; problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

Text Books:

1.Advanced Mechanics of materials by Boresi& Sidebottom-Wiely International.

2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw-Hill Publishers 3rd Edition

3. Advanced Mechanics of Solids, L.S Srinath

Reference Books:

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates – Timoshenko.
3. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia
4. Strength of materials by Sadhu Singh

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Interpret failure criteria and elastic deflections for statically indeterminate members and structures. (BL-2)
2. Summarize the effect of unsymmetrical bending (BL-2)
3. Understand the effect of curved beam theory (BL-2)
4. Find the effect of Torsion with Linear elastic solution and Prandtl elastic membrane (Soap-Film) Analogy. (BL-1)
5. Solve the problems for determining contact stresses and deflections of bodies with point contact(BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

IV Year-I Semester		L	T	P	C
		3	0	0	3
	UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY(R204103HS01)				

Course Objectives:

The students will acquire the knowledge:

1. To Development of a holistic perspective based on self exploration about themselves (humanbeing), family, society and nature/existence.
2. To Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Understanding the harmony in the society (society being an extension of family):Resolution,Prosperity,fearlessness(trust)andco-existenceas comprehensiveHumanGoals
4. To Strengthening of self-reflection.
5. To Development of commitment and courage to act.

Unit-I:Need,Basic Guidelines,Contentand Process for Value Education

Purposeandmotivationforthecourse,recapitulationfromUniversalHumanValues-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.

Unit-II:Understanding Harmony in the Human Being-Harmony in Myself!

Understanding human beingas aco-existence of the sentient 'I' and the material 'Body' – Understanding the needs of Self('I') and 'Body' –happiness and physical facility – Understanding the Body asaninstrument 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 and Health.

Unit-III:UnderstandingHarmonyintheFamilyandSociety-HarmonyinHuman-HumanRelationship

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 the harmony in the 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.

Unit-IV:UnderstandingHarmonyin theNatureandExistence-WholeexistenceasCoexistence

Understanding the harmony in the Nature – Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulationin nature – Understanding Existence as Co-existence of mutually interacting units in all-pervasive space – Holistic perception of harmony at all levels of existence.

Unit-V:ImplicationsoftheaboveHolisticUnderstandingofHarmonyonProfessionalEthics

Natural acceptance of human values – Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: a. Ability to utilize the 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 production systems. – Case studies of typical holistic technologies, management models and production systems - 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 and organizations.

Course Outcomes:

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

TEXT BOOKS:

1. RRGaur,RAsthana,GPBagaria,"AFoundationCourseinHumanValuesandProfessional 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 inHuman Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi,2019.ISBN978-93-87034-53-2

REFERENCES:

1. JeevanVidya:EkParichaya,ANagaraj,JeevanVidyaPrakashan,Amarkantak,1999.
2. A.N.Tripathi,"HumanValues",NewAgeIntl.Publishers,NewDelhi,2004.
3. TheStoryofStuff(Book).
4. MohandasKaramchandGandhi"The StoryofMyExperimentswithTruth"
5. E.FSchumacher."SmallisBeautiful"
6. SlowisBeautiful–CecileAndrews
7. JCKumarappa"Economyof Permanence"
8. PanditSunderlal"BharatMeinAngrejiRaj"
9. Dharampal,"RediscoveringIndia"
10. MohandasK.Gandhi,"HindSwarajorIndianHomeRule"
11. IndiaWins Freedom- MaulanaAbdulKalamAzad
12. Vivekananda-RomainRolland(English)
13. Gandhi- RomainRolland(English)

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-I Semester		**0**	**0**	**3**	**3**
SIMULATION LAB-II (R204103SC01)					

Course Objectives:

The students will acquire the knowledge:

1. To measure load and temperature using analogue and digitalsensors.
2. To measure displacement using analogue and digitalsensors.
3. To develop PLC programs for control of traffic lights, water level, lifts and conveyor belts.
4. To simulate and analyze PID controllers for a physical system usingMATLAB.
5. To develop pneumatic and hydraulic circuits using Automaton studio.

List of Experiments

1. DYNA 1750 Transducers Kit:-

   a. Characteristics of LVDT

   b. Principle & Characteristics of StrainGauge

   c. Characteristics of SummingAmplifier

   d. Characteristics of Reflective OptoTransducer

2. PLCPROGRAMMING

   a. Ladder programming on Logic gates ,Timers &counters

   b. Ladder Programming for digital & Analogysensors

   c. Ladder programming for Traffic Light control, Water level control and Lift controlModules

3. AUTOMATION STUDIOsoftware

   a. Introduction to Automation studio & itscontrol

   b. Draw & Simulate the Hydraulic circuit for series & parallel cylindersconnection

   c. Draw & Simulate Meter-in, Meter-out and hydraulic press andclamping.

4. MATLABProgramming

   a. Sample programmes onMatlab

   b. Simulation and analysis of PID controller usingSIMULINK

Course outcomes:

Upon successful completion of this course student should be able to:

1. Measure load using analogue and digital sensors (BL-5)
2. Measure displacement using analogue and digital sensors (BL-5)
3. Develop PLC programs for control of traffic lights, water level and lift system (BL-3)
4. AnalyzePID controllers for a physical system using MATLAB(BL-4)
5. Develop pneumatic and hydraulic circuits (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√			√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
IV Year-II Semester		**0**	**0**	**16**	**12**
PROJECT (R204203PR01)					

Objectives:

The aim of the course is to make the student perform a comprehensive project work that involves either or all of the following: optimum design of a mechanical component or an assembly, thermal analysis, computer aided design & analysis, cost effective manufacturing process, material selection, testing procedures or fabrication of components and prepare a detailed technical thesis report. The completed task should also take into account the significance of real time applications, energy management and the environmental effects.

Outcomes

- Understand the need of optimum design of a mechanical component or an assembly
- Study the procedure to bring cost effective manufacturing process with proper material selection

and technical procedure of planning the work.

- Recognize the need of scheduling the and realizing an engineering product design
- Realize the significance of real time applications, energy management and environmental affects
- Obtain the skill of data collection and technical report writing.

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√	√	√	√	√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	√	√
CO3	√	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√	√	√	√	√	√	√	√	√
CO5	√	√	√	√	√	√	√	√	√	√	√	√

B. Tech (MECHANICAL ENGINEERING) - R20

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

LIST OF HONORS SUBJECTS

HONORS IN MECHANICAL ENGINEERING		Pre-requisites
POOL – 1 (in II-II)		
1.	Advanced Mechanics of Fluids	Fluid Mechanics
2.	Advanced Optimization Techniques	Nil
3.	Analysis and Synthesis of Mechanisms	Kinematics of Machinery
4.	Advanced Thermodynamics	Basic Thermodynamics
5.	Gear Engineering	Kinematics of Machinery
POOL-2 (in III-I)		
1.	Experimental Methods in Fluid Mechanics	Fluid Mechanics
2.	Green Manufacturing	Production Technology
3.	Micro Electro Mechanical Systems	Nil
4.	Combustion, emissions and environment	Basic Thermodynamics
5.	Quality Engineering in Manufacturing	Engineering metrology
POOL-3 (in III-II)		
1.	Advanced Computational Fluid Dynamics	Fluid Mechanics
2.	Materials Characterization Techniques	Material Science and Metallurgy
3.	Product Design	Design of Machine Members-I
4.	Advanced IC Engines Electric, Hybrid Vehicles	Basic Thermodynamics
5.	Mechatronics	Nil
POOL-4 (in IV-I)		
1.	Alternative Fuels Technologies	Renewable Energy Sources
2.	Design for Manufacturing and Assembly	Production Technology
3.	Robotics and Control	Kinematics of Machinery
4.	Turbo Machines	Heat Transfer
5.	Marketing Management	Nil

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS- POOL-I II BTECH II SEM		L	T	P	C
		4	0	0	4
ADVANCED FLUID MECHANICS					

Course Objectives:

The students will acquire the knowledge:

1. To understand the general concepts of inviscid flow of incompressible fluids.
2. To apply the concepts of viscous flow.
3. To analyse the boundary layer concepts and expressions for local and mean drag coefficients for different velocity profiles.
4. To understand fundamental concept of turbulence.
5. To illustrate the compressible fluid flow and supersonic wave drag

UNIT -I:
INVISCID FLOW OF INCOMPRESSIBLE FLUIDS: Lagrangian and Eulerain Descriptions of fluid motion, Path lines, Stream lines, Streak lines, stream tubes – velocity of a fluid particle, types of flows, Equations of three dimensional continuity equation, Stream and Velocity potential functions.
Basic Laws of fluid Flow: Condition for irrotationality, circulation & vorticity Accelerations in Cartesystems normal and tangential accelerations, Euler's, Bernouli equations in 3D– Continuity and Momentum Equations.

UNIT -II:
Viscous Flow: Derivation of NavierStoke's Equations for viscous compressible flow – Exact solutions to certain simple cases: Plain Poisoulle flow, Coutte flow with and without pressure gradient , Hagen Poisoulle flow, Blasius solution.

UNIT -III:
Boundary Layer Concepts : Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory , Boundary layer thickness for flow over a flat plate – Approximate solutions – Creeping motion (Stokes) – Oseen's approximation , Von,Karman momentum integral equation for laminar boundary layer — Expressions for local and mean drag coefficients for different velocity profiles.

UNIT- IV:
Introduction to Turbulent Flow: Fundamental concept of turbulence – Time Averaged Equations – Boundary Layer Equations , Prandtl Mixing Length Model , Universal Velocity Distribution Law: Van Driest Model –Approximate solutions for drag coefficients – More Refined Turbulence Models – k,epsilon model , boundary layer separation and form drag – Karman Vortex Trail, Boundary layer control, lift on circular cylinders.
Internal Flow: Smooth and rough boundaries – Equations for Velocity Distribution and frictional Resistance in smooth and rough Pipes – Roughness of Commercial Pipes – Moody's diagram.

UNIT -V:
Compressible Fluid Flow – I: Thermodynamic basics – Equations of continuity, Momentum and Energy , Acoustic Velocity, Derivation of Equation for Mach Number – Flow Regimes – Mach Angle – Mach Cone – Stagnation State.
Compressible Fluid Flow – II: Area Variation, Property Relationships in terms of Mach number, Nozzles,

Diffusers – Fanno and Releigh Lines, Property Relations – Isothermal Flow in Long Ducts – Normal Compressible Shock, Oblique Shock: Expansion and Compressible Shocks – Supersonic Wave Drag.

TEXT BOOKS:

1. Fluid Mechanics / L.VictorSteeter / TMH
2. Fluid Mechanics / Frank M.White / MGH

REFERENCES:

1. Fluid Mechanics and Machines/Modi and Seth/Standard Book House
2. Fluid Mechanics/Cohen and Kundu/Elsevier/5th edition
3. Fluid Mechanics/Potter/Cengage Learning
4. Fluid Mechanics/William S Janna/CRC Press
5. Fluid Mechanics / Y.A Cengel and J.M Cimbala/MGH
6. Boundary Layer Theory/ Schlichting H /Springer Publications
7. Dynamics & Theory and Dynamics of Compressible Fluid Flow/ Shapiro.
8. Fluid Dynamics/ William F. Hughes & John A. Brighton/TMH
9. Fluid Mechanics / K.L Kumar /S Chand & Co.

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Understand the general concepts of inviscid flow of incompressible fluids. (BL-2)
2. Apply the concepts of viscous flow. (BL-3)
3. Analyse the boundary layer concepts and expressions for local and mean drag coefficients for different velocity profiles. (BL-4)
4. Understand fundamental concept of turbulence.(BL-2)
5. Illustrate the compressible fluid flow and supersonic wave drag. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS- POOL-I II BTECH II SEM		L	T	P	C
		4	0	0	4

ADVANCED OPTIMIZATION TECHNIQUES

Course Objectives:

The students will acquire the knowledge:

1. To understand the Engineering applications of optimization.
2. To apply the concepts of unconstrained optimization techniques.
3. To understand the concepts of constrained optimization techniques.
4. To solve geometric programming problems.
5. To solve multistage decision processes and dynamic programmingproblems.

UNIT- I

INTRODUCTION TO OPTIMIZATION: Engineering applications of optimization- statement of an optimization problem- classification of optimization problem- optimization techniques.
CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization- multivariable optimization with equality constraintsmultivariable optimization with inequality constraints.

UNIT-II

UNCONSTRAINED OPTIMIZATION TECHNIQUES: pattern search method- rosenbrock's method of rotating coordinates- the simplex methoddescent methods- gradient of function- steepest descent method.

UNIT-III

CONSTRAINED OPTIMIZATION TECHNIQUES: characteristics of aconstrained problem- methods of feasible directions - basic approach in the penalty function method- interior penalty function method- convex programming problem- exterior penalty function method.

UNIT-IV

GEOMETRIC PROGRAMMING (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P).Complimentary geometric programming (C.G.P).

UNIT-V

DYNAMIC PROGRAMMING (D.P): Multistage decision processes. Concepts of sub optimization, computational procedure in dynamic programming calculus method and tabular methods.Linear programming as a case of D.P., Continuous D.P.

Text Book:

1. Optimization Theory and Applications, by S.S.Rao, Wiley Eastern Limited, New Delhi.

References:

1. Engineering Optimization By Kalyanmanai Deb, Prentice Hall of India, New Delhi.
2. Optimization Techniques, C.Mohan, Kusum Deep.
3. Operations Research by S.D.Sharma.

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Understand the Engineering applications of optimization. (BL-2)
2. Apply the concepts of unconstrained optimization techniques. (BL-3)
3. Understand the concepts of constrained optimization techniques.(BL-2)
4. Apply concepts of geometric programming problems.(BL-3)
5. Analyze multistage decision processes and dynamic programmingproblems. (BL-4).

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS- POOL-I II BTECH II SEM		L	T	P	C
		4	0	0	4
ANALYSIS AND SYNTHESIS OF MECHANISMS					

Course Objectives:

The students will acquire the knowledge:

1. To understand the general concepts of advanced kinematics of plane motion-I.
2. To apply the concepts of advanced kinematics of plane motion-II.
3. To understand the introduction to synthesis-graphical methods – I with function and path generation
4. To analyze the synthesis-graphical methods with Velocity – pole method and Roberts's theorem.
5. To illustrate thesynthesis of four-bar mechanisms for prescribed extreme values of the angular velocity of driven link.

UNIT – I : ADVANCED KINEMATICS OF PLANE MOTION- I: Introduction to plane motion. The Inflection circle, Euler – Savary Equation, Analytical and graphical determination of di , Bobillier's Construction , Collineation axis , Hartmann's Construction ,Inflection circle for the relative motion of two moving planes, Application of the Inflection circle to kinematic analysis.
UNIT – II : ADVANCED KINEMATICS OF PLANE MOTION – II: Polode curvature, Hall's Equation, Polode curvature in the four bar mechanism, coupler motion, relative motion of the output and input links, Determination of the output angular acceleration and its Rate of change, Freudenstein's collineation –axis theorem, Carter –Hall circle, The circling – point curve for the Coupler of a four bar mechanism.
UNIT – III : INTRODUCTION TO SYNTHESIS-GRAPHICAL METHODS – I: The Four bar linkage ,Guiding a body through Two distinct positions, Guiding a body through Three distinct positions, The Roto center triangle , Guiding a body through Four distinct positions, Burmester's curve.
UNIT – IV: INTRODUCTION TO SYNTHESIS-GRAPHICAL METHODS – II: Function generation-General discussion, Function generation: Relative – Roto center method, Overlay's method, Function generation- Velocity – pole method, Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem.
UNIT – V : INTRODUCTION TO SYNTHESIS – ANALYTICAL METHODS:Function Generation: Freudenstien's equation, Precision point approximation, Precision – derivative approximation, Path Generation: Synthesis of Four-bar Mechanisms for specified instantaneous condition, Method of components, Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link, Method of components.

TEXT BOOKS:

1. Kinematics and Dynamics of plane mechanisms/ Jeremy Hirschhorn/McGraw-Hill.
2. Theory of Machines and Mechanisms/ J. E Shigley and J.J . Uicker Jr./ McGraw-Hill.

REFERENCES:

1. Design of machinery / Robert L Norton third edition/ McGraw-Hill 2004
2. Theory of Mechanisms and Machines/ Amitabh Ghosh and Ashok Kumar Mallik/ E. W. P. Publishers.
3. Kinematic Linkage Design/ Allen S.Hall Jr./ PHI.
4. Kinematics and Dynamics of Machinery/Charles E Wilson/Pearson/3rd Edition

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Understand the general concepts of advanced kinematics of plane motion-I.(BL-2)
2. Apply the concepts of advanced kinematics of plane motion-II. (BL-3)
3. Understand the introduction to synthesis-graphical methods – I with function and path generation. (BL-2)
4. Analyze the synthesis-graphical methods with Velocity – pole method and Roberts's theorem.(BL-4)
5. Illustrate the synthesis of four-bar mechanisms for prescribed extreme values of the angular velocity of driven link. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS- POOL-I II BTECH II SEM		L	T	P	C
		4	0	0	4
ADVANCED THERMODYNAMICS					

Course Objectives:

The students will acquire the knowledge:

1. To understand the review of thermodynamic laws and corollaries.
2. To illustrate the concepts of real gas behaviour,non-reactive mixtures of perfect gases and air conditioning processes.
3. To apply the general concepts of combustion reactions and chemical equilibrium of ideal gases.
4. To analyze power cycles, thermodynamic phenomena and thermo electric circuits.
5. To illustrate theworking principles of direct energy conversion techniques.

UNIT -I:

REVIEW OF THERMODYNAMIC LAWS AND COROLLARIES: Transient flowanalysis, Second law thermodynamics, Entropy, Availability and unavailability, Thermodynamic potential. Maxwell relations, Specific heat relations, Mayer's relation. Evaluation of thermodynamic properties of working substance

UNIT-II:

P.V.T SURFACE: Equation of state. Real gas behavior, Vander Waal's equation, Generalizationcompressibility factor.Energy properties of real gases. Vapour pressure, Clausius, Clapeyro equation. Throttling, Joule.Thompson coefficient.Non reactive mixtures of perfect gases.Governing laws, Evaluation of properties, Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers.Real gas mixture.

UNIT-III:

COMBUSTION: Combustion Reactions, Enthalpy of formation. Entropy of formation, Referencelevels of tables. Energy of formation, Heat reaction, Adiabatic flame temperature generated product, Enthalpies, Equilibrium. Chemical equilibrium of ideal gases, Effect of non reacting gases equilibrium in multiple reactions, The vent hoff's equation. The chemical potential and phase equilibrium. The Gibbs phase rule.

UNIT-IV:

POWER CYCLES: Review binary vapour cycle, co generation and combined cycles, Second lawanalysts of cycles. Refrigeration cycles.Thermodynamics off irreversible processes. Introduction, Phenomenological laws, Onsaga Reciprocity relation, Applicability of the Phenomenological relations, Heat flux and entropy production, Thermodynamic phenomena, Thermo electric circuits.

B. Tech (MECHANICAL ENGINEERING) - R20

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UNIT-V:

DIRECT ENERGY CONVERSION INTRODUCTION: Fuel cells, Thermo electric energy,Thermo ionic power generation, Thermodynamic devices magneto hydronamic generations,Photovoltaic cells.

TEXT BOOKS:

1. Basic and Applied Thermodynamics/ P.K.Nag/ TMH
2. Thermodynamics/Holman/ Me Graw Hill.

REFERENCES

1. Engg. Thermodynamics/PL.Dhar / Elsevier
2. Thermodynamics/Sonnatag & Van Wylen / John Wiley & Sons
3. Thermodynamics for Engineers/Doolittle-Messe / John Wiley & Sons
4. Irreversible thermodynamics/HR De Groff.
5. Thermal Engineering / Soman / PHI
6. Thermal Engineering / Rathore / TMH
7. Engineering Thermodynamics/Chatopadyaya/

Course Outcomes:

Upon successful completion of this course student should be able to:

1. To understand the review of thermodynamic laws and corollaries. (BL-2)
2. To illustrate the concepts of real gas behaviour,non-reactive mixtures of perfect gases and air conditioning processes.(BL-2)
3. To apply the general concepts of combustion reactions and chemical equilibrium of ideal gases. (BL-3)
4. To analyze power cycles, thermodynamic phenomena and thermo electric circuits.(BL-4)
5. To illustrate theworking principles of direct energy conversion techniques.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS- POOL-I II BTECH II SEM		L	T	P	C
		4	0	0	4

GEAR ENGINEERING

Course Objectives:

The students will acquire the knowledge:

1. To understand the Principles of gear tooth action and spur gears.
2. To illustrate the concepts of helical and bevel gears.
3. To interpret the design considerations and methodology of worm gear teethand gear failures.
4. To analyze design of gear trains for various applications.
5. To understand theoptimization of gear design parameters.

UNIT-I:
Introduction: Principles of gear tooth action, Generation of Cycloid and Involute gears, Involutometry, gear manufacturing processes and inspection, gear tooth failure modes, stresses, selection of right kind of gears.
Spur Gears : Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of spur gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT-II:
Helical Gears:Tooth loads, Principles of Geometry, Design considerations and methodology,Complete design of helical gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.
Bevel Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of bevel gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT-III:
Worm Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of worm gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Heat dissipation considerations. Design of gear shaft and bearings.
Gear failures: Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth breakage, pitting, scoring, wear, overloading, gear-casing problems, lubrication failures

UNIT-IV:
Gear trains: Simple, compound and epicyclic gear trains, Ray diagrams, Design of a gear box of an automobile, Design of gear trains from the propeller shafts of airplanes for auxiliary systems.

UNIT-V:
Optimal Gear design: Optimization of gear design parameters, Weight minimization, Constraints in gear train design-space, interference, strength, dynamic considerations, rigidity etc. Compact design of gear trains, multi objective optimization of gear trains. Application of Traditional and non-traditional optimization techniques

TEXT BOOKS:
1. Maleev and Hartman, Machine Design, C.B.S. Publishers, India.
2. Henry E.Merrit,Gear engineering ,Wheeler publishing,Allahabad,1992.

REFERENCES:
1. Practical Gear design by Darle W. Dudley, McGraw-Hill book company
2. Earle Buckingham, Analytical mechanics of gears, Dover publications, New York, 1949.
3. G.M.Maitha, Hand book of gear design, TaTa Mc.Graw Hill publishing company Ltd., New Delhi,1994.

Course Outcomes:
Upon successful completion of this course student should be able to:

1. To understand the Principles of gear tooth action and spur gears. (BL-2)
2. To illustrate the concepts of helical and bevel gears. (BL-2)
3. To interpret the design considerations and methodology of worm gear teethand gear failures.(BL-5)
4. To analyze design of gear trains for various applications. (BL-4)
5. To understand theoptimization of gear design parameters. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-II III B.TECH I SEM		L	T	P	C
		4	0	0	4

EXPERIMENTAL METHODS IN FLUID MECHANICS

Course objectives:

The students will acquire the knowledge:

1. To understand the general concepts of measurement systems and analysis of first order and second order measurement systems
2. To understand the operating principles and design considerations of various pressure measurement systems
3. To understand the operating principles and design considerations of various temperature measurement systems
4. To understand the operating principles and design considerations of various flow and velocity measurement systems
5. To understand working of different voltage indicating, recording and data acquisition systems

UNIT-I

GENERAL CONCEPTS: Basic concepts of measurement methods, Sensing elements and transducers, Errors in instruments, Processing of experimental data, curve fitting and regression analysis.

ANALYSIS OF MEASUREMENT SYSTEMS
Analysis of First & Second order systems with examples of mechanical and thermal systems.

UNIT-II

MEASUREMENT OF PRESSURE – Principles of pressure measurement, static and dynamic pressure, vacuum and high pressure measurement –Manometers- Analysis of liquid manometer, dynamics of variable area and inclined manometer, Pressure transducers- Bellow gauges, Diaphragm gauges- Measurement of low pressure, Calibration methods, Dynamic characteristics, design principles.

UNIT-III

TEMPERATURE MEASUREMENT: Different principles of Temperature Measurement, use of bimetallic thermometers ,Measurement Design, Construction and Analysis of liquid and gas thermometers, resistance thermometer with wheat stone bridge, Thermo-electric effect, Construction, testing and calibration of thermocouples and thermopiles, Thermistors, Pyrometry, measurement of heat flux, Calibration of temperature measuring instruments. Design of temperature measuring instruments.

UNIT-IV

FLOW AND VELOCITY MEASUREMENT: Positive displacement methods, Obstruction meters, variable area meters, Ultrasonic flow meter, Vortex –shedding flow meters, Turbine meters, Thermal anemometers, Laser application in flow measurement calibration of flow measuring instruments. Introduction to design of flow measuring instruments. Velocity measurements- pitot tubes, yaw tubes, pitot static tubes

UNIT-V

VOLTAGE INDICATING, RECORDING AND DATA ACQUISITION SYSTEMS:
Standards and calibration, Analog volt meters and potentiometers.Electrical instruments.Digital voltmeters

and multimeters. Signal generation. Electro mechanical servo type XT and XY recorders, Thermal array recorders and data acquisition systems. Analog and digital CROs. Displays and liquid crystals flat panel displays. Displays.Virtual instruments. Magnetic tape and disk recorders/reproducers.Fiber optic sensors.

TEXT BOOK:

1. Measurement System, Application & Design – E.O. Doeblin, MGH
2.

REFERENCES:

1. Mechanical and Industrial Measurements – R.K. Jain – Khanna Publishers.
2. Mechanical Measurements – Buck & Beckwith – Pearson.
3. Control Systems, Principles & Design, 2nd Edition – M. Gopal – TMH.
4. Mechanical Measurements – J.P Holman

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Understand general concepts of measurement systems and analysis of first order and second order measurement systems (BL-2)
2. Identify the operating principles and design considerations of various pressure measurement systems(BL-3)
3. Understands the operating principles and design considerations of various temperature measurement systems. (BL-2)
4. Apply the operating principles and design considerations of various flow and velocity measurement systems(BL-4)
5. Illustrate the working of different voltage indicating, recording and data acquisition systems (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-II III B.TECH I SEM		L	T	P	C
		4	0	0	4
GREEN MANUFACTURING					

Course Objectives:

The Students will acquire the knowledge

1. To understand concepts of green manufacturing
2. To illustrate various recycling techniques.
3. To apply concepts of green design methods.
4. To understand the concepts of eco design and emissionlessmanufacturing.
5. To apply concepts of the sustainable economic environment.

UNIT I

Environmental effects and environmental damage – In efficient energy use – Concepts of Green Manufacturing. Waste – Collection, sorting, cleaning –Characterization of waste streams.

UNIT II

Recycling Techniques: Recycling rate, material recovery facilities – Integrating recycling with landfills – Processing equipments,Processing facilities for recyclable materials.

UNIT III

Green design methods: Mass balance analysis – Green indicate – Design for disassembly design for recycle – Rist analysis – Material selection.

UNIT IV

Eco design – Industrial Ecology – Pollution prevention – Reduction of toxic emissions and Emissionlessmanufacturing.

UNIT V

Sustainable economic environment: Solar energy devices – wind energy resources – Full cost accounting methodology – Selection of natural friendly materials for green manufacturing.

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Understand concepts of green manufacturing. (BL-2)
2. Illustrate various recycling techniques. (BL-2)
3. Apply concepts of green design methods. (BL-3)
4. Understand the concepts of eco design and emissionless manufacturing. (BL-2)
5. Apply concepts of the sustainable economic environment. (BL-3)

TEXT BOOKS:

1. Dornfield David, Green Manufacturing, Springer, 2012
2. Davim.J.Pauls, Green Manufacturing Processes and Systems, Springer, 2013

REFERENCES:

1. Cairncrss and Francis – Costing the earth – Harvard Business School Press – 2009
2. Gradel.T.E. and B.R. Allenby – Industrial Ecology – Prentice Hall – 2010
3. World Commission on Environment and Development (WCED), Our Common Future, Oxford University Press 2005.

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CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-II III B.TECH I SEM		L	T	P	C
		4	0	0	4
MICRO ELECTRO MECHANICAL SYSTEMS					

Course Objectives:

The Students will acquire the knowledge

1. To understand basics of Micro Electro Mechanical Systems (MEMS), mechanical sensors and actuators
2. To illustrate thermal sensors and actuators used in MEMS.
3. To apply the principle and various devices of Micro-Opto-Electro Mechanical Systems (MOEMS), magnetic sensors and actuators.
4. To analyze applications and considerations on micro fluidic systems.
5. To illustrate the principles of chemical and bio medical micro systems.

UNIT – I: INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT – II: THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

UNIT – III: MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

UNIT – IV: MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps. RADIO FREQUENCY (RF) MEMS: RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

UNIT – V: CHEMICAL AND BIO MEDICAL MICRO SYSTEMS: Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (E-nose), mass sensitive chemosensors, fluroscence detection, calorimetric spectroscopy.

TEXT BOOK:

1.MEMS, Nitaigour Premchand Mahalik, TMH Publishing co.

REFERENCE BOOKS:

1. Foundation of MEMS, Chang Liu, Prentice Hall Ltd.
2. MEMS and NEMS, Sergey Edwrd Lyshevski, CRC Press, Indian Edition.
3. MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu, TMH Publishers.

4. Introductory MEMS, Thomas M Adams, Richard A Layton, Springer International Publishers.

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. To understand basics of Micro Electro Mechanical Systems (MEMS), mechanical sensors and actuators(BL-2)
2. Illustrate thermal sensors and actuators used in MEMS. (BL-2)
3. To apply the principle and various devices of Micro-Opto-Electro Mechanical Systems (MOEMS), magnetic sensors and actuators. (BL-3)
4. Analyze applications and considerations on micro fluidic systems.(BL-4)
5. Illustrate the principles of chemical and bio medical micro systems. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-II III B.TECH I SEM		L	T	P	C
		4	0	0	4

COMBUSTION, EMISSIONS AND ENVIRONMENT

Course Objectives:
The Students will acquire the knowledge
1. To understand the principles of combustion.
2. To apply the concepts of thermodynamics of combustion.
3. To analyze laminar and turbulent flames propagation and structure.
4. To illustrate pollution formation, measurement and control.
5. To understand environmental considerations and methods of emission control.

UNIT – I :
PRINCIPLES OF COMBUSTION: Chemical composition , Flue gas analysis, dew point of products, Combustion stoichiometry, Chemical kinetics, Rate of reaction, Reaction order, Molecularity, Zeroth, first, second and third order reactions , complex reactions, chain reactions, Theories of reaction Kinetics, General oxidation behavior of HCs.

UNIT-II:
THERMODYNAMICS OF COMBUSTION: Enthalpy of formation, Heating value of fuel, Adiabatic flame Temperature, Equilibrium composition of gaseous mixtures.

UNIT-III:
LAMINAR AND TURBULENT FLAMES PROPAGATION AND STRUCTURE: Flame stability, burning velocity of fuels, Measurement of burning velocity, factors affecting the Burning velocity. Combustion of fuel droplets and sprays, Combustion systems, Pulverized fuel furnaces- fixed, entrained and fluidized bed systems.

UNIT-IV:
POLLUTION FORMATION MEASUREMENT AND CONTROL: Causes for Formation of NOx, SOx, COx, Smoke and UBHC. Different methods of measurement of pollutants.methods of controlling the formation of pollutants, BHARAT and EURO standards of emissions.
UNIT-V:
ENVIRONMENTAL CONSIDERATIONS: Air pollution, effects on environment, human health etc. Principal pollutants, Legislative measures, methods of emission control.
TEXT BOOK:
1. Fuels and combustion, Sharma and Chandra Mohan, Tata McGraw Hill.

REFERENCES:
1. Combustion Fundamentals , Roger A strehlow , McGraw Hill.
2. Combustion Engineering and Fuel Technology , Shaha A.K., Oxford and IBH.
3. Principles of Combustion , KannethK.Kuo, Wiley and Sons.
4. Combustion , Samir Sarkar , Mc. Graw Hill, 2009.
5. An Introduction to Combustion , Stephen R. Turns, Mc. Graw Hill International Edition.
6. Combustion Engineering , Gary L. Berman & Kenneth W. Ragland, Mc. Graw Hill International Edition 2009.

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. To understand the principles of combustion.(BL-2)
2. To apply the concepts of thermodynamics of combustion. (BL-3)
3. To analyze laminar and turbulent flames propagation and structure. (BL-4)
4. To illustrate pollution formation, measurement and control.(BL-2)
5. To understand environmental considerations and methods of emission control. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-II III B.TECH I SEM		L	T	P	C
		4	0	0	4

QUALITY ENGINEERING IN MANUFACTURING

Course Objectives:

The Students will acquire the knowledge

1. To Interpret quality engineering in production design, Loss Function and Quality Level in production process
2. To explain tolerance design for Ntype. L-type and S-type characteristics and tolerance allocation
3. To interpret ANOVA techniques and need for ANOVA with multiple level factors.
4. To make use of orthogonal arrays for typical test strategies and interpolate experimental results
5. To explain six sigma DMAIC methodology and tools for process improvement in services and small organizations

UNIT - I

QUALITY VALUE AND ENGINEERING: An overall quality system, quality engineering inproduction design, quality engineering in design of production processes. Loss Function andQuality Level: Derivation and use of quadratile loss function, economic consequences oftightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,Stypeand L-type)

UNIT II:

TOLERANCE DESIGN AND TOLERANCING: Functional limits, tolerance design for Ntype.L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameterand Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter designstrategy, some of the case studies on parameter and tolerance designs.

UNIT – III

ANALYSIS OF VARIANCE (ANOVA): Introduction to ANOVA, Need for ANOVA, NOwayANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four levelfactors, multiple level factors.

UNIT - IV

ORTHOGONAL ARRAYS: Typical test strategies, better test strategies, efficient teststrategies, steps in designing, conducting and analyzing an experiment. Interpolation ofExperimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT - V

SIX SIGMA AND THE TECHNICAL SYSTEM: Six sigma DMAIC methodology, tools forprocess improvement, six sigma in services and small organizations, statistical foundations,statistical methodology.

TEXT BOOK:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition,1995.

REFERENCES:

1. Quality Engineering in Production systems by G. Taguchi, A. Elsayed et al, McGraw Hill Intl.Pub 1989.
2. Taguchi Methods explained: Practical steps to Robust Design / Papan P. Bagchi *I* PrenticeHall Pvt.Ltd. New Delhi

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Interpret quality engineering in production design, Loss Function and Quality Level in production process (BL-2)
2. Illustrate tolerance design for N-type. L-type and S-type characteristics and tolerance allocation (BL-2)
3. Interpret ANOVA techniques and need for ANOVA with multiple level factors.(BL-2)
4. Make use of orthogonal arrays for typical test strategies and interpolate experimental results (BL-3)
5. Understand six sigma DMAIC methodology and tools for process improvement in services and small organizations (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-III III B.TECH II SEM		L	T	P	C
		4	0	0	4

ADVANCED COMPUTATIONAL FLUID DYNAMICS

Course Objectives:

The students will acquire the knowledge:

1. To learn basic concepts of finite difference method, finite volume method, finite element method and solution methods
2. To understand the implementation of explicit and implicit schemes for hyperbolic equations
3. To learn the formulations of incompressible viscous flows and compressible flows
4. To understand difference between the finite volume method and finite difference method, and the application of finite volume method for fluid flow problems
5. To understand the application of standard variational methods for fluid flow problems

UNIT – I

INTRODUCTION: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions. Derivation of finite difference equations.

SOLUTION METHODS: Solution methods of elliptical equations – finite differenceformulations, interactive solution methods, direct method with Gaussian elimination.Parabolic equations, explicit schemes and Von Neumann stability analysis, implicit schemes,
alternating direction implicit schemes, approximate factorization, fractional step methods, directmethod with tridiagonal matrix algorithm.

UNIT – II

HYPERBOLIC EQUATIONS: Explicit schemes and Von Neumann stability analysis, implicitschemes, multi step methods, nonlinear problems, second order one-dimensional wave equations.Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

UNIT – III

FORMULATIONS OF INCOMPRESSIBLE VISCOUS FLOWS: Formulations ofincompressible viscous flows by finite difference methods, pressure correction methods, vortexmethods.

TREATMENT OF COMPRESSIBLE FLOWS: Potential equation, Eluer equations, Navier-Stokes system of equations, flow-field, dependent variation methods, boundary conditions.

UNIT – IV

FINITE VOLUME METHOD: Finite volume method via finite difference method, formulations for two and three, dimensional problems.

UNIT – V

STANDARD VARIATIONAL METHODS: Linear fluid flow problems, steady state problems, Transient problems.

TEXT BOOKS:

1. Computational fluid dynamics, T. J.Chung, Cambridge University press,2002.
2. Computational Fluid Dynamics by John D. Anderson, McGraw Hill Book Company 2017.

REFERENCE:

1. Text book of fluid dynamics, Frank Chorlton, CBS Publishers &distributors, 1985.
2. Computational Techniques for Fluid Dynamics, Volume 1& 2 By C. A. J. Fletcher, Springer Publication, 2012.

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Understand and be able to numerically solve the governing equations for fluid flow (BL-2)
2. Understand and be able to numerically solve the governing equations of fluid flow in hyperbolic form (BL-2)
3. Apply finite difference techniques for incompressible viscous flows and compressible flows (BL-3)
4. Illustrate the volume difference method for fluid flow problems. (BL-2)
5. Interpret the standard variational methods for various fluid flow problems.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-III III B.TECH II SEM		L	T	P	C
		4	0	0	4

MATERIALS CHARACTERIZATION TECHNIQUES

Course Objectives:

The students will acquire the knowledge:

1. To understand the use the various Structure analysis tools likeX-ray diffraction
2. To apply the microscopy techniques in materials characterization.
3. To understand the concepts of thermal analysis technique.
4. To analyze the knowledgeonmagnetic characterization techniques.
5. To illustrate optical and electronic characterization techniques.

UNIT I

Introduction to materials and Techniques, Structure analysis tools: X-ray diffraction: phase identification, indexing and lattice parameter determination, Analytical line profile fitting using various models, Neutron diffraction, Reflection High Energy Electron Diffraction, and Low Energy Electron Diffraction.

UNIT II

Microscopy techniques: Optical microscopy, transmission electron microscopy (TEM), energy dispersive X-ray microanalysis (EDS), scanning electron microscopy (SEM), Rutherford backscattering spectrometry (RBS), atomic force microscopy (AFM) and scanning probe microscopy (SPM).

UNIT III

Thermal analysis technique: Differential thermal analysis (DTA), Differential Scanning Calorimetry (DSC), Thermogravimetric analysis (TGA); Electrical characterization techniques: Electrical resistivity, Hall effect, Magnetoresistance.

UNIT IV

Magnetic characterization techniques: Introduction to Magnetism, Measurement Methods, Measuring Magnetization by Force, Measuring Magnetization by Induction method, Types of measurements using magnetometers: M-H loop, temperature dependent magnetization, time dependent magnetization, Measurements using AC susceptibility, Magneto-optical Kerr effect, Nuclear Magnetic Resonance, Electron Spin Resonance.

UNIT V

Optical and electronic characterization techniques: UV-VIS spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy, X-ray photoelectron spectroscopy.

TEXT BOOKS:

1. Characterization of Materials (Materials Science andTechnology:A Comprehensive Treatment, Vol 2A & 2B,
2. Semiconductor Material and Device Characterization, 3rdEdition, D. K. Schroder, Wiley-IEEE Press (2006).
3. Materials Characterization Techniques, S Zhang, L. Li andshok Kumar, CRC Press (2008).

REFERENCES:

1. Physical methods for Materials Characterization, P. E. J.Flewitt and R K Wild, IOP Publishing (2003).
2. Characterization of Nanophase materials, Ed. Z L Wang,Willet-VCH (2000).

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Understand the use the various Structure analysis tools likeX-ray diffraction. (BL-2)
2. Apply the microscopy techniques in materials characterization.(BL-3)
3. Understand the concepts of thermal analysis technique. (BL-2)
4. Analyze the knowledgeonmagnetic characterization techniques.(BL-4)
5. Illustrate optical and electronic characterization techniques.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-III III B.TECH II SEM		L	T	P	C
		4	0	0	4

PRODUCT DESIGN

Course objectives:

The students will acquire the knowledge:
1. To understand the basic concepts of product design process
2. To interpret the operations of product management and impact of manufacturing processes on product decisions
3. To understand concepts of risks and reliability of the products design.
4. To interpretthe various testing procedure of the product design .
5. To understand the concepts of maintenance concepts and procedures of product design

UNIT I

Product Design Process: Design Process Steps, Morphology of Design. Problem Solving andDecision Making: Problem-Solving Process, Creative Problem Solving, Invention, Brainstorming, Morphological Analysis, Behavioural Aspects of Decision Making, Decision Theory, Decision Matrix, Decision Trees. Modelling and Simulation: Triz, Role of Models in Engineering Design, Mathematical Modelling, Similitude and Scale Models, Computer Simulation, Geometric Modelling on Computer, Finite-Element Analysis.

UNIT II

Product management: The operation of product management: Customer focus of product management, product planning process, Levels of strategic planning, Wedge analysis, Opportunity search, Product life cycle Life cycle theory and practice.
Product development: Managing new products, Generating ideas, Sources of product innovation, selecting the best ideas, The political dimension of product design, Managing the product launch and customer feedback.
Product managers and manufacturing: The need for effective relationships, The impact ofmanufacturing processes on product decisions, Prototype planning,, Productivity potentials,Management of product quality, Customer service levels.

UNIT III

Risk and Reliability: Risk and Society, Hazard Analysis, Fault Tree Analysis. Failure Analysis and Quality: Causes of Failures, Failure Modes, Failure Mode and Effect Analysis, FMEA Procedure, Classification of Severity, Computation of Criticality Index, Determination of Corrective Action, Sources of Information, Copyright and Copying.
Patent Literature.

UNIT IV

Product Testing; Thermal, vibration, electrical, and combined environments, temperature testing, vibration testing, test effectiveness. Accelerated testing and data analysis, accelerated factors. Weibull probability plotting,testing with censored data.

UNIT V

Design For Maintainability: Maintenance Concepts and Procedures, Component Reliability, Maintainability and Availability, Fault Isolation in design and Self-Diagnostics.

Product Design for Safety, Product Safety and User Safety Concepts, Examples of Safe Designs. Design Standardization and Cost Reduction: Standardization Methodology, Benefits of Product Standardization; International, National, Association and Company Level Standards; Parts Modularization

TEXT BOOKS:

1. Engineering Design, George E. Dieter, McGRAW-HILL
2. Product Integrity and Reliability in Design, John W. Evans and Jillian Y. Evans, Springer Verlag

REFERENCES:

1. The Product Management Handbook, Richard S. Handscombe, McGRAW-HILL
2. New Product Design, Ulrich Eppinger, 3. Product Design, Kevin Otto.

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Understand the basic concepts of product design process (BL-2)
2. Identify the operations of product management and impact of manufacturing processes on product decisions (BL-3)
3. Understand concepts of risks and reliability of the products design (BL-2)
4. Interpretthe various testing procedure of the product design.(BL-2)
5. Illustrate the concepts of maintenance concepts and procedures of product design (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-III III B.TECH II SEM		L	T	P	C
		4	0	0	4

ADVANCED IC ENGINES ELECTRIC, HYBRID VEHICLES

Course Objectives:

The Students will acquire the knowledge

1. To interpret gas exchanging processes in SI engines and scavenging in two stroke cyclic engines
2. To explain the effect of intake jet flow, mean velocity and turbulence characteristics on the charge motion within the cylinder
3. To analyze the effect of cylindrical pressure data in SI and CI engine on combustion process
4. To interpret the components of Electric Vehicles of DC and AC electric machines
5. To explain the configurations of hybrid vehicles and fuel cell vehicles

UNIT-I:

GAS EXCHANIGING PROCESSES:

Inlet and exhaust processes in the four stroke cycle volumetric efficiency quasi static effects combined quasi static and dynamic effects variation with speed and valve area lift and timing – flow through valves poppet valve geometry and timing flow rate and discharge coefficients, residual gas fraction , exhaust gas flow rate and temperature variation, scavenging in two stroke cyclic engines, scavenging parameters and models actual scavenging processes , flow through ports, super charging and turbo changing – methods of power boosting basic relationships compressors, turbines wave compression devices.

UNIT-II:

CHARGE MOTION WITHIN THE CYLINDER:

Intake Jet Flow, Mean velocity and turbulence characteristics definitions application to engine velocity data swirl – swirl measurement, swirl generation during induction swirl modification within the cylinder squish pre chamber engine flows crevice flows and blowby flows generated by piston –cylinder wall interaction.

UNIT-III:

COMBUSTION IN S.I AND C.I ENGINES:

Review of normal and abnormal combustion in SI and CI engine cyclic variation in combustion of SI engine , analysis of cylindrical pressure data in SI and CI engine ,MPFI in SI engines common rail fuel injection system in CI engines fuel spray behavior in CI engines.

UNIT- IV:

ELECTRIC VEHICLES:

Introduction: Limitations of IC Engines as prime mover, History of EVs, EV system, components of EV-DC and AC electric machines: Introduction and basic structure, Electric vehicle drive train, advantages and limitations, Permanent magnet and switched reluctance motors

BATTERIES: Battery: lead, acid battery, cell discharge and charge operation, construction, advantages of lead, acid battery, Battery parameters: battery capacity, discharge rate, state of charge, state of discharge, depth of discharge, Technical characteristics, Ragone plots.

UNIT- V:

HYBRID VECHILES: Configurations of hybrids, Series and Parallel, advantages and limitations, Hybrid drive trains, sizing of components Initial acceleration, rated vehicle velocity,

Maximum velocity and maximum gradeability, Hydrogen: Production, Hydrogen storage systems, reformers.

FUEL CELL VECHILES: Introduction, Fuel cell characteristics, Thermodynamics of fuel cells, Fuel cell types: emphasis on PEM fuel cell.

TEXT BOOKS:

1. J.B. Heywood Internal Combustion Engine Fundamentals, McGraw Hill Co.1988
2. Seth Leitman and Bob Brant Build your own electric vehicle McGraw Hill Co.2009.
3. F. Barbir PEM Fuel Cells-Theory and Practice Elsevier Academic Press,2005.

REFERENCES:

1. W.W. Pulkrabek Engineering Fundamentals of IC Engine, PHI Pvt. Ltd 2002

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Interpret gas exchanging processes in SI engines and scavenging in two stroke cyclic engines (BL-2)
2. Explain the effect of intake jet flow, mean velocity and turbulence characteristics on the charge motion within the cylinder (BL-2)
3. Analyze the effect of cylindrical pressure data in SI and CI engine on combustion process(BL-3)
4. Interpret the components of Electric Vehicles of DC and AC electric machines(BL-2)
5. Explain the configurations of hybrid vehicles and fuel cell vehicles(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-III III B.TECH II SEM		L	T	P	C
		4	0	0	4

MECHATRONICS

Course Objectives:

The Students will acquire the knowledge

1. To understand the use the various mechatronics systems, measurement systems, sensors and transducers.
2. To apply the concepts of solid state electronic devices.
3. To identify the components in the design of electro mechanical systems.
4. To apply the concepts of digital electronics and applications of PLCs for control.
5. To understand system interfacing, data acquisition and design of mechatronics systems.

UNIT-I

Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT-III

Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-IV

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives. Design of mechatronics systems & future trends.

Text Books:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition

References:

1. Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford UniversityPress
2. Mechatronics Source Book / Newton C Braga/ThomsonPublications,Chennai.
3. Mechatronics – N. Shanmugam / Anuradha AgenciesPublishers.
4. Mechatronics System Design / Devdasshetty/Richard/Thomson.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton/ Pearson,2012
7. Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indianprint

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Understand the use the various mechatronics systems, measurement systems, sensors and transducers. (BL-2)
2. Apply the concepts of solid state electronic devices. (BL-3)
3. Identify the components in the design of electro mechanical systems. (BL-2)
4. Apply the concepts of digital electronics and applications of PLCs for control. (BL-3)
5. Understand system interfacing, data acquisition and design of mechatronics systems.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-IV IV B.TECH I SEM		L	T	P	C
		4	0	0	4

ALTERNATIVE FUELS TECHNOLOGIES

Course Objectives:
The Students will acquire the knowledge
1. To understand significance of fossil fuels and their limitations.
2. To apply the concepts of Methods of production of various liquid alternative fuels.
3. To identify different ways of using alternative liquid fuels in engines.
4. To illustrate the concepts of usage of gaseous fuels in alternative fuels technologies.
5. To understand principles of duel fuel combustion, hybrid power plants and fuel cell.

UNIT I:
Fossil fuels and their limitations Engine requirements; Potential alternative liquid and gaseous fuels.

UNIT II:
Methods of production; Properties, safety aspects, handling and distribution of various liquid alternative fuels like alcohols, vegetable oils, Di,methyl and Di,ethyl ether etc.

UNIT III:
Different ways of using alternative liquid fuels in engines, performance and emission characteristics; Conversion of vegetable oils to their esters and effect on engine performance.

UNIT IV:
Use of gaseous fuels like biogas, LPG, hydrogen, natural gas, producer gas etc. in SI/CI engines; Production, storage, distribution and safety aspects of gaseous fuels.

UNIT V:
Different approaches like duel fuel combustion and surface ignition to use alternative fuels in engines; Use of additives to improve the performance with alternative fuels; Hybrid power plants and fuel cell.

TEXT BOOK:
1. Alternative Fuels: The Future of Hydrogen, Second Edition**,** Michael Frank Hordeski, CRC Press

REFERENCES:
1. Alternative Fuels for Transportation, A S Ramadhas, CRC Press
2. Alternative Fuels & Advanced Technology Vehicles: Incentives & Considerations, Thomas Huber, Jack Spera, Nova Science Publishers

Course Outcomes:
Upon successful completion of this course, the students will be able to:
1. Understand significance of fossil fuels and their limitations. (BL-2)
2. Apply the concepts of methods of production of various liquid alternative fuels. (BL-3)
3. Analyze different ways of using alternative liquid fuels in engines. (BL-4)
4. Illustrate the concepts of usage of gaseous fuels in alternative fuels technologies.(BL-2)
5. Understand principles of duel fuel combustion, hybrid power plants and fuel cell. (BL-2)

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

HONORS-POOL-IV IV B.TECH I SEM		L	T	P	C
		4	0	0	4
DESIGN FOR MANUFACTURING AND ASSEMBLY					

Course Objectives:

The students will acquire the knowledge:
1. To understand the basic concepts of design for manual assembly
2. To interpret basic design procedure of machining processes
3. To understand design considerations metal casting, extrusion and sheet metal work
4. To interpret the design considerations of various metal joining process.
5. To interpret the basic design concepts involved in the assembly automation

UNIT - I
Introduction to DFM, DFMA: How Does DFMA Work? Reasons for Not Implementing DFMA,What Are the Advantages of Applying DFMA During Product Design?, Typical DFMA CaseStudies, Overall Impact of DFMA on Industry.
Design for Manual Assembly: General Design Guidelines for Manual Assembly, Development of theSystematic DFA Methodology, Assembly Efficiency, Effect of Part Symmetry, Thickness, Weight onHandling Time, Effects of Combinations of Factors, Application of the DFA Methodology.

UNIT - II
Machining processes: Overview of various machining processes-general design rules for machiningdimensionaltolerance and surface roughness-Design for machining – ease –redesigning ofcomponents for machining ease with suitable examples. General design recommendations formachined parts.

UNIT - III
Metal casting: Appraisal of various casting processes, selection of casting process,-general designconsiderations for casting-casting tolerance-use of solidification, simulation in casting design-productdesign rules for sand casting.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for
punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – componentdesign for blanking.

UNIT - IV
Metal joining: Appraisal of various welding processes, factors in design of weldments – generaldesign guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design ofbrazed joints. Forging: Design factors for forging – closed die forging design – parting lines of dies –drop forging die design – general design recommendations.

UNIT – V
Design for Assembly Automation: Fundamentals of automated assembly systems, System
configurations, parts delivery system at workstations, various escapement and placement devicesused in automated assembly systems, Quantitative analysis of Assembly systems, Multi stationassembly systems, single station assembly lines.

TEXT BOOKS:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
1. Design for Manufacture by Boothroyd,
2. Design for manufacture, James Bralla

REFERENCE:

ASM Hand book Vol.20

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Understand the basic concepts of design for manual assembly (BL-2)
2. Identify basic design procedure of various machining processes.(BL-3)
3. Illustrate the design considerations metal casting, extrusion and sheet metal work (BL-2)
4. Interpret the design considerations of various metal joining process.(BL-2)
5. Understand the basic design concepts involved in the assembly automation(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

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HONORS-POOL-IV IV B.TECH I SEM		L	T	P	C
		4	0	0	4

ROBOTICS AND CONTROL

Course Objectives:

The Students will acquire the knowledge

1. To demonstrate basic concepts of motion controllers, robot actuation and feedback components
2. To interpret the sensing and Digitizing-imaging devices, image processing and analysis on image data reduction, feature extraction and Object recognition
3. To classify generations of robot programming languages, Robot language structures, their elements and function
4. To make use of RAPID language basic commands and AML Language statements
5. To explain Robot cell design and control and practical study of virtual robot

UNIT - I

INTRODUCTION: **CONTROL SYSTEM AND COMPONENTS:** Basic concepts and motion controllers, control system analysis, robot actuation and feedback components, control systems and dynamic performance, precision of movement.

SENSORS: Desirable features, tactile, proximity and range sensors, uses of sensors in robotics. Positions sensors, velocity sensors

UNIT - II

MACHINE VISION: Functions, Sensing and Digitizing-imaging devices, Lighting techniques, Analog to digital single conversion, image storage: Image processing and Analysis-image data reduction, Segmentation, feature extraction, Object recognition. Training the vision system, Robotic application.

UNIT - III

ROBOT PROGRAMMING: Textual robot Languages, Generations of robot programming languages, Robot language structures, Elements and function. VAL language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program

UNIT - IV

RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Move master command language-Introduction, syntax, simple problems

AML Language-General description, elements and functions, Statements, constants and variables-Program control statements-Operating systems, Motion, Sensor commands-Data processing

UNIT - V

ROBOT CELL DESGIN AND CONTROL: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detection, Work cell controller.

PRACTICAL STUDY OF VIRTUAL ROBOT Robot cycle time analysis-Multiple robot and machine Interference-Process chart-Simple problems-Virtual robotics, Robot studio online software- Introduction, work planning, program modules, input and output signals – Singularities - Collision detection-Repeatability measurement of robot-Robot economics.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.

REFERENCES:

1 Robotics / Fu K S/ McGraw Hill.
2 Robotic Engineering / Richard D. Klafter, Prentice Hall
3 Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
4 Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley
5 Introduction to Robotics by SK Saha, The McGrah Hill Company, 6th, 2012
6 Robotics and Control / Mittal R K & Nagrath I J / TMH

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Demonstrate basic concepts of motion controllers, robot actuation and feedback components (BL-2)
2. Interpret the sensing and Digitizing-imaging devices, image processing and analysis on image data reduction, feature extraction and Object recognition (BL-2)
3. Classify generations of robot programming languages, Robot language structures, their elements and function (BL-2)
4. Make use of RAPID language basic commands and AML Language statements (BL-3)
5. Explain Robot cell design and control and practical study of virtual robot (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
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HONORS-POOL-IV IV B.TECH I SEM		L	T	P	C
		4	0	0	4

TURBO MACHINES

Course Objectives:
The Students will acquire the knowledge

4. To learn basic concepts of turbo machines
5. To learn the thermal analysis of steam nozzles and steam turbines
6. To learn the basic concepts of gas dynamics and centrifugal compressor
4. To learnthe basic concepts of cascade analysis and axial compressors
5. To learn the concepts axial flow gas turbines

UNIT-I:

FUNDAMENTALS OF TURBO MACHINES: Classifications, Applications,Thermodynamic analysis, Isentropic flow. Energy transfer. Efficiencies, Static and Stagnation conditions, Continuity equations, Euler's flow through variable cross sectional areas, Unsteady flow in turbo machines

UNIT -II:

STEAM NOZZLES: Convergent and Convergent-Divergent nozzles, Energy Balance, Effect ofback pressure of analysis. Designs of nozzles.

Steam Turbines: Impulse turbines, Compounding, Work done and Velocity triangle, Efficiencies,Constant reactions, Blading, Design of blade passages, Angle and height, Secondary flow. Leakage losses, Thermodynamic analysis of steam turbines.

UNIT-III:

GAS DYNAMICS: Fundamental thermodynamic concepts, isentropic conditions, mach numbersand area, Velocity relations, Dynamic Pressure, Normal shock relation for perfect gas. Super sonic flow, oblique shock waves. Normal shock recoveries, Detached shocks, Aerofoil theory.

Centrifugal compressor: Types, Velocity triangles and efficiencies, Blade passage design,Diffuserand pressure recovery. Slip factor, Stanitz and Stodolas formula's, Effect of inlet mach numbers, Pre whirl, 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: Geometrical and terminology. Blade force, Efficiencies, Losses, Free endforce, Vortex Blades.

UNIT-V:

AXIAL FLOW GAS TURBINES: Work done. Velocity triangle and efficiencies,Thermodynamic flow analysis, Degree of reaction, Zweifels relation, Design cascade analysis, Soderberg, Hawthrone, Ainley, Correlations, Secondary flow, Free vortex blade, Blade angles for variable degree of reaction. Actuator disc, Theory, Stress in blades, Blade assembling, Material and cooling of blades, Performances, Matching of compressors and turbines, Off design performance.

TEXTBOOK:

1. Principles of Turbo Machines/DG Shepherd / Macmillan

REFERENCES:

1. Fundamentals of Turbomachinery/William W Perg/John Wiley & Sons
2. Element of Gas Dynamics/Yahya/TMH
3. Principles of Jet Propulsion and Gas Turbine/NJ Zucrow/John Wiley & Sons/New york
4. Turbines, Pumps, Compressors/Yahya/TMH
5. Theory and practice of Steam Turbines/ WJ Kearton/ELBS Pitman/London
6. Element of Gas Dynamics/Liepeman and Roshkow/ Dover Publications

Course Outcomes

At the end of the course the students shall be able to:

1. Illustrate the concepts of turbo machines. (BL-2)
2. Analyze the thermal analysis of steam nozzles and steam turbines(BL-4)
3. Build the concepts of gas dynamics and centrifugal compressor(BL-3)
4. Build the concepts of cascade analysis and axial compressors (BL-3)
5. Understand the concepts axial flow gas turbines(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

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HONORS-POOL-IV IV B.TECH I SEM		L	T	P	C
		4	0	0	4

MARKETING MANAGEMENT

Course Objectives:

The Students will acquire the knowledge

1. To illustrate the functions and planning of marketing.
2. To analyzemarketing environmentand techniques of environment scanning.
3. To understand the concepts of marketing- information systems.
4. To build the concepts of market segmentation.
5. To understand the concepts product management.

UNIT-I

Marketing: Market - Exchange Process, Core Concepts of Marketing,Functions of Marketing, Importance of Marketing, Marketing Orientations, The marketing process, Marketing Mix-The Traditional 4Ps, The Modern Components of the Mix- The Additional 3Ps,Developing an Effective Marketing Mix, Marketing Planning, Marketing Implementation and Control,

UNIT-II

Marketing Environment:Environmental Scanning, Analyzing the Organization's Micro Environment, Company's MacroEnvironment, Differences between Micro and Macro Environment, Techniques of Environment Scanning.

UNIT-III

Understanding the Marketing-Information Systems (MIS): Characteristics of MIS, Benefits, Types, Components, MarketingResearch, consumer buying behavior: Characteristics, Types of Buying Decision Behaviour: Henry Assael Model, Consumer BuyingDecision Process, Buyer Decision Process, for New Products, Buying Motives, Buyer Behaviour Models

UNIT-IV

Segmentation, Targeting and Positioning: Introduction, Concept of Market Segmentation, Benefits of Market Segmentation, Requisitesof Effective Market Segmentation, The Process of Market Segmentation, Bases for Segmenting Consumer Markets, Targeting (T), Market Positioning (P).

UNIT-V

Product Management: Decisions, Development and Lifecycle Strategies: Introduction, Levels of Products, Classification of Products,Product Hierarchy, Product Line Strategies, Product Mix Strategies, Packaging and Labeling, New Product Development, Product Life Cycle(PLC).

TEXT BOOKS:

1. Marketing Management by Philip Kotler (Author), Keven Lane Keller
2. Principles of Marketing By Pearson Paperback

REFERENCES

1. Marketing Analytics: Data-Driven Techniques with Microsoft Excel 1st Edition, Kindle Edition

Course Outcomes

At the end of the course the students shall be able to:

1. Illustrate the functions and planning of marketing. (BL-2)
2. Analyzemarketing environmentand techniques of environment scanning. (BL-4)
3. Understand the concepts of marketing- information systems (BL-2)
4. Build the concepts of market segmentation. (BL-3)
5. Understand the concepts product management.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

LIST OF SUBJECTS FOR B.Tech (MINOR) in MECHANICAL ENGINEERING

B.Tech (MINOR)in MECHANICAL ENGINEERING		Pre-requisites
1.	ENGINEERING THERMODYNAMICS	NIL
2.	ENGINEERING METROLOGY	NIL
3.	PRODUCT DESIGN & DEVELOPMENT	NIL
4.	SUPPLY CHAIN MANAGEMENT	NIL
5.	RELIABILITY ENGINEERING	NIL
6.	POWER PLANT ENGINEERING	NIL
7.	AUTOMOBILE ENGINEERING	Engineering Thermodynamics
8.	TOTAL QUALITY MANAGEMENT	NIL
9.	ADVANCED MATERIALS	Material Science
10.	CAD/CAM	Basic Engineering Drawing
11.	ROBOTICS	Engineering Mechanics
12.	MECHATRONICS	NIL

B. Tech (MECHANICAL ENGINEERING) - R20

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
ENGINEERING THERMODYNAMICS					

Course Objectives:

The students will acquire the knowledge:

1. To understand the concepts of heat, work, energy and zeorth law of thermodynamics.
2. To understand first law of thermodynamics for closed and open systems undergoing different thermodynamic processes.
3. To understand the concept of second law of thermodynamics, entropy .
4. To analyze the air standard cycles and fundamental concepts of IC engines
5. To analyze the vapour power cycles and basic concepts of components of steam power plant.

UNIT – I

Introduction: Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process - Reversible, Quasi static & Irreversible Processes, cycle, Causes of Irreversibility. Energy in State and in Transition - Types, Work and Heat, Point and Path function.

Zeroth Law of Thermodynamics – Concept of Temperature

UNIT – II

Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

Conservation of mass- Flow work and Energy of a flowing fluid- Energy analysis of steady flow systems- Some steady flow engineering devices, PMM-I.

UNIT III

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements, Corollaries, PMM of Second kind, Carnot cycle and its specialties, Carnot's theorem, Thermodynamic scale of Temperature. Clausius Inequality, Entropy.

UNIT IV

Air standard Cycles: Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency

IC ENGINES :Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems – Fuel, Carburettor, Fuel Injection System, Ignition, Cooling and Lubrication. Combustion in S.I. Engines **:**Normal Combustion and abnormal combustion Combustion in C.I. Engines **:** Four stages of combustion – Diesel knock

UNIT – V

VAPOUR POWER CYCLES: Carnot,Rankine cycle - schematic layout, thermodynamic analysis

BOILERS : Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles.

STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient

STEAM TURBINES: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency

TEXT BOOKS:

1. Engineering Thermodynamics, PK Nag 6th Edn , McGraw Hill.
2. I.C. Engines - V. Ganesan- Tata McGraw Hill Publishers
3. Basics & Applied Thermodynamics- P.K.Nag – 4th edition- McGraw Hill

REFERENCES:

1. Engineering Thermodynamics – Jones & Dugan PHI
2. Thermal Engineering - Mahesh Rathore- McGraw Hill publishers.
3. Thermodynamics – J.P.Holman , McGrawHill
4. Heat engines, Vasandani & Kumar - Thermal publications
5. Applied Thermodynamics by R Yadhav
6. Thermal Engineering-M.L.Marthur & Mehta/Jain bros. Publishers

COURSE OUTCOMES:

After undergoing the course the student is expected to learn

CO1: Understand the concepts of heat, work, energy and zeorth law of thermodynamics. (BL-2)

CO2: Apply the first law of thermodynamics for closed and open systems undergoing different thermodynamic processes.(BL-3)

CO3: Interpret the concept of second law of thermodynamics, Entropy. (BL-2)

CO4: Analyze the air standard cycles and fundamental concepts of IC engines.(BL-2)

CO5: Illustrate the vapour power cycles and basic concepts of components of steam power plant.(BL-2)

CO-PO Mapping

S.N	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO1
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
ENGINEERING METROLOGY					

Course Objectives:
The students will acquire the knowledge:

1. To interpret the principles of different types of limits and fits and explain the operating principles of linear measurements. (BL-2)
2. To illustrate the operating principles of angle and taper measurements and limit gauges. and study the basic principles of optical measuring instruments and interferometry. (BL-2)
3. To classify the different types of comparators and understanding the principles of surface roughness measurement (BL-2)
4. To illustrate the concepts of gear and screw thread measurements. (BL-2)
5. To apply the knowledge of flatness measurement principles and machine tool alignment tests (BL-3)

UNIT-I

SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, fits - Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, deterministic & statistical tolerances, selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning.

LINEAR MEASUREMENT: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micrometers.

UNIT-II

MEASUREMENT OF ANGLES AND TAPERS:

Different methods – bevel protractor, angle slip gauges- angle dekkor- spirit levels- sine bar- sine table, rollers and spheres used to measure angles and tapers.

LIMIT GAUGES:

Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

OPTICAL MEASURING INSTRUMENTS: Tools maker's microscope and uses- autocollimators, optical projector, optical flats and their uses.

INTERFEROMETRY:

Interference of light, Michelson's interferometer, NPL flatness interferometer, and NPL gauge interferometer.

UNIT-III

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness –Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, Method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish.

COMPARATORS: Types - mechanical, optical, electrical and electronic, pneumatic comparators and their uses.

Introduction to Geometric Dimensioning and Tolerance(GD&T) and Coordinate Measuring Machines (CMM)

UNIT – IV

GEAR MEASUREMENT: Nomenclature of gear tooth, tooth thickness measurement with gear tooth vernier & flange micro meter, pitch measurement, total composite error and tooth to tooth composite errors, rolling gear tester, involute profile checking.

SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads- concept of virtual effective diameter, measurement of effective diameter, angle of thread and thread pitch, and profile thread gauges.

UNIT – V

FLATNESS MEASUREMENT:

Measurement of flatness of surfaces- instruments used- straight edges- surface plates – auto collimator.

Text Books:

3. Dimensional Metrology/Connie Dotson/Cengage Learning
4. Engineering Metrology / R.K.Jain / Khanna Publishers

References:

1. Engineering Metrology / Mahajan / Dhanpat Rai Publishers
2. Engineering Metrology / I.C.Gupta / Dhanpat Rai Publishers
3. Precision Engineering in Manufacturing / R.L.Murthy / New Age
4. Engineering Metrology and Measurements / NV Raghavendra, L Krishna murthy/ Oxford publishers.
5. Engineering Metrology / KL Narayana/Scitech publishers

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Interpret the principles of different types of limits and fits and explain the operating principles of linear measurements. (BL-2)
2. Illustrate the operating principles of angle and taper measurements and limit gauges. and study the basic principles of optical measuring instruments and interferometry. (BL-2)
3. Classify the different types of comparators and understanding the principles of surface roughness measurement (BL-2)
4. Illustrate the concepts of gear and screw thread measurements. (BL-2)
5. Apply the knowledge of flatness measurement principles and machine tool alignment tests (BL-3)

CO-PO Mapping:

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

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		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
PRODUCT DESIGN AND DEVELOPMENT					

COURSE OBJECTIVES:
The students will acquire the knowledge:
1. Apply the principles of generic development process; conduct customer need analysis; and set product specification for new product design and development.
2. Generate, select, screen, and test concepts for new product design and development.
3. Apply the principles of product architecture and industrial design to design and develop new products.
4. Apply the principles of DFMA and Prototyping to design and develop new product.
5. Apply the concepts of economics principles sustainable product development and life cycle assessment.

UNIT I
INTRODUCTION – A Generic Development Process – Adapting the Generic Product Development Process - Product Development Process Flows- Digital tools for product design– Identifying Customer Needs - Product Specifications: Establishing Target Specifications; Setting the Final Specifications.

UNIT II
CONCEPT GENERATION
Concept Generation: The Activity of Concept Generation - Concept Selection: ConceptScreening; Concept Scoring – Concept Testing – Concept innovation using TRI

UNIT III
PRODUCT ARCHITECTURE
Implications of the Architecture; Establishing the Architecture; Delayed Differentiation;
Platform Planning; Related System-Level Design Issues – Industrial Design: Assessing the Need for Industrial Design; Impact of Industrial Design; The Industrial Design Process; Management of the Industrial Design Process; Assessing the Quality of Industrial Design.

UNIT IV
DFM AND PROTOTYPING
Design for Manufacturing: Estimate the Manufacturing Costs; Reduce the Costs of Components; Reduce the Costs of Assembly; Reduce the Costs of Supporting Production; Consider the Impact of DFMA– Prototyping: Type; Uses; Principles; Technologies; Planning for Prototypes.

UNIT V
PRODUCT DEVELOPMENT ECONOMICS
Elements of Economic Analysis; Economic Analysis Process – sustainable productdevelopment: framework and metrics – life cycle assessment of a product: stages and impact.

TEXT BOOK:
1. Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press, 2018.
2. Karl, T. Ulrich and Steven, D. Eppinger, “Product Design and Development”, McGraw Hill, 2003.

REFERENCES:
1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013.

3. Pugh S., "Total Design – Integrated Methods for successful Product Engineering", Addison Wesley Publishing, 1991.
4. Rosenthal S., "Effective Product Design and Development", Business One, 1992.
5. Silva, A., Handbook of Research on Trends in Product Design and Development: Technological and Organizational Perspectives: Technological and Organizational Perspectives,IGI Global, 2010.
6. Devdas Shetty, "Product design for Engineers", Cengage Learning

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the principles of generic development process; conduct customer need analysis; and set product specification for new product design and development. (BL-3)
2. Select, screen, and test concepts for new product design and development. (BL-3)
3. Apply the principles of product architecture and industrial design to design and develop new products. (BL-3)
4. Apply the principles of DFMA and Prototyping to design and develop new product. (BL-3)
5. Apply the concepts of economics principles sustainable product development and life cycle assessment. (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
SUPPLY CHAIN MANAGEMENT					

Course Objectives:
The students will acquire the knowledge:
1. To explain the importance of Supply chain management frame work in business management
2. To understand basic concepts of Supply Chain Drivers and Metrics
3. To interpret the Design of Supply Chain Network and factors influencing distribution network design
4. To understand role of forecasting in a supply chain
5. To analyze aggregate Planning and inventories in supply chain

Unit-I
Strategic Framework: Introduction to Supply Chain Management, Decision phases in a supply chain, Process views of a supply chain: push/pull and cycle views, Achieving Strategic fit, Expanding strategic scope.

Unit-II
Supply Chain Drivers and Metrics: Drivers of supply chain performance, Framework for structuring Drivers, Obstacles to achieving strategic fit.

Unit-III
Designing Supply Chain Network: Factors influencing Distribution Network Design, Design options for a Distribution network, E-Business and Distribution network, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation.

Unit-IV
Forecasting in SC: Role of forecasting in a supply chain, Components of a forecast and forecasting methods, Risk management in forecasting.

Unit-V
Aggregate Planning and Inventories in SC: Aggregate planning problem in SC, Aggregate Planning Strategies, Planning Supply and Demand in a SC, Managing uncertainty in a SC: Safety Inventory. Coordination in SC: Modes of Transportation and their performance characteristics, Supply Chain IT framework, Coordination in a SC and Bullwhip Effect.

Text Books:
1. Sunil Chopra and Peter Meindl, Supply Chain Management - Strategy, Planning and Operation, 4th Edition, Pearson Education Asia, 2010.
2. David Simchi-Levi, PhilpKamintry and Edith Simchy Levy, Designing and Managing the Supply Chain - Concepts Strategies and Case Studies, 2nd Edition, Tata-McGraw Hill, 2000.

Course Outcomes:
Up on completion of course students will be able to
1.Illustrate the importance of Supply chain management frame work in business management.(BL-2)

2. Understand basic concepts of Supply Chain Drivers and Metrics.(BL-2)

3. Interpret the Design of Supply Chain Network and factors influencing distribution network design.(BL-3)

4. Apply role of forecasting in a supply chain.(BL-3)

5. Analyze aggregate planning and inventories in supply chain.(BL-4)

B. Tech (MECHANICAL ENGINEERING) - R20

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
RELIABILITY ENGINEERING					

Course Objectives:
The students will acquire the knowledge:
1. To illustrate the importance of reliability engineering.
2. To understand basic concepts of reliability of various systems
3. To understand concepts of reliability maintenance.
4. To illustrate the role of reliability testing methods.
5. To applyconcepts of software reliability engineering approach.

UNIT-I
Reliability – Definition and evaluation of design by tests - Hazard Models, Linear, Releigh, Weibull. Failure Data Analysis, Reliability improvement.

UNIT-II
Reliability of series, parallel, standby systems & complex systems, reliability prediction and system effectiveness.

UNIT-III
Reliability maintenance-elements and principle-measures- - Corrective maintenance, types-measures- - Reliability Centered Maintenance-goals and principles-components

UNIT-IV
Reliability Life Testing Methods, - Test time calculations, Acceptance testing, accelerated life testing, Reliability Growth Testing - Growth process, Idealized growth curve.

UNIT-V
The Need for Reliable Software, Software Reliability Engineering Concepts, Basic definitions, software reliability engineering approach, software reliability engineering process.

TEXT BOOKS
1. E. Bala Guruswamy, 'Reliability Engineering', by Tata McGraw Hill.
2. Handbook of Software Reliability Engineering Edited by Michael R. Lyu, published by IEEE Computer Society Press and McGraw-Hill Book Company.
3. Software Reliability Engineering John D. Musa, second edition Tata McGraw-Hill.

REFERENCE BOOKS:
1. G. Haribaskaran, Probability, Queuing Theory & Reliability Engineering, by Laxmi publications, Second Edition.

Course Outcomes:
Up on completion of course students will be able to
1.Illustrate the importance of reliability engineering. (BL-2)
2. Understand the basic concepts of reliability of various systems.(BL-2)
3. Understand the concepts of reliability maintenance. (BL-2)
4. Illustrate the role of reliability Life Testing Methods. (BL-2)
5. Applyconcepts ofsoftware reliability engineering approach. (BL-3)

B. Tech (MECHANICAL ENGINEERING) - R20

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CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
POWER PLANT ENGINEERING					

Course Objectives:
The students will acquire the knowledge:

1. To learn the working of different circuits of the steam power plant.
2. To learn the layout and auxiliaries of the diesel and gas power plants.
3. To learn the different elements in the hydro electric and nuclear power plants.
4. To learn the basic concepts for power production in combined plants and usage of different instrument to measure the operating parameters of the power plant.
5. To learn the concepts of power plant economics and pollution standards to be observed in the power plants.

UNIT – I
Introduction to the sources of energy – resources and development of power in india.
STEAM POWER PLANT: Plant layout, working of different circuits, fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems.

UNIT – II
INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:
DIESEL POWER PLANT: Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.
GAS TURBINE PLANT: Introduction – classification - construction – layout with auxiliaries, combined cycle power plants and comparison.

UNIT – III
HYDRO ELECTRIC POWER PLANT: Water power – hydrological cycle / flow measurement – drainage area characteristics – hydrographs – storage and pondage – classification of dams and spill ways.
NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – nuclear reactor – reactor operation. sodium-graphite reactor, radiation hazards and shielding – radioactive waste disposal.

UNIT – IV
POWER PLANT INSTRUMENTATION AND CONTROL: Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis, O_2 and CO_2 measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

UNIT – V
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 – related exercises. effluents from power plants and Impact on environment – pollutants and pollution standards – methods of pollution control.

Text Books:

3. A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai & Co.
4. Power Plant Engineering /P.C.Sharma / S.K.Kataria Pub

References:

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power station Engineering – ElWakil / McGrawHill.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Identify the different circuits of the steam power plant for power production (BL-3)
2. Illustrate the layouts and different auxiliaries used in the diesel and gas power plant for power production(BL-2)
3. Understand how the power can be produced by hydro-electric and nuclear power plants(BL-2)
4. Interpret the power production by combined power plants and operating principles ofdifferent instruments used in power plants. (BL-5)
5. Analyze power plant economics and implementation of pollution standards and control of pollution caused by the power plants. (BL-4)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

B. Tech (MECHANICAL ENGINEERING) - R20

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
AUTOMOBILE ENGINEERING					

Course Objectives:

The Students will acquire the knowledge

1. To learn basic components and functions of automobile
2. To learn the various elements and working of transmission system of automobile
3. To learn the working of steering system, suspension system and braking system of automobile
4. To learn the concepts involved in the electrical system of automobile, engine specifications and safety systems
5. To learn the concepts involved in the emission control and engine service of different parts

UNIT – I

INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

UNIT – II

TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT – III

STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle toein, centre point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

UNIT – IV: BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

ELECTRICAL SYSTEM: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – V

ENGINE SPECIFICATION AND SAFETY SYSTEMS: Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc.

SAFETY: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2.Automobile Engineering / William Crouse/TMH Distributors
3.Automobile Engineering/P.S Gill/S.K. Kataria& Sons/New Delhi.

References:

1.Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr.,/ Pearson education inc.
2. Automotive Engineering / K Newton, W.Steeds& TK Garrett/SAE
3. Automotive Mechanics : Principles and Practices/ Joseph Heitner/Van Nostrand Reinhold 4. Automobile Engineering / C Srinivasan/McGrawHill

Course Outcomes:

At the end of the course the students shall be able to:
1. Acquire the basic knowledge of anatomy of an automobile and its components. (BL-2)
2. Analyze the systems of automobile transmission systems. (BL-3)
3. Realize the functions of various steering systems, suspension and braking systems (BL-2)
4. Illustrate the functions of electrical systems and understands the concepts of engine specifications and safety systems. (BL-2)
5. Analyze the systems of engine servicing and emission control systems. (BL-3)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

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	MINOR	L	T	P	C
		4	0	0	4
TOTAL QUALITY MANAGEMENT					

Course Objectives

The students will acquire the knowledge:

1. To understand the concepts of TQM, Quality and Business performance
2. To understand importance of customer satisfaction and loyalty
3. To analyze Organizing for quality implementation
4. To learn the concept of cost of quality
5. To understand ISO 9000 universal standards of quality

UNIT – I:

INTRODUCTION: The concept of TQM, Quality and Business performance, attitude andinvolvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT – II:

CUSTOMER FOCUS AND SATISFACTION: The importance of customer satisfaction and loyalty-Crating satisfied customers, Understanding the customer needs, Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marketing: Evolution of Bench Marketing, meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

UNIT – III:

ORGANIZING FOR TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT – IV:

THE COST OF QUALITY: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT – V:

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOKS:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI

REFERENCES:

1 Beyond TQM / Robert L.Flood
2 Statistical Quality Control / E.L. Grant / McGraw Hill.
3 Total Quality Management- A Practical Approach/H. Lal

4 Quality Management/KanishkaBedi/Oxford University Press/2011
5 Total Engineering Quality Management/Sunil Sharma/Macmillan

Course Outcomes:
On completion of this course, the students will be able to:

1. Understand the concepts of TQM, Quality and Business performance(BL-2)
2. Understand importance of customer satisfaction and loyalty(BL-2)
3. Analyze Organizing for quality implementation(BL-3)
4. Summarize the concept of cost of quality(BL-2)
5. Understand ISO 9000 universal standards of quality(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

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		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
ADVANCED MATERIALS					

Course Objectives

The students will acquire the knowledge:

1. To classify the composite materials and identify the applications
2. To understand manufacturing methods of PMC, MMC & CCC and their applications
3. To understand macro-mechanical analysis of a lamina
4. To interpret the functionally graded materials and their properties
5. To understand types of nano materials and their properties

UNIT-I

INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber-reinforced composites and nature-made composites, and applications

REINFORCEMENTS: Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and borncarbide fibres.

UNIT-II

AEROSPACE MATERIALS: Metallic materials- super alloys, Aluminium, Magnesium, titanium and Nickel based alloys and intermetallics, High temperature polymers, Materials for cryogenic application, Materials for space environment, Evaluation of materials for extreme environment, Materials processing and manufacturing in zero gravity.

UNIT-III

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification different systems-preparation-properties and applications of functionally graded materials.

UNIT-IV

SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloys-composition-properties and applications of shape memory alloys.

UNIT-V

NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages applications in comparison with bulk materials (nano – structure, wires, tubes, composites).

Text Books:

1. Nano material /A.K. Bandyopadyay/New age Publishers
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH
3. Engineering Mechanics of Composite Materials / Isaac and M Daniel/Oxford University Press

References:

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY 1969
3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience, New York, 1980
4. Mechanics of Composite Materials - Second Edition (Mechanical Engineering) /Autar K.Kaw /CRC Press

Course Outcomes

After learning the course the students should be able to

6. Classify the composite materials and identify the applications (BL-2)

7. Identify the aerospace materials and their applications (BL-3)
8. Understand macro-mechanical analysis of a lamina (BL-2)
9. Interpret the functionally graded materials and their properties (BL-2)
10. Understand types of nano materials and their properties (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
CAD/CAM					

Course Objectives:

The Students will acquire the knowledge

1. To understand the basic fundamentals of computer aided design and manufacturing.
2. To learn concepts of drafting and modeling systems.
3. To understand the part programming for NC machines.
4. To learn the importance of group technology and computer aided process planning.
5. To understand the computer aided quality control.

UNIT – I

Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices. Raster scan graphics coordinate system, database structure for graphics modeling,

UNIT – II

DRAFTING AND MODELING SYSTEMS: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modelling.

UNIT – III

PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT – IV

GROUP TECHNOLOGY: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types.

UNIT – V

COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

Text Books:

1. CAD / CAM Principles and Applications/PN Rao / McGraw-Hill
2. Automation, Production systems & Computer integrated Manufacturing/ M.P. Groover/Pearson Education

References:

1. Mastering CAD / CAM / Ibrahim Zeid / McGraw-Hill
2. Principles of Computer Aided Design and Manufacturing / FaridAmirouche / Pearson
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson learning, Inc
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang/Elsevier Publishers

Course Outcome:

At the end of the course the students shall be able to:

1. Understand the basic fundamentals of computers in industrial manufacturing and applications of computer graphics. (BL-2)
2. Interpret geometric modeling techniques and requirements. (BL-2)
3. Develop part programming for NC and CNC machines. (BL-3)
4. Illustrate the concepts of group technology and computer aided process planning for the product development.(BL-2)
5. Understand the concepts of computer aided quality control. (BL-2)

1. To understand the basic fundamentals of computer aided design and manufacturing.
2. To learn concepts of drafting and modeling systems.
3. To understand the part programming for NC machines.
4. To learn the importance of group technology and computer aided process planning.
5. To understand the computer aided quality control methods.

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

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		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
ROBOTICS					

Course Objectives:
The students will acquire the knowledge:

1. To understand various applications of robotics and classification of coordinate system and control systems.
2. To build the concepts of components of industrial robotics.
3. To determine kinematic analysis with D-H notations.
4. To model trajectory planning for a manipulator by avoiding obstacles.
5. To understand the applications of robots in manufacturing.

UNIT-I
INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT – II
COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom

UNIT – III
MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.
MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates
UNIT IV
General considerations in path description and generation.Trajectory planning and avoidance of obstacles, path planning.
Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT V
ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

3. Industrial Robotics / Groover M P /Mc Graw Hill
4. Introduction to Robotics / John J. Craig/ Pearson

REFERENCE BOOKS:

1. Theory of Applied Robotics /Jazar/Springer.
2. Robotics / Ghosal / Oxford

Course outcomes:
Upon successful completion of this course student should be able to:

1. Understand various applications of robotics and classification of coordinate system and control systems (BL-2)
2. Build the concepts of components of industrial robotics. (BL-3)

3. Apply kinematic analysis with D-H notations. (BL-3)
4. Model trajectory planning for a manipulator by avoiding obstacles. (BL-3)
5. Understand applications of robots in manufacturing. (BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

		L	T	P	C
	MINOR	**4**	**0**	**0**	**4**
MECHATRONICS					

Course Objectives:

The Students will acquire the knowledge

1. To understand the use the various mechatronics systems, measurement systems, sensors and transducers.
2. To apply the concepts of solid state electronic devices.
3. To identify the components in the hydraulic and pneumatic actuating systems.
4. To apply the concepts of digital electronics and applications of PLCs for control.
5. To understand system interfacing, data acquisition and design of mechatronics systems.

UNIT-I

Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems.

UNIT-II

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT-III

Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-IV

Digital electronics and systems, digital logic control, microprocessors and micro controllers, programmable logic controllers (PLC), PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition – Data Acquisition Systems, Design of mechatronics systems & future trends.

Text Books:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition

References:

1. Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford UniversityPress
2. Mechatronics Source Book / Newton C Braga/ThomsonPublications,Chennai.
3. Mechatronics – N. Shanmugam / Anuradha AgenciesPublishers.
4. Mechatronics System Design / Devdasshetty/Richard/Thomson.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton/ Pearson,2012
7. Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indianprint

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Understand the use the various mechatronics systems, measurement systems, sensors and transducers. (BL-2)
2. Apply the concepts of solid state electronic devices. (BL-3)
3. Identify the components in the design of electro mechanical systems. (BL-2)
4. Apply the concepts of digital electronics and applications of PLCs for control. (BL-3)
5. Understand system interfacing, data acquisition and design of mechatronics systems.(BL-2)

CO-PO Mapping

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√							√
CO2	√	√	√	√	√							√
CO3	√	√	√	√	√							√
CO4	√	√	√	√	√							√
CO5	√	√	√	√	√							√